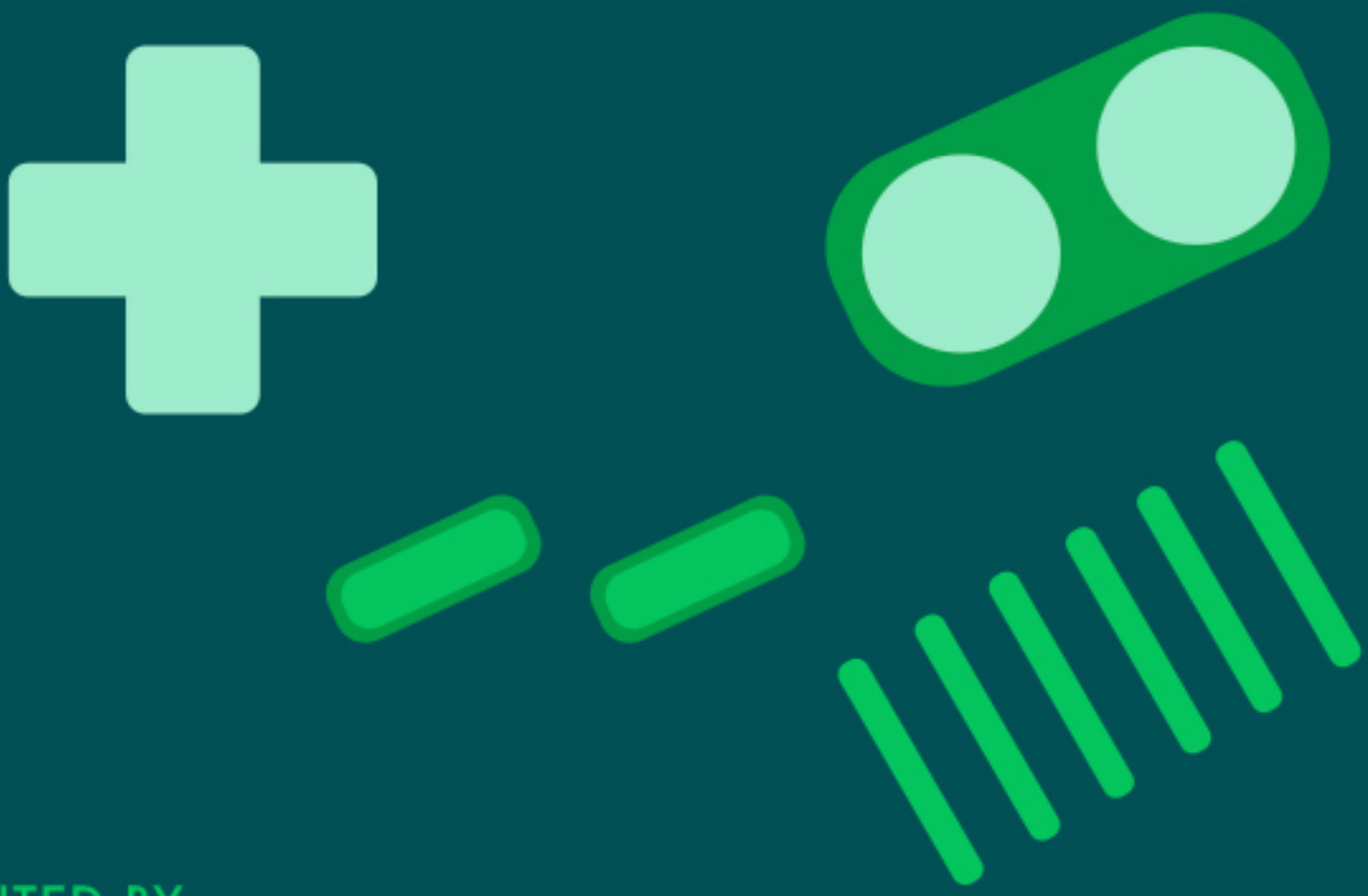
VOLUME 2

TEACHING THE GAME

A COLLECTION OF SYLLABI FOR GAME DESIGN, DEVELOPMENT, AND IMPLEMENTATION



EDITED BY

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Teaching the Game

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A collection of syllabi for game design, development, and implementation, Vol. 2

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"Do nothing out of selfish ambition or vain conceit. Rather, in humility value others above yourselves, not looking to your own interests but each of you to the interests of the others."

(Philippians 2:3-4; NIV)

FOREWORD

This collection represents a maturing discipline and the culture that brought post-secondary games education from the backrooms and basements of academic institutions to the frontispiece of internationally recognized programs. Collections such as these are a reminder of the strength of the collaborative, earnest, and cooperative character of game academics. It is this history in game-focused education that helped establish the legitimacy of such work in sometimes adversarial and skeptical environments.

The work enclosed here is evidence of a community that aims to support quality education by fostering an open and transparent community of pedagogic discourse. These syllabi not only reflect the instructional goals of their authors, but they are also informed by the perpetual post-mortem of being an effective educator. They are the product of successful and unsuccessful experiments in improving student outcomes, addressing learning objectives, and working within the set of constrains common to all education. They are outlines of lessons learned to meet the common goal of providing a game-focused education.

They also demonstrate the many foci of a complete ludic education. What is shown here is variety. A variety of disciplinary practices, a variety of institutions, and a variety of ways to help students examine the characteristics that makes games engaging, meaningful, and socially relevant media. From assessment tools to rubrics, and timelines to philosophies, the diversity here is evidence of a thriving community strengthened by entangling disciplines.

For those who helped create the first generation of games degree programs, this is the collection we needed. Before such a collection, administrators, lead faculty, and committees effectively scrounged for such resources, tapping their network to understand what had been done. This collection simplifies that task by offering a single resource, much wider and more inclusive than those supported by traditional peer networks and organic web searches. It is a much-needed resource for any kind of starting – a new course, a new program, or a new take on a topic that educators know well.

It is also a reminder that there is no one right way to teach games. Instead, like all interdisciplinary and transdisciplinary work, there are a variety of solutions to help move the entire practice foreword. It is a collection not unlike what those of us who have created game programs start with – a collection of syllabi from a wide-ranging faculty. This treasure trove is collected in a way that reduces redundancy and supports a wide view.

This collection is also important as educators consider the evolving space of media literacy and global engagement. There are countless ways to interpret the study of games. When educators move

away from the practice of teaching it the way they were taught, they often have an opportunity to improve the instructional value of their course. Having access to other syllabi facilitates a wider view of pedagogic solutions, references, assignments, resources, and teaching philosophies. While many early-generation faculty teaching games did not have this resource, its contents support both experienced and inexperienced faculty. It provides heuristics from the field. In this case, the field is the classroom.

In these pages, foci vary from recognizing games as media artifacts or as technical experiments to commercial, artistic, or pragmatic products. There is study of the economics, history, operations, and more in the context of games. The breadth of study in itself serves as heuristic on how games act as both case study for a variety of disciplines and how the ludic pervades so much of life. Unsurprisingly, there are faculty using the canon of commercial games, while others aim for global, independent, and artistic intersections. Some focus on the technological, others on media or aesthetics. Ultimately, the mere aggregation of this knowledge lends perspective to the many approaches to teaching games.

While this collection offers obvious practical resource in demonstrating how people educate others on games, it also serves as a snapshot of a time and space for games pedagogy. While in the short term it is useful to consider how such syllabi might support educator needs, it is also a tool for understanding what needed to be taught in the contemporary. For this reason, it remains a long-term resource. It provides evidence of that which needed to be taught when it was taught. That evidence is useful in capturing the shifts apparent in wider education. Where once there were collegiate courses to introduce the web, eventually the Internet's pervasiveness and technological simplicity rendered different needs for such courses. There is a chance that some of what is listed here will become so fundamental to the experience of all learners, it will not warrant a college level course. What will be left instead is an archive like this, that helps map how education itself changed over time.

Ultimately the health of any environment, whether academic or natural, is in its ability to thrive. Where those less informed about games education might perceive a monoculture, the syllabi collected here offer evidence of a much healthier community. Resting in these pages is humanist pedagogy among technology, media studies mingled with education, narrative alongside ethics. It is evidence of a community that is thriving in its diversity of subject and resources. As academic environments shift, this diversity of focus helps insulate games education from the disruption that could prove detrimental to less diverse topics.

Readers are invited to not only review the contents of this book as an encyclopedic reference, but also as an artifact. As a way of seeing more globally the ways in which games, broadly, are taught. In so doing, readers' pedagogical approaches may broaden or even be inspired in entirely new directions. At the least, reading through the resources presented here gives an opportunity to peek into another instructor's classroom, learn what they are doing, and help the community grow through a kind of informal, asynchronous class visit.

Reading such a collection comes with a responsibility. Readers are encouraged to continue to contribute to the practice in an equally generous way. Just as this collection provides evidence of a collaborative, earnest, and cooperative character in game academics, it also calls forth the reader to continue that tradition.

Games, for all their social pervasiveness and potential, are not always educationally accessible to many communities. The momentum of games education has been its hallmark for decades. As educators examine this collection and use it in their own planning it seems a self-evident responsibility to continue that commitment. The practice and strength of the community grows not from the darkness of obscuring our work behind closed doors, but instead by generously sharing it widely, freely, and with the light available to all.

Just as the contributors and editors have given you this valuable resource to support the strength of games education, you are invited to continue contributing, collaborating, and working to make the opaque more transparent. Give light to academic rhizomes as they rise and leave space for them to grow in full support of our shared strength.

Lindsay D. Grace
Knight Chair in Interactive Media, University of Miami
Vice President, Higher Education Video Game Alliance

PREFACE

INTRODUCTION

Academics are taught about the importance of standing on the shoulders of giants (Merton, 1993). We are trained to ground our efforts in the theoretical and empirical work of others. However, we are not always shown how to play nice with others. For instance, we are not always taught to share, nor are we necessarily taught how to share.

We are not just referring to college or university rivalries. This can even happen within programs. A good example is our teaching materials. Universities often own course numbers, course titles, and the *basic data sheets*—the forms that go through curriculum committees listing basic objectives and outcomes. But faculty are given the freedom to meet those objectives—and to develop their syllabus—in whatever way they choose. As such, faculty might be assigned to a course and given nothing to begin with—or simply given a very basic syllabus to develop a course and teach from.

There are several challenges in such an approach, particularly as it relates to games and gaming. First, even if faculty do share syllabi, the (normally) basic documents do not act as rich and thick descriptions (Geertz, 1973) of actual practice. Faculty are not necessarily given examples of best products or practices from previous iterations. They are not always instructed in successes in engaging students or course ideas that could have succeeded with more work.

We are not suggesting sharing never happens. As a matter of fact, most of us have been part of teaching assignments where other faculty gave us pointers and even product materials to teach from. Rather, we are suggesting that this is not always the norm, particularly when it comes to course materials.

A second problem is that the field of gaming and game studies is naturally interdisciplinary. A student could often take one of several gaming courses at a college or university just by looking across departments in communication, education, health, business, computer science, etc. However, conversations about gaming within those courses are not necessarily interdisciplinary. Yet students graduate and go into fields where they are expected to engage with those who share different perspectives on–and experiences with–gaming. Faculty may not know how to connect across disciplines to help prepare their students for such endeavors.

The good news from academia is that collaborative and interdisciplinary practices and processes are changing. For instance, many colleges and universities are now freely and openly sharing their syllabi and their course materials online (e.g., https://ocw.mit.edu/). Learners around the world can

take classes for free through massive open online courses (MOOCs; Nigh, Pytash, Ferdig, & Merchant, 2015). And open access journals have grown in popularity (Solomon, Laakso, & Björk, 2013). There is even an open access journal dedicated to the sharing of syllabi called *Syllabus* (http://www.syllabusjournal.org/).

Collaboration continues to grow in gaming, too. This refers, for instance, to collaborative play in the form of massive multiplayer online (MMO) games like *Guild Wars 2* (https://www.guildwars2.com/), *Fortnite* (https://www.epicgames.com/fortnite/en-US/home), and *Genshin Impact* (https://genshin.mihoyo.com/). This collaboration can be for fun or for competition through K-12 or postsecondary eSports in games like *League of Legends* (https://www.leagueoflegends.com/) and *Rocket League* (https://www.rocketleague.com/).

It also refers to collaboration through open access tools for creating gaming experiences like *Unity* (https://unity.com/), *Unreal Engine* (https://www.unrealengine.com/), *Ogre* (https://www.ogre3d.org/), and *Scratch* (https://scratch.mit.edu/). Collaboration can refer to how we share our games through social avenues like streaming on *Twitch* (https://twich.tv) and chat and audio channels on Discor (https://discord.com/). Through game streaming or game podcasts, thousands of people interact as professionals and novices play or/or talk about their play.

Finally, collaboration and open access refers to how we talk and write about games and gaming. We collaborate through mailing lists (e.g., *Gamesnetwork*; https://lists.tuni.fi/mailman/listinfo/gamesnetwork). We collaborate with and through open access journals (e.g., *Well Played*; http://press.etc.cmu.edu/index.php/publication-tag/well-played/). For instance, Jennifer deWinter and Carly A. Kocurek guest edited a special issue of *Syllabus* on teaching with games (deWinter & Kocurek, 2015). And there are open access books that showcase research and information about games such as Kat Schrier's (2014; 2016; 2019) series on *Learning, Education & Games*. In short, gaming is collaborative. This book is an effort to honor that collaboration by supporting academic efforts to strengthen teaching in our collective and collaborative fields.

WHY THIS BOOK?

We wrote this book to help game instructors prepare better and more comprehensive courses. There were several other intended goals. First, we believed that creating this book would provide an opportunity to see the current state of gaming instruction at various places throughout the world. Second, we hoped it would strengthen all of us individually as instructors, and in doing so, would strengthen the field. A third proposed outcome was that we would be able to improve the interdisciplinary nature of game instruction. In doing so, we would be able to help students look across what researchers, teachers, and developers do in other fields.

Last, but not least, in these chapters you will see examples of what students are being asked to reflect on and create. Many of these chapters include links to templates or exemplar student materials. It is one thing to read about what a course entails but another to see what the students can produce from the instruction. While not all chapters have included student work, there are some fantastic examples throughout the book.

THE GENERAL OUTLINE OF CHAPTERS

Ask to see syllabi from 20 different instructors, and you will typically see 20 different formats. They will, for the most part, contain similar themes or headers; however, they will often look incredibly different. We as individual instructors even have different formats and templates for different audiences or different formats of instruction (e.g., medium or time). The challenge for us as editors was to improve readability, so that someone could easily compare and contrast across courses. As such, we gave authors a template to follow, ensuring readability and encouraging everyone to include comparable content.

It is worth clearly stating that there are certain components of syllabi that are either required or encouraged by every institution. These include, but are not limited to sections on academic integrity, plagiarism, Title IX information, and support for students with disabilities. **We need to state clearly that these are important pieces of information that should be required for every syllabus.** (We would even add additional sections related to students seeking counseling or needing extra support.) However, we did not ask authors to include this information in their individual chapters for space reasons. While critical to student success, many statements like these are standardized and read similarly between colleges and universities. We asked authors to focus instead on the gaming aspects of their curriculum and syllabi.

We added some additional conversational sections such as the Course Best Practices and Future Course Plans sections. These sections are important as the authors can communicate what they have learned from teaching their course and how you could potentially implement some of their ideas into your own course. Many of the chapters also include direct links to online materials that instructors use in their course. Some have even included links to *Google Drive* materials they have created for their courses.

We asked authors to use the following template:

- **Front Material**
    - Author Information – Authors were asked to include their names, emails, affiliations, and a brief bio to support collaboration and communication.
    - Chapter Title – The title includes the name of the course the author teaches including their course number. Note that course numbers vary across different universities.
    - Course University; College/School; Department/Program – This section includes information about where this course is taught and what department and school it is part of.
    - Course Level – The level will signify if the course is intended for graduate, undergraduate, or both.
    - Course Length – This section indicates the length of time this course is taught such as one semester, full-year, module, or others. Note that this book includes chapters from across the world, so a typical semester may be different in other countries.
    - Course Medium – The course medium indicates whether the course is taught face-to-face, online, or a hybrid of both. We also told authors they can talk about what they did

during the COVID-19 pandemic, as many in-person courses transitioned fully online.

    - Course Keywords – We told authors to include 7-10 keywords that describe their course of their choosing.

- **Catalog Description** (~125-250 words). This section is the catalog description that the students see in their university course catalog. While some courses in this book may be in the process of redesign, some of these may not be official.
- **Course Purpose and Objectives** (~250-750 words). This section includes the overall mission or purpose of the course. We told authors to include their large course goals in this section, and the individual weekly goals later in the course outline below.
- **Course Context** (~100-500 words). This section is for the authors to explain what the course is for, meaning, if it is included as part of a program, as an elective, for a certificate, or many other possibilities. We also told authors to include what types of students typically the course and what experience with gaming they have prior to attending, as these variabilities can impact how the course is taught.
- **Course Pedagogy** (~250-500 words). Authors were given the opportunity to describe their own pedagogical beliefs that set the stage for creating and teaching this course. The authors were able to describe the techniques they use and some insight to what format they teach their courses in. Some opted to include how their pedagogy changed during the 2020 COVID-19 pandemic, as many had to rapidly adapt their course for teaching online.
- **Course Texts, Games, Software, and Hardware** (~200-500 words). This section included any required textbooks, software, and hardware that students are required to obtain for their course. Many authors included links to the games they utilize, many of which are free.
- **Course Assignments** (~500-1500 words). This section included the course's major assignments. This section was to generalize the major assignments during the course, not necessarily each week's individual readings and activities. Instead, those are found below in the Expanded Course Outline section.
- **Course Assessment** (potential bulleted list) – We told authors to list their assessment types, grades, and weights with a final total. This will not include the grading scale, but rather how the instructors calculate a student's final grade.
- **Expanded Course Outline –** This section is the bulk of each chapter. Authors were told to include weekly activities, assignments, readings, and topics. There are also many links to outside materials that you may utilize in your own course.
- **Course Best Practices –** (~250-1000 words). We asked the authors to list their tips and tricks that they recommend based on their experiences teaching the course. Some chapters discuss what worked and what did not in the past. Additionally, we suggested to authors to include examples of products that students have created in the course.
- **Future Course Plans** (~250-1000 words). This section allowed the authors to discuss what their future ideas were for their course. Some chapters included what technologies they are interested in trying in the future, while others discussed what they are hoping to improve based upon student feedback.

- **References –** We encouraged authors to include any materials that would allow readers to immediately implement the author's work into their own courses. This section also includes readings that were required for students.

THE SECTIONS OF THE BOOK

When preliminarily discussing the focus of this book, we wanted to look specifically at courses about video games. While gamification of teaching methods is important and effective, we instead wanted to focus on courses that are about video games, about designing video games, and include video games in their curriculum. You will see many disciplines through the book, and they are categorized into theses five sections:

1. Business, Health, and Humanities. This section encompasses courses in the business disciplines that focus on the business side of the video game industry. Additionally, this includes history, music, and ethics of video games.
2. Communication and Media Studies. The Communication and Media Studies section includes chapters from communications, storytelling, writing, and theory.
3. Computer Science. This section encompasses courses where students are programming games
4. Education. The Education section includes courses regarding game-based learning and games for learning
5. Game Design and Development. The Game Design and Development section includes both intro-level courses and advanced for game design.

ITEMS TO CONSIDER

Readers who scan across chapters will be able to see themes emerging. We encourage this cross-chapter examination to continue to push our thinking in the field. To support such an exploration, we would recommend several items for readers to consider. Listed below are topics and then questions to consider.

- While the disciplines covered in this book vary, many courses implemented free games into their curriculum. What are the advantages of using free vs. commercial games? How do instructors best support students without knowing what consoles or playing devices they have access to?
- Some instructors chose to gamify their gaming course. This included points, scores, and levels. Is this a best practice that should be considered for all gaming courses?
- This book is a collection of syllabi across disciplines and content areas. That does not mean, however, that the chapters themselves contain interdisciplinary content. There were examples of domain specificity within the courses. What do we need to do in order to facilitate more interdisciplinary engagement within courses?
- There were some great examples of cutting-edge gaming interests within the book. Other areas, however, were not addressed. For instance, there was very little discussion about eSports; there were no syllabi related to eSports classes. There were no classes on gaming accessibility. There were very few classes describing the role of e*Xtended Reality* (XR), *Virtual*

Reality (VR), or *Augmented Reality* (AR) in gaming. The likely answer is that those courses exist, but no authors of such content contributed to this book. However, what do we all need to do as a field to make sure certain topics like accessibility are addressed in all courses? How do we ensure that all courses are updated to reflect new practices in our fields?

- Innovative technologies used for pedagogical purposes often focus on the consumption of that product. In other words, classes about gaming often show games being played. There are obvious exceptions in this book where the focus of the class is game development. But what is the balance between teaching students to consume vs. produce games, particularly in non-game-development courses?
- One of the biggest trends in gaming recently has been the role of gaming communities through platforms like *Twitch* (https://www.twitch.tv/) and *Discord* (https://discord.com/). What is the role of coursework in introducing these tools as well as using these tools as part of pedagogical practice?

These are just some of the questions we hope readers will consider.

CONCLUSION AND GETTING INVOLVED

We hope this book continues great conversations about gaming across many fields. We also hope that the content provided by so many great authors improves course instruction around the world. On behalf of the authors, we would like to request three things.

1. If you use materials from a chapter, please reference the chapter. The authors have provided this work in an open access format to help us all. Please give credit where credit is due.
2. Consider starting a conversation with the author, letting them know what you have used and how it worked. This will benefit the reader and author.
3. We hope this is just one of many iterations of the book. If you are reading this and have a chapter to propose, please contact us so that this syllabi work can be a living and breathing project.

Respectfully,

Richard E. Ferdig, *Summit Professor of Learning Technologies, Research Center for Educational Technology, Kent State University, USA*

Emily Baumgartner, *Assistant Professor of Technology, Ohio Northern University, USA*

Enrico Gandolfi, *Assistant Professor of Educational Technology, Kent State University, USA*

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We would like to thank the authors for being willing to be a part of this book. Their excitement for being able to share their course materials, their enthusiasm for the end product, and their suggestions for various components to strengthen book all contributed to our joy in being able to put this book together.

As you read these pages and focus on their teaching, we hope that you are encouraged in two ways. First, we hope that you are inspired to be reflective of your own practice. Second, we hope that you are inspired to make your classes even better given the great resources provided by the authors.

We also want to thank ETC Press for their willingness to partner on this work. Drew Davidson and Brad King always seem to be on the forefront of innovation in publishing. We appreciate their trust in putting this volume together and for connecting us with both potential authors and our foreword contributor, Lindsay Grace. We share our gratitude to Lindsay for taking time to write the foreword.

In closing, we wish to thank our families for their encouragement of our professional efforts and the time they gave up with us so that we could finish this book.

PART III.

COMPUTER SCIENCE

CHAPTER 1.

GAME DESIGN & DEVELOPMENT (COMP 4555)

KATRIN BECKER[1]
MOUNT ROYAL UNIVERSITY

Course Title: COMP 4555 – Game Design & Development
Course University: Mount Royal University
Course College/School: n/a
Course Department/Program: Mathematics and Computing
Course Level: Graduate, Undergraduate, PD, etc.
Course Credits: 3
Course Length: 15 weeks
Course Medium: Blended/Hybrid
Course Keywords: collaborative, meaningful critique, iterative design, digital games, prototyping, playtesting

CATALOG DESCRIPTION

This course focuses on the design and implementation of interactive computer games. It emphasizes understanding games, social issues related to games, the game development life cycle, prototyping, playtesting, working within constraints, and productive, meaningful critiquing. In the technical segment, the course uses a variety of development tools and techniques in conjunction with a modern game engine. Students work collaboratively to design and develop a number of game prototypes, one of which will be implemented as a digital game.

COURSE PURPOSE AND OBJECTIVES

The video game industry is an important software industry, both for entertainment and serious applications. Developing games and simulations is among the most challenging and interesting forms of programming. This course explores the concepts and techniques of game programming and design. Coursework emphasizes the game design and development lifecycle.

This course provides an in-depth examination of video game design and best practices to study

1. Dr. Katrin Becker (kbecker@mtroyal.ca) is an Adjunct Professor in the Department of Mathematics and Computing at Mount Royal University. She is an innovative instructional designer with decades of teaching experience currently exploring how the best aspects of games can be used to enhance teaching and learning for the 21st century.

the issues and challenges that arise when developing games for both entertainment and serious applications. Topics include: the history of video games; game development teams, processes, and management; principles of game design, game play, and balance; game genres and genre-specific design issues; plot, story, and level design; technical design issues with respect to foundations from computing (graphics, artificial intelligence, networking, software engineering, and so on), and elsewhere (physics, anatomy, language studies, and so on); ethical issues in video games and the gaming industry; and the future of gaming. The course will culminate with a significant development project focused on the design of an innovative video game and its proof of concept through prototyping.

This course may be of interest to anyone interested in improving their design and programming abilities. Within the context of computer science, a variety of researchers have found game assignments to be helpful for teaching and motivating programming students. As well, it has been noted in the literature that games can provide an extremely project-oriented, upper-division course to exercise and enhance the programming and problem-solving skills of advanced students. The integration of concepts and techniques required to design and build computer games covers many of the topics offered in an undergraduate computer science or CIS curriculum, allowing students concrete application of much of the theory, concepts, and skills they have been exposed to.

COURSE CONTEXT

This is a 4th year, optional course in the Bachelor of Computer Information Systems (BCIS) program. This program includes a number of courses in management, as well as accounting, marketing, human resources, and entrepreneurial experience. Students are in their last year of their program, with a few in their second last year. Occasionally we accept other students into this course by special request, but as it is typically over-subscribed, this is rare. Students have a variety of backgrounds as far as courses goes, and some are not strong programmers. Very few, if any will become game designers, so the focus in this course is on providing them with transferrable skills that they can use in whatever job they end up with. The class size is capped at 30 students, although it is oversubscribed most years.

Prerequisite(s): COMP 3504 (Software Engineering II) or COMP 3512 Web II: Web Application Development) or COMP 3551 (GUI Development) or COMP 2633 (Foundations-Software Engineer) with a minimum grade of C-.

COURSE PEDAGOGY

The pedagogy of this course is unique. In this course we take a highly collaborative gamified apprenticeship approach. There are no high-stakes exams. Students may work together on almost everything, in fact, it is encouraged. This course is also 'front-loaded', meaning that all required work is described and available on the very first day of class. Students can see exactly what they have to do and how it will be graded right from the start.

The course is timetabled as two 75-minute 'lectures' and one 50-minute 'tutorial' that immediately follows one of the lectures. It is preferred that the tutorial hour follow the second lecture of the week, but in 2019, it followed the first lecture. Generally speaking, the first lecture is run as an actual

lecture. My lectures[2] tend to be supported by slide presentations that include a variety of media – short videos, podcasts, websites to visit, etc. Students may come and go as they choose so long as they are considerate of other classmates. They are responsible for any material covered in class, but I would rather have a student come for part of a class than to skip it entirely. I recognize that students sometimes miss classes for reasons beyond their control, and sometimes they decide that their time is better spent on something else – like studying for an impending exam. Attendance in my classes is usually very high, but I also want *my* class to be the least stressful class possible. While there is a considerable amount of work to do to get through this class, I feel very strongly that time pressures do not contribute to meaningful learning so they are largely free to complete work according to their own schedule.

Gamification

Grades are recorded as points (XP). Students start off with a score of 0 (zero) and all marks are strictly cumulative. There is no compartmentalization of marks (i.e. 30% for assignments, 30% for the project, 40% for the exam); instead, everything they submit for grading adds to their score. For ease of translation to the university grading system, 1,000 XP is equivalent to 100%. However, since there are more tasks that can be completed and submitted for marks than are needed for a perfect score, it is possible to earn well over 1,000 XP (>100%). There are some tasks that can be repeated a predetermined number of times for scores, such as playtesting another group's game, and others that can only be submitted once. Tasks are called quests and are categorized by type. Students must complete at least ONE of every type of quest. This ensures a wider range of experience. Repeatable quests typically don't take a great deal of time, and are ones where practice (repetition) can be beneficial. That said, almost all tasks can be re-submitted as often as needed, and there are very few actual deadlines. This scheme is outlined in the Playbook, found in the Game Syllabus Google Folder (GSGF).

There are many benefits to a set-up like this. Students are largely free to arrange the work in this course around their personal schedules. While there are small bonuses for submitting work by a particular date, there are no penalties for submitting something late. If someone feels they already know how to complete a particular quest, they are welcome to do so and submit it. They do not need to wait until the assignment is officially handed out. With the ability to resubmit, students are also free to re-do or fix submitted work that was insufficient, and with the wide variety of available quests, they may also choose to complete a different task instead. An unanticipated outcome of allowing both re-submission AND additional tasks is that students now reflect on their work and on my feedback more carefully. Since they now have a choice to make: re-do this one or do something else – they are encouraged to assess which strategy will benefit them the most personally. Whichever they choose, they will have actually read my feedback and considered it, which is something not common in courses where assignments are submitted, and then forgotten as they tackle the next one.

Another unanticipated effect of this approach is a significant reduction in the students' perception of risks associated with the work, which in turn also results in substantially less stress. When the stakes for any single task are lowered, students are free to be more experimental in their approach. Since

2. See the example lecture in the Game Syllabus Google Folder (GSGF), which can be found in the Resources section at the end of this chapter.

they can re-submit work, it is possible to submit partially completed work 'just to see' if they are on the right track.

Interestingly, this design has also resulted in a significant reduction in cheating.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

I don't typically teach from a textbook, so texts in my classes are supplementary.

The last time this course was offered, there was only one optional text: The Art of Computer Game Design, Chris Crawford, 1984 ASIN: B0052QA5WU [available as a free downloadable PDF]. I have used a variety of textbooks and other trade books in game design and in GameMaker, which was the primary game engine used. None really fit well with the approach I was taking so I stopped requiring texts and shifted to a variety of readings and videos.

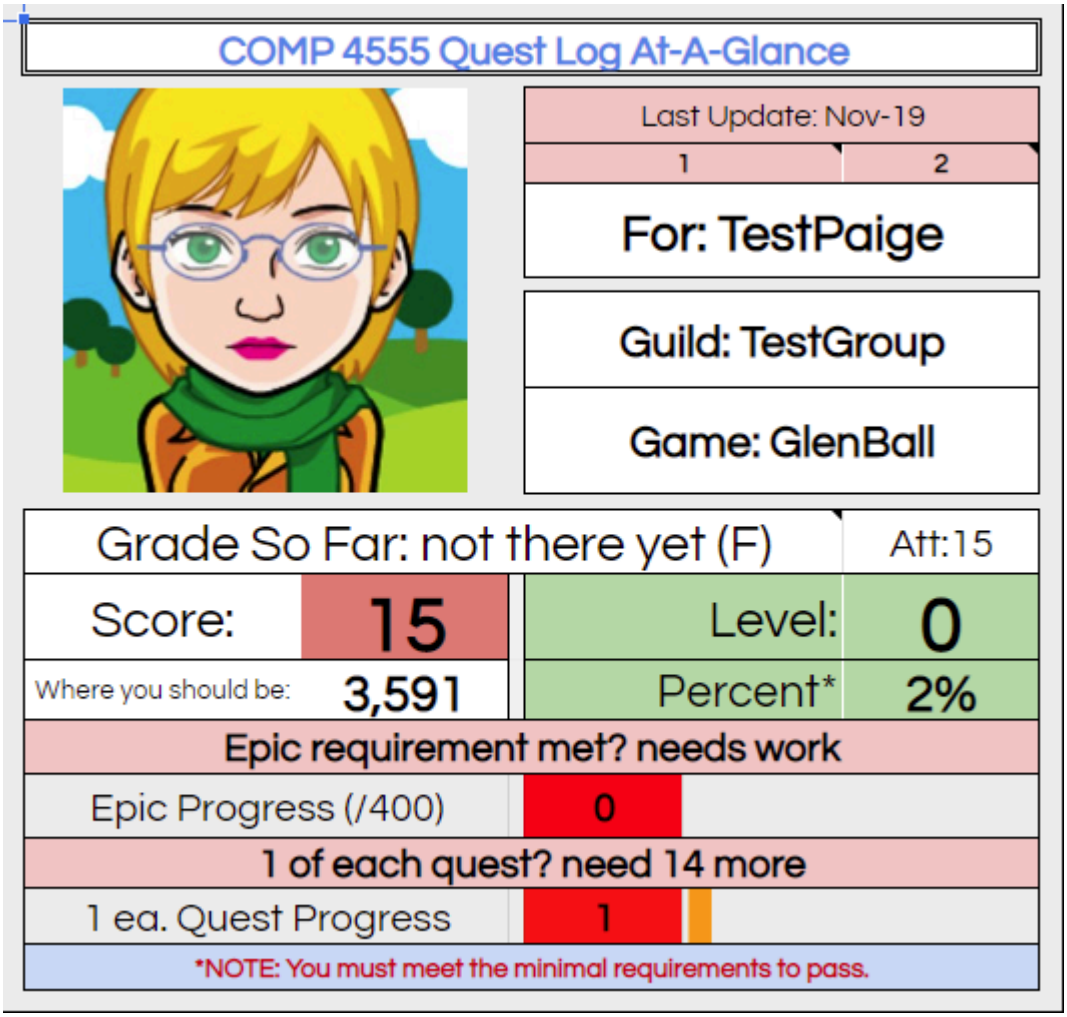
Given the variation in programming experience of the students, I chose the GameMaker engine as a way to allow students to complete a simple game in the time given (15 weeks). As the site license became quite expensive and the individual licenses became more expensive as well, I had planned to shift to using Processing in the next semester as most students are familiar with Java.

The university uses Google for Education, which allows for considerable integration of a wide variety of artifacts, some of which can be seen in the Game Syllabus Google Folder, GSGF[3]. We make extensive use of Google documents in this course. Grades are managed using Google sheets. There are four main parts to the course documents.

1. The Quest Log

This is a multi-sheet spreadsheet that contains individual student assessment date. The file is accessible only to me and the student whose quest log it is. Students can only edit certain parts of it. It contains a list of all the quests that can be completed. The front 'page' provides a brief summary and a visual guide to let students know where they are in the course (see Figure 001).

3. A link and further details of the Game Syllabus Google Folder (GSGF) can be found in the Resources section at the end of this chapter.



This Quest Log also contains a page that provides one row (line item) for every possible quest they can submit. (See Figure 002). This is how students submit their work. They are to paste a link to the item to be assessed in the correct row, and set the date of submission. All of the quest logs are kept in a folder owned and controlled by me, and I can tell who has submitted something that needs marking by the last modified data (when and who) on the file itself. When a student wants to resubmit something, the link will usually be unchanged and all they need to do is change the submitted date in the quest log.

COMP 4555 Quest Log / Score Card

attendance: 15 | 1 | See PlayBook for details | 2 | Note that items highlighted in yellow have bonus points for on time delivery.

FOR: TestPaige Blanque

Epic	Quest [Guild]	Item Count / Number	Max Score / Due Date	Item Score / Date Assessed	YOUR Score	Bonus	1	2	3	4	5	Date Submitted	Items to be Marked
	Last Marked			Nov-19									
1	1.00 [MUST get a passing score (>= 200) to pass]			415 XP	0 XP								EVERY member to log this quest in their own log.
	1.01 High Concept Pitch (Presentation)	1	Oct 1		0 XP								Link to PPT presentation
	1.02 High Concept Document	2	Oct 8		0 XP								Link to Document
	1.03 Prototype I (non-digital)	3	Oct 25		0 XP								Link to Playtest Report
	1.04 Prototype II (Digital)	4	Nov 26		0 XP								Link to Document
	1.05 Treatment / Script	5	Dec 3		0 XP								Link to Playtest Report
	1.06 Final Presentation	6	Dec 3		0 XP								Link to PPT presentation
	1.07 Post Mortem	7	Dec 14		0 XP								INDIVIDUAL: Link to document
	1.08 Peer-Review Group Work	8	Dec 14		0 XP								INDIVIDUAL: Form

See Epic Page for grading details.

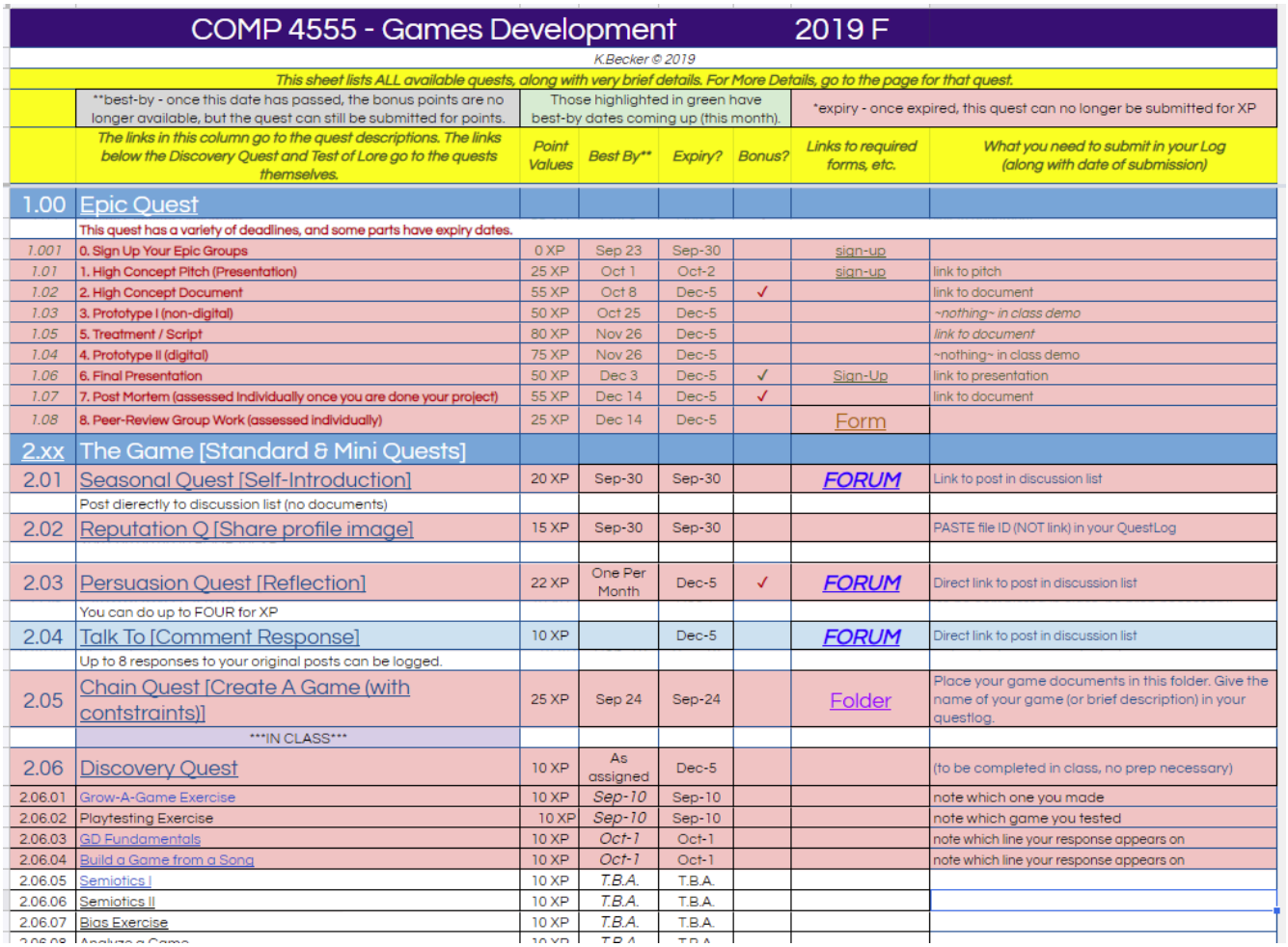
The Game [Solo Standard & Mini Quests - MUST attempt at least ONE of EACH to pass]

		See Playbook for details on marking criteria.	Item Count / Number	Max Score / Due Date	Item Score / Date Assessed	YOUR Score	Bonus	Crit.A	Crit.B	Crit.C	Crit.D	Crit.E	Date Submitted	What to link / enter
1	2.01	Seasonal Quest [Self-Introduction]	0	20 XP	20 XP	0 XP		5	5	5	5			Link to YOUR post here.
				Sep 30		0 XP								
1	2.02	Reputation Q [Share profile image]	1	15 XP	15 XP	0 XP		10	5					File ID (NOT LINK) of your photos below.
	2.02		1a	Sep 30	Nov-19	0 XP							Nov-19	1gmxXGlg-pdqNVrVsS8-atCZS4kO_wtXh
	2.02		1b	Sep 30		0 XP							Nov-19	1bCNjyp7dWTcI2C0jfpjqRV1YA4X2d4Zm
4	2.03	Persuasion Quest [Reflection]	0	88 XP	22 XP	0 XP	2	5	5	5	5			Link to YOUR post here.
	2.03		1	Sep 30		0 XP								
	2.03	*EXPIRES on last day of class.*	2	Oct 31		0 XP								
	2.03		3	Nov 30		0 XP								
	2.03		4	Dec 5		0 XP								
8	2.04	Talk To Quest [Post Comment]	0	80 XP	10 XP	0 XP		5	5					Link to YOUR post here.
	2.04		1	Dec 5		0 XP								
	2.04	*EXPIRES on last day of class.*	2	Dec 5		0 XP								
	2.04		3	Dec 5		0 XP								
	2.04		4	Dec 5		0 XP								
	2.04		5	Dec 5		0 XP								
	2.04		6	Dec 5		0 XP								
	2.04		7	Dec 5		0 XP								
	2.04		8	Dec 5		0 XP								
1	2.05	Chain Quest [Make Game from Stuff]	0	25 XP		0 XP		5	5	5	5	5		Say the name of YOUR game below.
				Sep 24		0 XP								
10	2.06	Discovery Quest [IN Class]	0	100 XP	10 XP	0 XP		5	5					Say which rows.

The key values and information in the student quest logs are automatically copied to my master grade book (also a Google Sheet) using the ***importrange*** function. The current limitation on the number of calls to *importrange* allowable in a single spreadsheet of 50 means that if I have a class that is larger than that, I will have to redesign my system. At the beginning of term, I spend several days setting everything up, but it works quite seamlessly once term starts. With that many items to mark, even an additional 3-4 clicks per student add up quickly. I'd much rather spend my time helping students and actually assessing work than waiting for webpages to load.

2. The Playbook

The Playbook is another spreadsheet that contains the descriptions and detailed marking guides for each available quest. Students are not allowed to modify this. Figure 3 shows a portion of the overview page which also has links to more detailed descriptions for each quest.



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K.Becker © 2019

This sheet lists ALL available quests, along with very brief details. For More Details, go to the page for that quest.

	**best-by - once this date has passed, the bonus points are no longer available, but the quest can still be submitted for points.	Those highlighted in green have best-by dates coming up (this month).			*expiry - once expired, this quest can no longer be submitted for XP	
	The links in this column go to the quest descriptions. The links below the Discovery Quest and Test of Lore go to the quests themselves.	*Point Values*	*Best By***	*Expiry?*	*Links to required forms, etc.*	*What you need to submit in your Log (along with date of submission)*
1.00	Epic Quest					
	This quest has a variety of deadlines, and some parts have expiry dates.					
1.001	0. Sign Up Your Epic Groups	0 XP	Sep 23	Sep-30	sign-up	
1.01	1. High Concept Pitch (Presentation)	25 XP	Oct 1	Oct-2	sign-up	link to pitch
1.02	2. High Concept Document	55 XP	Oct 8	Dec-5	✓	link to document
1.03	3. Prototype I (non-digital)	50 XP	Oct 25	Dec-5		*~nothing~ in class demo*
1.05	5. Treatment / Script	80 XP	Nov 26	Dec-5		*link to document*
1.04	4. Prototype II (digital)	75 XP	Nov 26	Dec-5		~nothing~ in class demo
1.06	6. Final Presentation	50 XP	Dec 3	Dec-5	✓	Sign-Up	link to presentation
1.07	7. Post Mortem (assessed individually once you are done your project)	55 XP	Dec 14	Dec-5	✓		link to document
1.08	8. Peer-Review Group Work (assessed individually)	25 XP	Dec 14	Dec-5		Form	
2.xx	The Game [Standard & Mini Quests]					
2.01	Seasonal Quest [Self-Introduction]	20 XP	Sep-30	Sep-30		FORUM	Link to post in discussion list
	Post dierectly to discussion list (no documents)						
2.02	Reputation Q [Share profile image]	15 XP	Sep-30	Sep-30			PASTE file ID (NOT link) in your QuestLog
2.03	Persuasion Quest [Reflection]	22 XP	One Per Month	Dec-5	✓	FORUM	Direct link to post in discussion list
	You can do up to FOUR for XP						
2.04	Talk To [Comment Response]	10 XP		Dec-5		FORUM	Direct link to post in discussion list
	Up to 8 responses to your original posts can be logged.						
2.05	Chain Quest [Create A Game (with contstraints)]	25 XP	Sep 24	Sep-24		Folder	Place your game documents in this folder. Give the name of your game (or brief description) in your questlog.
	IN CLASS						
2.06	Discovery Quest	10 XP	As assigned	Dec-5			(to be completed in class, no prep necessary)
2.06.01	Grow-A-Game Exercise	10 XP	*Sep-10*	Sep-10			note which one you made
2.06.02	Playtesting Exercise	10 XP	*Sep-10*	Sep-10			note which game you tested
2.06.03	GD Fundamentals	10 XP	*Oct-1*	Oct-1			note which line your response appears on
2.06.04	Build a Game from a Song	10 XP	*Oct-1*	Oct-1			note which line your response appears on
2.06.05	Semiotics I	10 XP	*T.B.A.*	T.B.A.			
2.06.06	Semiotics II	10 XP	*T.B.A.*	T.B.A.			
2.06.07	Bias Exercise	10 XP	*T.B.A.*	T.B.A.			

Figure 4 shows the Explore Quest, which is a game review. It includes instructions as well as links to all relevant files and folders. The grading scheme is also outlined. It is designed so each line item can be assessed on a sliding scale of 5 (well done) to 0 (missing).

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Explore Quest — 22 XP — 4 X

2.09 Review a Game

Source: K.Becker © 2019

This quest EXPIRES on the last day of class.

In Brief:		Practice critical and cognisant analysis of games.	
Specifications		Choose a digital game (it could be one that you already play) and write a review for it. If you have something in mind but are not sure if it will be appropriate, check with me. NOTE: it can not be a game with an RL version that predates the digital one. This means that Solitaire is not eligible, but Angry Birds is.	
What You Need You will need these to complete the quest.		Make a copy of this template Edit your copy as appropriate and then drag or move it into the shared folder.	
What to Submit		A link to the document you made.	
Scoring Thi s is how this quest will be scored.	0	Bonus	2
	1	used template and placed it in the correct folder; info complete including screenshots, properly credited	5
	2	comments are reasonable and contextual	5
	3	clear that reasonable amount of time was devoted to playing game for review,	5
	4	includes criticisms as well as praise	5
Help			
Background Info:		A strange game. The only winning move is not to play. –WOPR - In the movie "War Games" after learning the futility of "playing" Global Thermonuclear War by playing a seemingly endless series of games of Tic-Tac-Toe with itself.	

Figure 5 shows the Turn-In Quest, or Critical Incident Questionnaire. It is described further elsewhere.

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Turn-In Quest — 22 XP 4 X

2.15 Critical Incident Questionnaire

Source: K.Becker © 2013, Revised 2015, 2019

You must complete at LEAST one, but you can do as many as four for points.
It is suggested that you turn one in every four weeks. You may not turn in more than one per week.

In Brief:

For this quest you will need to follow the link to the online form and fill it out. All parts of the form are required.
You may choose to submit anonymously or you may include your name. If you submit anonymously, you will not be able to earn points. I value the feedback even if you don't want to give your name. If nothing comes to mind for any of the questions just put ""nothing"" (or some such) in the space (You won't get points for this).
This form requires some response for each question.

Specifications

For this quest you will need to follow the link to the online form and fill it out.
You may choose to submit anonymously or you may include your name. If you submit anonymously, you will not be able to earn points. I value the feedback even if you don't want to give your name. If nothing comes to mind for any of the questions just put "nothing" (or some such) in the space (You won't get points for this).
This form requires some response for each question.

Fill out an online form that asks the standard Critical Incident Questionnaire questions:

1. At what moment in class this week did you feel most engaged with what was happening?
2. At what moment in class this week were you most distanced from what was happening?
3. What action that anyone (teacher or student) took this week did you find most affirming or helpful?
4. What action that anyone took this week did you find most puzzling or confusing?
5. What about the class this week surprised you the most?

What You Need

A link to the survey.

What to Submit

Just say you did it.

Scoring

0	Bonus	2
1	Answered: Most Engaged	4
2	Answered: Most Distanced	4
3	Answered: Most Helpful	4
4	Answered: Most Confusing	4
5	Answered: Most Surprising	4

Help

It helps if you actually come to class.

Background Info:

Reflecting on one's own learning helps you learn better. Providing feedback to the instructor can help them teach better, and providing feedback while the course is still running can help the instructor adjust their teaching / course to better meet the needs of their students.

Figures 6-8 show the pages for the Chain Quest, which is a classroom activity spread over 1 ½ weeks.

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Chain	25 XP	1 X

2.05 Create a Game with Contstraints

Source: K.Becker © 2013, Revised 2015, 2019

In Brief:	This is your first run-through of a game design and development. It will give you some practice on what you will need to do for your Epic Quest.
Specifications	This exercise asks you to create a game from random junk, write up the rules for that game, get some class-mates to test it and give you feedback, and to then create a brief High Concept document for the game you invented.
	IMPORTANT NOTE: **The playtesting you are doing for this quest is NOT eligible as submission for 2.12**

What You Need		
You will need these to complete the quest.	High Concept Template (make a copy)	Playtesting Template (make a copy)
	Game Rules Template (make a copy)	Chain Quest Folder (put ALL your files here)

What to Submit		
	In your QuestLog: You need the name of your game, and the submission date.	
	You need to put the following files in the Chain Quest Folder:	
	1	Your Group's High Concept (ONE per GROUP)
	2	Your Group's Game Rules (ONE per GROUP)
	3	Your playtesting report of the game you TESTED (ONE report / game / PERSON)
	4	Your second playtesting report (if you have one)

Scoring			
Thi s is how this quest will be scored.	1	Completed Game	5
	2	Game description completed and posted in Public Square.	5
	3	Description adequate to play the game.	5
	4	Play another team's game.	5
	5	Report on another team's game reasonable and complete.	5

Help		
	For what to do in class, see this tab.	For more explanation on what to hand in, see this tab.

Background Info:	
	It's one thing to design a game that draws on other games you know, but it's another to start with specific constraints and then try and design a game around those constraints. This exercise gives you a random set of objects and asks you to create a game using those objects.

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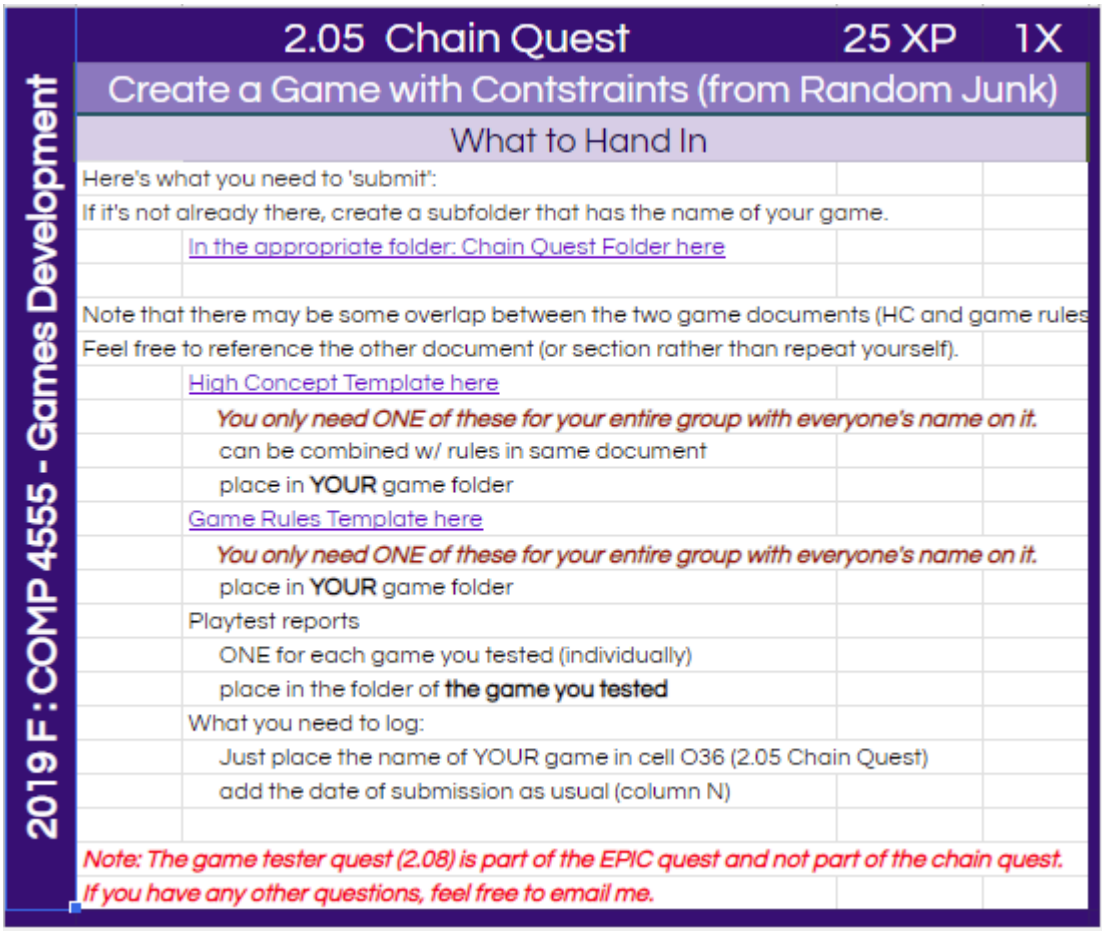
2.05 Chain Quest — 25 XP — 1X

Create a Game with Contstraints (from Random Junk)

Detailed Description for each of the 3 days

		Time in Minutes	Start	Finish
Day 1:	Total	1:20		
0	Introduction of Exercise	15	11:30	11:45
1	Form into groups of 4 or 5 (move desks if necessary).	10	11:45	11:55
2	Choose ONE each of the brainstorming cards: Genre Card, Value Card(+), Value Card(-), Fun Card, Reward Card Choose TWO each of the following cards: Theory Card, Verb Card, Mechanic Card Given the cards you have chosen and what's available on the table, design a game and then take the items you will need to implement (build it) it. This includes the time it will take to actually build the game.	55	11:55	12:50
Day 2:	Total	1:20		
1	Set up your game.	8	11:30	11:38
	Finish Up your design.	15	11:38	11:53
	Write up a 1-2 page description of your game design, including the rules. This should be a google doc shared with the class.	15	11:53	12:08
	Game Rules Template			
2	Choose 1 person to stay with your game, while the rest of the team each choose another game to play.	1	12:08	12:09
3	Play another team's game.	10	12:09	12:19
4	Write a brief report on the game you just played. (use template)	10	11:30	11:40
5	Choose 1 person to stay with your game, while the rest of the team each choose another game to play.	1	11:40	11:41
6	Play another team's game.	10	11:41	11:51
7	Write a brief report on the game you just played. (use template)	10	11:51	12:01
8	Copy/move report into public square.			
Day 3:	Total	35		
	As a group: Collect and analyse data on your game.	10	12:01	12:11
	Present a brief summary of what you learned:	25	12:11	12:36
	What did you find easiest of the game design part?			
	What did you find hardest of the game design part?			
	What did you learn from the playtesting - as a tester?			
	What did you learn from the playtesting - as a host?			
	What should we definitely do again in another game design exercise?			
	What should we definitely NOT do again in another game design exercise?			
	What should we definitely do again in another playtesting exercise?			
	What should we definitely NOT do again in another playtesting exercise?			



3. The Store

The "Store" is a Google folder that contains any files that the students may find useful. It contains templates they can copy, all PowerPoint presentations, copies of papers to read, code examples, etc. Students have read-only access to this folder.

4. The Public Square

Students have edit permission on this folder and it is where we put everything that is to be shared with the whole class, such as high-concept pitch feedback, playtesting results, in-class exercises, and so on.

Together these four parts contain all of the course assets the students will need. It appears to be quite complex and it normally takes the students a few weeks to get the hang of it. A few always complain that they can't use their usual CMS (BlackBoard at our institution), but I argue that is useful for them to get to know various systems for organizing data, and since they have few deadlines and the ability to re-submit items, no student is at risk of losing marks if it takes them a bit longer than others to familiarize themselves with this system. Many come to like the freedom it provides.

COURSE ASSIGNMENTS

As the core of this course is the actual work that they do, the quests have been carefully designed to

provide students with appropriate practice and experience. The quests in this course are classed into three broad categories:

The Epic Quest (main group project).

The "Game": Standard and Mini-Quests. These translate to more traditional regular assignments that are often completed solo.

The Boss Battle. The Final Exam.

The Epic Quest

Epic Quest [Guild : must earn at least 200XP to pass.]

- High Concept Pitch (Presentation)
- High Concept Document
- Prototype I (non-digital)
- Prototype II (digital)
- Treatment / Script
- Final Presentation
- Post Mortem (assessed Individually once you are done your project)
- Peer-Review Group Work (assessed individually)

The Epic Quest is the major group project. They may work in groups of up to 5 people, and are allowed to choose their own groups. It is to design and develop a game to the 1st playable stage.

Game MUST be a Short Form game; in other words, play for a single round or level must not exceed 15 minutes. The game may NOT be multiplayer, a shooter (FPS), a frame game or interactive worksheet. It MUST be an original design or clever adaptation. The game may also not include fighting or violence as a means to advance, and it may not feature any but the simplest character animation.

The Game [Standard & Mini Quests]

Some of these quests are small and some are more involved. Some are scored pass/fail, and others are marked according to criteria that the students can examine at any time. Some of these quests are repeatable, but a few are not.

- **Seasonal Quest** [Self-Introduction] – This is a short post published on the course internal discussion board. It may only be completed once, and it must be completed before the end of the first month of classes.
- **Reputation Q** [Share profile image] – This quest has 2 purposes: it familiarizes the students with the grading system and log books, and it provides me with a picture of that student so I can better familiarize myself with them. These images are not shared with the class – they are only used by me. This can also only be completed once, although they can keep trying until

they get it right.

- **Persuasion Quest** [Reflection] This is effectively an Op-Ed piece to be written on any topical theme related to game design and development, or to the game industry as a whole. It is repeatable and is to be posted in the class discussion group. This is meant to prompt discussion and to give them an opportunity to learn professional casual discourse. Many programs in computer science focus very little on writing and communicating skills, yet it is one of the most important skills needed by today's graduates.
- **Talk To Quest** [Post Comment] This is a mini-quest designed to promote discussion among class members. They get points for responding to someone else's reflection, as well as responding back to someone's comment on their own reflection. Citation style is casual, and I rarely get involved. I have found that my comments tend to shut down discussion. If there is something I need to correct, or say to a poster, I will do so in a private email.
- **Chain Quest** [Make Game from Stuff] This is their first crack at designing and building a game. They are to build a physical game from a variety of dollar-store do-dads. They are given brain-storming cards to help them. This is completed over 3 75 minute classes. The final class is where they bring in their completed games for other class members to playtest.
- **Discovery Quest** [IN Class] These consist of a variety of small, usually in-class activities, most of which are shared with the class and discussed.
- **Fetch Quest** [Share Class Resource.] Students can earn points for providing a resource suitable for use in this course. It could be a video, document, podcast, etc. They need to provide a proper APA style citation for their resource and they must also include a brief summary and justification (i.e. why would our class find this useful?). The formal citation is required here because most resources will not be the usual peer-reviewed papers and books. It is useful for them to learn how to properly cite other kinds of media.
- **Escort Quest** [Share GameMaker Tutorial] One of the best ways to really learn something is to try and teach it to someone else. Students are provided with a template for creating a tutorial suitable for teaching other class members something about GameMaker. This quest and the previous one also helps to underscore the collaborative nature of this course.
- **Explore Quest** [Game Review] A template is again used to focus the student's efforts here.
- **PvP Q** [Peer Review High Concept] This quest is related to the Epic Quest but is separate as I did not want the total value of the Epic to become too weighty. Here students are asked to fill in a Google form WHILE their classmates present their high-concept designs.
- **Character Building Q** [Self-Assessment of High Concept] This is the same as the previous except that students are evaluating their OWN pitches. These assessments are combined with the previous ones, anonymized, and then given to each group so they can have fast feedback on their designs.
- **Craftskill Q** [Game Tester] This quest is also related to the Epic, but playtesting done in conjunction with the Chain Quest can qualify. There is also a template for this and students must submit a brief written report. It is important that they learn how to respectfully critique each other's work.
- **Test of Lore** [GameMaker] There are a series of online quizzes. Students can re-do them as

often as desired. It is suggested that they try the quiz without help first, then look up the answers they got wrong and re-do the quiz. Most students end up repeating the quiz 3-5 times. The main goal here is for them to review important material.

- **Test of Lore** [General Quiz] These are also short, online quizzes that help students review. Many have commented that they tend to remember the ones they first got wrong longer than the ones they got right.
- **Turn-In Quest** [CIQ – Form] This final quest is a critical incident questionnaire that contains 5 questions:
- At what moment in class this week did you feel most engaged with what was happening?
- At what moment in class this week were you most distanced from what was happening?
- What action that anyone (teacher or student) took this week did you find most affirming or helpful?
- What action that anyone took this week did you find most puzzling or confusing?
- What about the class this week surprised you the most?
- They may repeat this up to 4 times, and there are no right or wrong answers; only ones that are too short. This is 'live' feedback for me that allows me to adjust the course as it is still in progress, thereby benefitting the students while they are still in the class, rather than after they are gone, as is typical in other student feedback.

Boss Battle [The Final]

I teach in the Science faculty and am normally required to hold a final exam. In this case it is a low-value, in-class, studio style final. Students are given requirements and constraints for a board game that they must design, pitch, and playtest in one 2-hour session. Students may communicate with each other; they will play-test each other's games, and are free to use any online resources they wish. Since ALL components of the course are cumulative, any students who already have as many points as they want by the last day of class can opt out.

COURSE ASSESSMENT

Given the design of this course, there really are no "weights" given to specific components. As the course is cumulative rather than compartmentalized, all scores are added together to form their final score. There is a direct mapping between XP and the traditional university percentages. At our institution, anything above 95% is considered an A . That means that students need to earn a minimum of 950 XP in order to earn an A . Students can see at any point in time where they are in relation to where they want to be. They are also given guidelines for where they should be each week.

It has been said elsewhere that there are very few deadlines, and students may resubmit any assignment.

Figure 9 outlines the scoring for all the components of the course.

Quest	Details	XP each	Reps	1385 XP
Epic Quest	**1.00 Design a Game and build a Prototype**	**400 XP**	**1 X**	**415 XP**
Seasonal Quest	2.01 Posting a Self-Introduction	20 XP	1 X	20 XP
Reputation Quest	2.02 Profile Image	15 XP	1 X	15 XP
Persuasion Quest	2.03 Editorial Response - OpEd	22 XP	4 X	88 XP
Talk To Quest	2.04 Respond to a Post	10 XP	8 X	80 XP
Chain Quest	2.05 Create a Game with Constraints	25 XP	1 X	25 XP
Discovery Quest	2.06 In/Out of Class Exercise	10 XP	10 X	100 XP
Fetch Quest	2.07 Share a Resource	17 XP	4 X	68 XP
Escort Quest	2.08 Share GameMaker Tutorial	22 XP	4 X	88 XP
Explore Quest	2.09 Review a Game	22 XP	4 X	88 XP
PvP Quest	2.10 Peer Review High Concept	10 XP	6 X	60 XP
Character Building	2.11 Self-Assessment High Concept	20 XP	1 X	20 XP
Craftskill	2.12 Be a Play Tester	10 XP	5 X	50 XP
Test of Lore	2.13 & 2.14 Quiz(es)	10 XP	8 X	80 XP
Turn-In Quest	2.15 Critical Incident Questionnaire	22 XP	4 X	88 XP
Boss Battle	**Studio Final**	**100 XP**	**1 X**	**100 XP**

The first number represents the maximum number of points that can be earned for each submission. The next number is the number of variations of that quest can be submitted. For example, students can submit up to four game reviews, but they must be of different games. The rightmost number is the total number of points that can be earned, including bonus points.

As you can see, the maximum points possible is 1385. Since students only need 950 to get an A , they now have choices as to how they achieve that.

There are several minimal requirements that must also be met:

- Students must earn a minimum of 500 XP (= 50%, a fairly standard requirement).
- Students must earn at least 200 XP on the group project (to force them to make a reasonable effort).
- Students must attempt and submit at least one of every type of quest (to force a wide variety of experience).

This approach allows for two main modes of course completion:

- The traditional approach, which is to complete the minimum number of tasks and earn a high score on each one.
- A novel approach, which is to complete a wide variety of tasks adequately, earning a moderate score on each one.

The traditional approach to assessment favors students who are able to get everything right the first time. There are others who are willing to keep trying at something until they get it right. These are the 'sloggers'. It may take them a bit longer than others, but it is not necessarily an indication of lower potential.

If I were staffing up for a game (or any other) project, I would certainly want to hire a few of the first kind, but the bulk of my hires would be of the latter kind – they are less likely to give up when things get tough. Really, the only way to fail to get a reasonable grade in this class by not doing the work. In traditional kinds of classes, there are many ways to do poorly in a class that have nothing to do with the students' abilities.

EXPANDED COURSE OUTLINE

Note that given the fluid nature of this course, most of the quests are not "handed out" in the traditional way. Instead, students have access to the assignment specifications for every assignment on the first day of class. The Persuasion (2.03), Talk-To (2.04), Fetch (2.07), Escort (2.08), Explore (2.09), The Tests of Lore (2.13 & 2.14), and the Turn-In (2.15) Quests can be submitted any time and are on-going throughout the term.

Week 1 Orientation; Overview: Why are we here?

As this course design is radically different from what most students have ever experienced, the orientation part of the course takes considerably more time than it would in a more traditional course. Most of the first week or two are devoted to getting the students accustomed to how the course works.

Class Topics/Activities

- About the Uncanny Valley – includes video on Vimeo (3DAR, 2015)
- Notes (course map slides)
- Figure out how to submit stuff for marking.

Assignments

- Intro Survey
- Guilds Sign-Up
- 2.01 Timed Quest [Self-Introduction]
- 2.02 Interact Quest [Share a profile image]

Week 2 What are games? What is design?

Students begin designing games as quickly as possible. Most of the designs only go as far as the initial prototype, but this is enough to begin learning about playtesting and the reporting that goes with it. Most computer science students are unaccustomed to critiquing each other's work so the playtesting process is one that is quite foreign to most. It is also a process that can be extremely helpful to them in their professional careers whether they become game designers or not. To that end, we spend only one class talking about what a game actually is, and then we get right to designing some. I have

found that brain-storming cards can be extremely helpful for students not experienced in rapid design endeavors.

Class Topics/Activities

- First part of class will be primarily devoted to making sure everyone knows how to complete and log their quests
- Debrief on Playtesting Exercise
- Game Design (Lecture/Presentation)
- EC: What is a Game? (Extra Credits, n.d.)
- PBS Game/Show: What is a Game?
- EC: Be A Game Designer (Extra Credits, n.d.)

Assignments

- 2.06.01 Grow-A-Game Exercise (Belman, et al. 2011)
- 2.06.02 Playtesting Exercise

Week 3 Chain Quest

This exercise was designed by the author. It also uses a set of brain-storming cards adapted from a set used in a course taught by Carrie Heeter at Michigan State University in 2013 (Heeter, 2013). Students in groups are first told to use the brainstorming cards to come up with a very rough high concept for a game. They are then given a very wide variety of miscellaneous 'junk' (paper, markers, glue, tape, foam shapes, small toys, etc.) and asked to create their prototypes using some of the materials given. This exercise serves to both help them practice going from initial idea to high level concept, but it also places constraints on them. Learning to be creative within given constraints is essential for game design, but it is also a useful skill in all forms of software development.

Class Topics/Activities

- EC: Making Your First Game [5:52] (Extra Credits, n.d.)

Assignments

- 2.05 Create a Game with Constraints – IN CLASS
- 2.12.01 First Test of Lore
- 2.07 Chain Quest

Week 4 Simulations & Randomness

Since all games are simulations, it is important to have a basic understanding of simulations. Similarly, almost all games rely heavily on various forms of randomness in order to make them fun and challenging. There are no courses in our program on either topic so it is covered very briefly during this week.

Class Topics/Activities

- Simulations (Lecture/Presentation)
- Randomness (Lecture/Presentation)
- Podcast [11:51]: Meet the woman who designed an early version of Monopoly — and only made $500 (The Current, 2019)
- How to Draw [TEDxHull YouTube] (Shaw, 2015)
- Introduction to GameMaker

Assignments

- 2.07 Finish Chain Quest
- 2.12.02 2nd Test of Lore (simulation & random numbers).

Week 5 Gameplay & Prototyping

This is the week that the students present their high concept games, so one lecture is devoted to prototyping, and the rest of the week is for their presentations. Students also perform peer-reviews while the high concepts are presented.

Class Topics/Activities

- Prototyping (Lecture/Presentation)

Assignments

- 1.01 High Concept Presentations
- 1.02 High Concept Document
- 2.05 Peer Review of High Concept

- 2.06 Character Building Q [Self-Assessment of HC]
- 2.06.03 Game Design Fundamentals Exercise
- 2.12.03 3rd Test of Lore (prototyping)
- 2.12.04 4th Test of Lore (playtesting)

Week 6 Playtesting

This is the first round of playtesting for their epic games. The first prototype must be non-digital, and while they can display game art or audio using their computers, they are not supposed to have written any code yet. The reason for this is that students are often very reluctant to discard code once it's been written. This in turn will cause resistance to game changes that may come out of the playtesting. If their initial prototypes are made of paper (or Lego, or using human actors, …) then it is much easier to adjust rules and other game aspects on the fly. In a longer playtesting session, they can then do several rounds of testing and adjusting.

Playtesters are required to write up reports which are then shared with the game designers. This exercise is also unfamiliar to most computer science students and the idea of critiquing someone else's ideas in order to help them build a better game fosters a more collaborative environment than most classrooms. Since the grading system ensures that there is no limit on how many students in the class can earn 'A's, there is no penalty for helping another group. In fact, most students quickly realize that helping other groups make better games also helps them to understand what they are doing with their own designs.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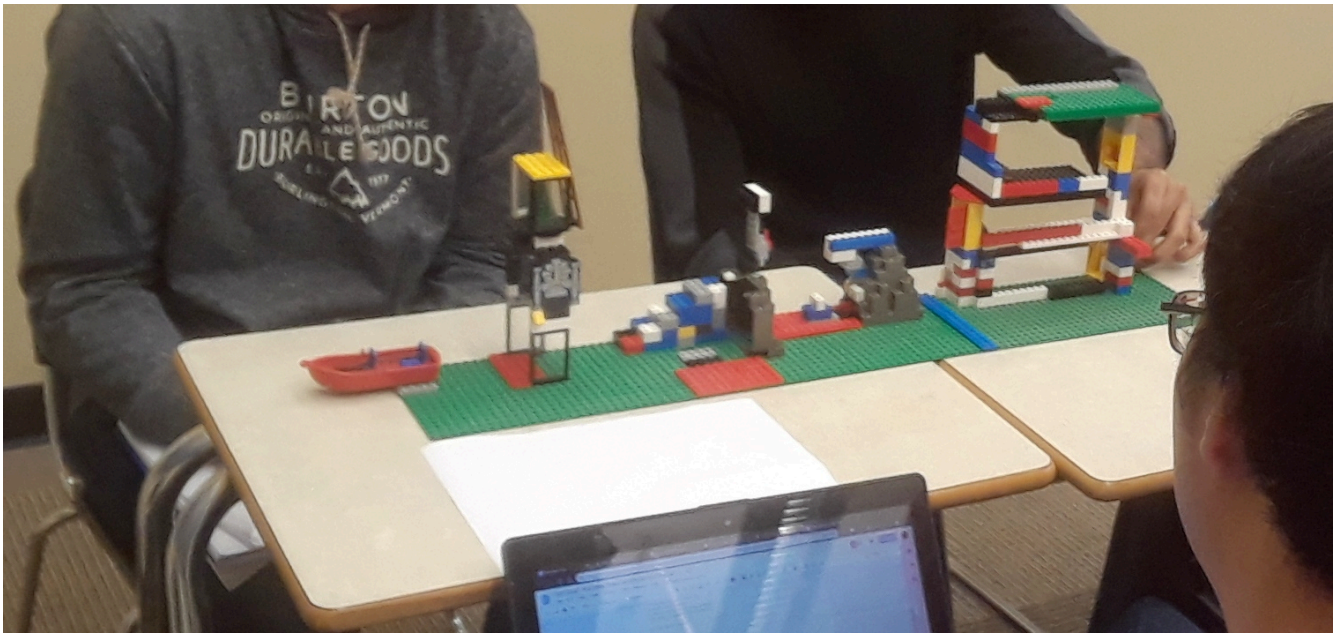

Class Topics/Activities

- How a Game Works (Lecture/Presentation)
- Playtesting (Lecture/Presentation)

Assignments

- 1.03 – EPIC Non-Digital Prototype
- 2.12 – Craftskill – Be a Playtester.

Week 7 Reading Week

There are no classes this week.

Week 8 Game Structure, Mechanics

Introductory game design is a complex topic and it is simply not possible to teach them everything they need to know before they begin to work on their designs. As a result, there are many topics that are covered after they would have been most useful. Learning about game structure and mechanics are two of those. It is made clear to the students that they will likely not know all the things they need to know in order to complete their epic quests until the end of the course. This is taken into account in my assessment of their work.

Class Topics/Activities

- 100 things Every Game Student Should Know (Elling, 2013)
- How a Game Works (Lecture/Presentation)
- Stroop Transitions (GameMaker Game Example)

Assignments

- No 'new' assignments this week.

Week 9 Semiotics, Game Analysis

This week the lectures are devoted to semiotics and analyzing games. There are several exercises that students are to do to help them become more aware of semiotics in games. One exercise has students find links to things that embody certain words such as "war", "fast", or "white". They may not use straight text. The links must be to an image, sound, video, etc. that somehow represents or embodies the terms, and then we all present our links in class. The game analysis section uses an analytical tool designed by the author called the Magic Bullet (Becker, 2015, 2016). Students practice analyzing games they already know using the Magic Bullet template. At the end of the course, they are also asked to use the same template to evaluate the course itself as if it were a game. Part of my strategy is to invite my students to critique my own work just as I am asking them to critique each other's as well as those of developers they don't know. This provides multiple venues for practice but also helps to build a feeling of community in the class which is important if students are to feel safe while taking creative risks.

Class Topics/Activities

- Semiotics (Lecture/Presentation)
- Games you can't win? (Lecture/Presentation)
- Game Analysis (Lecture/Presentation)

Assignments

- 2.06.05 Semiotics Exercise I
- 2.06.06 Semiotics Exercise II
- 2.06.08 Analyze a Game

Week 10 Sound (Audio, Music)

Sound is an often-undervalued aspects of games and in the first class we examine some aspects of sounds effects and score. The Audio lecture draws examples from both games and film. The audio exercise has students create a very brief high concept for a game from a song they have been given. The instructor has a number of songs to choose from. This week we also discuss the author's Decorative Media Principle, which has to do with the notion that a visually pleasing background and decorations for a worksheet, website, game, etc. that is thematically connected with the message being featured can enhance the overall impact in important ways (Becker, 2017). On the other hand, people sometimes fall into the 'decorative media trap' which causes people to assume that something that is visually pleasing must also be robust and fit for purpose.

Class Topics/Activities

- Audio (Lecture/Presentation)
- Decorative Media Principle (Lecture/Presentation)
- The Magic of Making Sound (YouTube Video) (Great Big Story, 2017)
- Audio – Sound Effects Example Shape of You (YouTube Video) (Walk Off The Earth, 2017)

Assignments

- 2.06.04 Design a game from a song Exercise

Week 11 Social Issues: Gender & Violence in Games

This theme is a very important one and it is left to near the end of term because I feel it is important to have built up trust between the students and the instructor, which will allow for more meaningful discussions. One of the exercises we do this week involves students taking two self-tests from the website Project Implicit (https://implicit.harvard.edu/implicit/) to identify some of their biases. They are not required to share their personal results with the class, but they are instead asked to choose a videogame they know fairly well – one with a narrative. In light of the two aspects of bias they have just tested themselves on, they are asked to explain in what ways the game they have chosen exhibits either of those biases.

Class Topics/Activities

- Games for a change: Brenda Brathwaite at TEDxPhoenix [9:30] (Romero, 2012)
- Bias [1 min] How To Overcome Unconscious Bias [1 min] (Media Partners, 2017)
- The Female Tax | Brenda Romero | TEDxSantaCruz [9 min.] (Romero, 2016)
- GamerGate [4 min]
- What It Feels Like to Be a Gamergate Target [8:17] (ABC News, 2015)
- EC: Harassment – Why Gaming Struggles to Escape Toxicity [7:26] (Extra Credits, n.d.)
- Article: The games industry responds to #MeToo (Gamesindustry.biz, 2017)

Assignments

- 2.06.07 Bias Exercise

Week 12 Content Creation & Asset Management

This week has a presentation on content creation and asset management, and the rest of the week is devoted to helping them finish their next prototypes.

Class Topics/Activities

- Deep Dive into Player Motivations (Yee, 2019)
- Asset Management (Lecture/Presentation)

Assignments

No 'new' assignments this week.

Week 13 Playtest II

This week is devoted to playtesting and helping them finish up their games as far as possible.

Class Topics/Activities

- Playtesting of Epic Games

Assignments

- 2.12 Craftskill Quest [Class Game Tester]
- 1.04 Prototype II (digital)
- 1.05 Treatment / Script

Week 14 End Game: Post Mortems, Boss Battle

In the final week of class student present post mortems of their games that also includes a critique of the entire process. Reflecting on work completed is a highly under-rated activity in many post-secondary classes as it is often seen as taking time away from lectures. However, giving students time to do and guidance on how to reflect on the work they did in a way that is intended to be constructive rather than punitive can result in lasting impacts.

Class Topics/Activities

- Presentations of Post Mortems
- Boss Battle

Assignments

- 2.06.09 Post Mortem
- 2.06.10 Analyze Course as a Game

- 1.06 Final Presentation
- 3.00 Boss Battle (Optional Final Exam)

15 Game Over

Group work is often seen by students as unpleasant. In this class, the grading is set up so that students will never be denied an opportunity for an 'A' because of the activities of their group. They are given considerable guidance in how to divide the work, and the epic quest is scored in such a way that they can earn the minimal required points even if they have several uncooperative group members. Here too, they are asked to reflect on the process and are given an opportunity to evaluate their own group members using private feedback to the instructor.

Assignments

- 1.07 Post Mortem of Epic Game (assessed Individually once you are done your project)
- 1.08 Peer-Review Group Work (assessed individually)

COURSE BEST PRACTICES

As stated before, the course consists of two 75-minute lecture 'hours' and a 50-minute tutorial 'hour'. Ideally, the tutorial will immediately follow the second lecture and that the lectures and tutorials will be held in the same room. This allows for a scenario where an activity can be set up in the first lecture and then completed in the second. Having the tutorial right after the lecture allows for the 'lecture' to run long. This has been especially helpful during playtesting sessions. Towards the end of the term, when students have had considerable practice conducting playtests, the extra time is not needed, but while students are still learning how to conduct playtests, the extra time is essential.

In order to work effectively, my design requires a number of things:

Front-Loaded Materials

All student assignments must be described, along with the marking schemes on the first day of class. This requires considerable 'front-loading', but also has the benefit of lessening the workload during the term.

Bonus Points

In the first few iterations, I left the deadlines completely open and found that most students had difficulty in managing their own time. It would appear that while we put considerable effort into setting deadlines and lauding the value of meeting them, we rarely spend time in formal education helping students actually manage their time when there are no clear deadlines. I found that setting "Best Before" dates helped the students to organize better. I also included a very small number of bonus points to help encourage students to meet 'deadlines'. In the same way that having to put a quarter into a lock to get a shopping cart helps encourage people to replace them, a small number of bonus points helps people to complete work in a timely fashion. The fact that it is a 'bonus' for on-time delivery rather than a late penalty feels better for the students when they are unable to meet the deadline.

Expiries

There are a considerable number of items among the quests that involve creating something of value for the class that can be shared. I allow my students to continue to submit items for marking until about 24 hours before I am required to submit my final marks by the university. I found that a few students would post discussion pieces, or resource items in the last days after classes had ended. As part of the objective of these kinds of quests were for class sharing, I ended up having some quests 'expire' so that they would no longer be accepted for scoring. Any item that was meant for class sharing now expires on the last day of lectures.

Custom Grade Book

An efficient and easily accessible grade 'book' is essential. There are a great many items both large and small that students can submit. I have not yet found a single Course Management System that allows for multiple submissions of the 'same' assignment, re-submission, and that allows for a score that goes over 100%. As a result, I built my own grading system using Google Sheets. Each student is given a Quest Log, accessible only by that student and me, that contains all of the quest assessments.

Fast Feedback

Fast turn-around of marking is essential. I typically mark items about twice a week. Since almost anything can be submitted at any time, I need to be prepared to mark any of the assigned work. Many of the quests are set up so that they are easy to mark, with templates for them to fill and in-class presentation. A number of items are simply marked pass/fail. It is in doing the work itself that they will learn the material. My responsibility as the instructor to ensure that the work they are asked to do will in fact help them learn what I need them to learn.

Marks are posted in a leaderboard that anonymizes individuals, and sorts scores in descending order (see Figure 009). Each column represents one 'round' of marking. Rows do not represent individual students, simply the sorted scores. Note how many students continued to submit work for marking *after* they had earned sufficient points for an A . Those additional submissions could in no way change their marks, but they completed and submitted them anyways.

4555 Leaderboard for Nov. 29, 2020																				
Week	3	3.5	4	4.5	5	6	6.5	7	7.5	8	8.5	9	10.5	11	11.5	12	12.5	13	13.5	14
(date posted)	Sep 23	Sep 26	Sep 30	Oct 3	Oct 7	Oct 14	Oct 17	Oct 21	Oct 24	Oct 28	Oct 31	Nov 4	Nov 14	Nov 18	Nov 21	Nov 25	Nov 28	Dec 2	Dec 5	Dec 9
Current mean	103	163	234	352	390	451	463	471	528	577	612	662	693	715	739	764	854	861	884	921
--> where you should be -->	176	205	234	264	293	352	381	410	440	469	498	528	616	645	674	703	733	762	791	821
			1	1	1	1	1	2	2	2	2	2	4	5	6	7	8	9	10	11
1	247	413	552	619	692	769	769	769	872	893	895	895	896	944	1,030	1,040	1,040	1,073	1,073	1,073
2	240	286	407	611	666	709	731	731	850	866	866	866	866	897	999	1,010	1,035	1,040	1,040	1,040
3	213	285	377	608	657	704	704	704	774	794	840	861	861	893	908	999	1,010	1,010	1,012	1,012
4	188	266	365	558	611	690	701	701	758	789	801	802	819	866	897	967	999	999	1,012	1,012
5	174	229	341	504	608	681	690	690	738	759	795	797	803	819	866	866	976	976	1,010	1,010
6	151	224	311	489	606	645	645	667	733	755	781	795	801	803	853	864	971	971	999	999
7	146	214	310	481	510	642	642	650	711	751	779	790	798	798	835	860	944	970	976	999
8	144	192	306	477	508	618	618	642	701	748	766	781	795	795	819	853	941	944	971	976
9	112	189	303	476	502	607	607	612	689	732	760	761	781	789	798	830	932	941	970	971
10	111	183	285	446	489	580	580	607	636	726	751	752	777	787	795	819	916	916	958	970
11	105	175	264	432	481	559	567	567	626	692	750	751	762	780	789	814	900	900	944	962
12	105	172	259	419	478	550	559	559	605	691	719	741	754	779	780	808	880	880	925	958
13	102	170	256	407	419	525	550	550	597	669	695	731	752	777	779	787	879	879	900	935
14	102	170	218	394	407	488	525	532	596	625	680	726	742	762	777	780	871	871	880	925
15	100	159	218	335	373	426	488	525	554	606	663	719	742	754	772	779	871	871	879	880
16	79	154	215	273	355	411	444	444	493	606	652	716	741	752	772	772	869	869	876	879
17	68	153	213	269	336	394	426	426	480	599	646	710	731	747	754	772	864	864	871	876
18	67	138	206	268	304	384	411	411	455	590	596	676	716	741	747	754	858	858	871	871
19	65	137	193	263	293	356	394	404	440	527	592	672	711	716	741	747	855	855	869	871
20	64	136	183	241	273	356	381	381	414	483	527	648	703	712	716	726	854	854	867	869
21	58	105	176	231	268	345	345	365	410	461	523	632	667	699	712	712	853	853	864	869
22	58	93	153	222	263	306	306	358	405	426	505	599	632	681	699	701	851	851	858	867
23	58	84	141	217	231	294	294	306	357	425	427	559	601	632	632	699	769	807	853	864
24	57	84	129	197	197	264	264	264	325	377	381	461	506	560	560	640	738	776	776	858
25	57	83	116	188	188	199	199	199	279	280	378	434	494	495	524	619	694	694	773	855
26	42	64	85	187	187	190	190	190	229	230	302	382	465	495	505	517	626	626	765	853
27	38	59	84	154	154	156	156	156	220	221	281	370	454	454	495	515	607	626	656	853
28	23	48	69	154	154	155	155	155	187	207	207	325	409	409	454	498	588	607	607	852
29	22	48	60	86	86	88	88	108	184	200	202	253	327	388	409	409	585	585	585	761

FUTURE COURSE PLANS

I change some of the videos and articles I reference every year. Given that this is effectively an introductory course in game design and development, the content, while remaining current, need not change drastically over time. The game engine used will change as appropriate. I've been using GameMaker, but have found it has become rather expensive, and so I am inclined to switch to something like Processing. I prefer software that is freely available so students can work from wherever is convenient. For the purposes of this course, the game engine used is not particularly important as the focus is on the design *process*, including proto-typing, playtesting, and rapid, iterative design

Entry level courses typically provide an overview of a large topic, and this course is no different. Overviews tend not to change very quickly. For example, entry-level programming courses need not change very quickly, and it could be argued that responding to closely to market pressures in foundational courses can be detrimental (Becker, 2001, 2002). The Epic Quest is the initial design of a single-player game, the constraints for which need not be tied to changes in gaming. For example,

keeping it as a single player game is appropriate to focus efforts on the design process rather than network concerns. Similarly, restricting character animation de-emphasizes graphics and animation in favor of iterative design and adequate playtesting. When left to their own devices, students tend to choose variations of their favorite games. First Person Shooters are popular, but are effectively low-hanging fruit as it pertains to design. The constraint of not being able to advance or win in the game through violence makes students consider other approaches.

I would love to find a course management system that I could use to manage the quests and grades. Once set up, my current system works quite well, but it does take several days each semester to set up and there are always a few errors that need to be corrected. I find that as instructors, we too often tailor our courses to fit the course management software rather than the other way around. I would like to include unlockable content as well as badges, but adding these to my current system would add a layer of management complexity that I am not prepared to tackle. Confidentiality is also a concern, and since this course is being taught at a Canadian university, we have additional restrictions as to where the servers that hold student information reside.

RESOURCES

Game Syllabus Google Folder (GSGF)

All extra materials are available in a Google Folder: http://bit.ly/becker-game-syllabus
(Full URL: https://drive.google.com/drive/u/0/folders/1SUT0rZzviYlVxgRQJyZm6160BeYI5gnq)
Please note that some links found within the documents may not be accessible as they are restricted to the university domain.

This folder contains the following:

- The official syllabus for the fall 2019 semester. [PDF]
- The 2019 boss battle (final exam). [PDF]
- The 2019 Class Schedule. [Google Sheets]
- Example Slides for a Lecture: Playtesting [Google Slides]
- The Playbook (includes all quest descriptions along with the marking guidelines.) [Google Sheets]
- 2.05 Game Rules Template [Google Doc]
- 2.07 Template for Shared Resource [Google Doc]
- 2.12 Play-Testing Questions [Google Doc]

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CHAPTER 2.

COMPUTERS AND GAMES (INT D 450)

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Course Title: Interdisciplinary Undergraduate and Graduate Courses (INT D) 450: Computers and Games
Course University: University of Alberta
Course College/School: Faculty of Arts
Course Department/Program: Department of Media and Technology Studies
Course Level: Undergraduate
Course Credits: 3
Course Length: 13 weeks
Course Medium: Face-to-face and virtually
Course Keywords: video games, interdisciplinarity, game development, game design, rapid prototyping, ready research, presentations, agile development

CATALOG DESCRIPTION

An advanced interdisciplinary course for students in Science, Arts, and other faculties who have completed the introductory games course, CMPUT 250. The focus of the course is the development of a complete game to be released on any computing platform. Teams composed of students with diverse backgrounds follow the entire creative process: from concept to pitch, prototype, testing, and delivery. Game post-mortems and industry lectures provide context for the team projects.

COURSE PURPOSE AND OBJECTIVES

The purpose of the course is threefold: Prepare, Progress, and Present. The Prepare phase is focused on preparing upper-level undergraduate students for life after graduation. Students improve executive functioning skills such as time and task management, meeting and report preparation, and ideation and feedback practices, essentially putting into practice the theories and skills they have

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developed over the course of the entire Game Development Certificate. That transition from theory to practice is accentuated in the Progress stage where students are asked to apply all of their previous game design classes into one final, highly-polished capstone game experience. Working as part of an interdisciplinary team, students plan, design, build, and release a game of their choice with no restrictions on development platform or genre. This project becomes the centrepiece of the students' portfolio. The Present stage includes exercises that take one of two forms. First, there are numerous rapid prototyping exercises that include ideation, revision, and presentation elements using a variety of constrained game design activities. The goal is the production of a playable game within a single class, with the ancillary benefit that students end up with additional portfolio objects. Second, student teams conduct a game post-mortem that focuses on a particular game design issue, such as affective game design or asymmetrical game design. At the end of that class, students present a comprehensive overview of the topic and featured game. By the end of the course, students should be well-prepared to engage in various aspects of the game industry.

The specific learning objectives for each stage are as follows. 'Prepare' objectives include having students develop skills in presenting material effectively, investigating game design challenges, and discussing key lessons with potential employers. 'Progress' objectives include developing deep domain expertise in one specific game development skill, accelerating the process of ideation and prototyping, and generating familiarity with inadequate preparation and failure. Finally, 'Present' objectives include delivering competent presentations, deliberating strengths and weaknesses of games and game mechanics, and promoting their games and game ideas to potential collaborators and investors. As with the other stages, all 'Present' objectives are done within tight time constraints.

COURSE CONTEXT

INT D 450 is the capstone course of the Certificate in Computer Game Development in Media and Technology Studies. Students who enter the class have taken five other classes focusing on game development. The first of these is CMPUT 250: Computers & Games, which introduces students to working in interdisciplinary teams and the entire game development process from pitch to publishing. In fact, the motivation for creating the game development certificate emerged from the success of this course which filled up quickly with an enormous waiting list. Students must complete four courses that reside between the introductory and capstone courses, each of which focuses on specific aspects of game development, such as creative writing, game programming, and sound production. There are usually six or seven options offered each year. These courses provide students a common ground to discuss and create games, which permits instructors of the capstone course to avoid re-teaching core game design concepts and game production basics. Any undergraduate student at the University of Alberta can take the certificate assuming they can fit the courses into their schedule. Students from Computing Science make up a third to a half of all students in the course each year, with the remaining coming from creative writing, music, media studies, English, film studies, industrial design, visual communication design, gender studies, mathematics, nutrition, psychology, physics, economics, anthropology, sociology, history, general science, and general arts. Interestingly, on average, less than half of students are committed to pursuing a career in the games industry. Many take the class and certificate for other reasons, including interest in a shared educational experience and/or interdisciplinary investigations, the pursuit of a broad learning experience, or a love of games.

These factors allowed us to focus on important job skills that most other classes do not get the opportunity to teach.

COURSE PEDAGOGY

The course pedagogy is centered around the following tools: a constructivist approach that values the building of the objects of study, researching and presenting interactive intellectual tasks, and a flipped classroom. The class is relatively small (maximum of 36 students), which allows the students to bond over their shared past courses as well as the group projects that shape this class. The most important aspect of this process is that we can challenge students once we know they feel confident in this safe and collegial learning environment. Moreover, in such an environment, they can challenge themselves. When the class is too tense/strict/formal, it is our experience that students do not take risks, which is a critical part of education. Not only do students learn from taking risks, but arguably, school is the best place to take risks as the stakes are generally lower. For example, in feedback on presentations, we often encourage students "to meaningfully involve your co-presenters more." Normally, even when risk-taking is encouraged, students finish the semester with a pretty standard group presentation in which they each take a topic, each create a few of their own slides, and present together or, separately. One team this semester took one slide and had a planned, in-presentation debate about a complex topic. They were on Zoom, so Matt had to listen carefully, but he could hear the excitement in their voices (before and during the presentation), and the relief and pride after the presentation when they got a torrent of positive feedback from the instructor and classmates. If they had done a terrible job of that section, they would have gotten nearly full credit and a risk-taking bonus in grading. As it happens, they performed beautifully and got full marks plus a bonus. This is representative of our teaching philosophy: give directive (rather than overly prescriptive) feedback, create a safe environment, make them do the work, and congratulate both the effort and the result.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Generally, key readings are provided on the various topics as source material for students to reference as needed, but we do not spend class time specifically reviewing those sources. Instead, we have used various game design challenges and toolkits to address course content. For the Fall 2020 semester, for example, Matt used *Root of Play*, a game design toolkit created by Matt and his colleague Andy Keenan (Keenan and Bouchard, 2015). *Root of Play* (thegamecrafter.com/games/root-of-play) is a meaningful play exercise that takes players through ideation, pitch, prototyping, and improving a game in as little as an hour. Students find it useful for moving beyond the ideation phase (an area with which most early game designers struggle) and for reinforcing the importance of playtesting and iteration. Students are able to choose their own technology for the game project, so nothing is required in terms of other technologies.

COURSE ASSIGNMENTS

The following three exercises (*Root of Play*, Hot Topics, and Scrum-style meetings) are completed in-class and make up most of the participation grade for the course, which accounts for 40% of the term mark. They were used in the Fall 2020 version of the course taught by Matt.

The usual format of a class focused on a design challenge, for example, would have students ideate and

prototype game design challenges in small groups with tight timelines. Normally, we use their project groups as getting over social barriers with new people takes away valuable time from the exercise. Students would then present their responses and results to the entire class for group discussion and feedback. This process is intended to be completed in a single class, but often activities stretch over two or more classes, depending on other presentations and guest speakers. The instructor, senior undergraduate and graduate students, and/or industry representatives (as appropriate for the exercise) would provide guidance through the process and help evaluate the presentations. Our role in facilitating is most often reminding students of key questions like "Where's the fun?" or "How can you implement that given your current constraints?"

Exercise 1: Root of Play

Approximately every other week, students play a session of *Root of Play*. First, they are broken into teams. 4 or 5 people per team is ideal, but smaller and larger teams can work. Sometimes the teams are their project teams, but later in the semester, we will begin to mix up the teams for these assignments. The teams draw prompt cards from the *Root of Play* deck. The prompt cards come in three categories: Place, Player, and Constraint. Place cards have a word or a few words to describe a situation (e.g., "at sea" or "homecoming"). The place can be interpreted as a setting for the story of the game or a location the game should be played. Player cards describe active agents that could be involved in the game either as characters for the game's story or as a way to describe what types of players would play the game (e.g., "lions" or "teenagers"). Constraint cards are generally mechanics, but again, they are open to a broad array of interpretations. For example, the card "telling stories" has resulted in games that were (not surprisingly) about telling stories (similar to *Dixit* by Roubira, 2008), games focused on bluffing and lying (similar to *Coup* by Tahta, 2014), and games where dice-rolling is the main mechanic but the story is important too (similar to *Dungeons & Dragons* by Gary Gygax and Dave Arneson, 1974).

Generally, the cards are meant to both stimulate the imagination and to provide gentle constraints so that players do not spend too much time in the ideation phase. After each team gets their cards, they can begin the five stages of *Root of Play*: brainstorming, pitch, design, playtest, and iterate. The brainstorming stage is about coming up with a good game idea quickly, using your cards, and the result is a short pitch presentation describing the game in a way to excite potential players or investors. In a ninety minute class, this stage is allotted about 20 minutes.

The pitch phase is next and each team goes in front of the whole class to pitch their game ideas. When each team finishes, the rest of the class votes on which game the presenting team should pursue. *Root of Play* suggests that the team follows the will of the class, but ultimately, they will develop the game that excites them most. In the design phase, players use available materials (usually paper, pens, and scissors) to create a playable prototype as quickly as possible. This phase is also allotted about 20 minutes. The fourth phase is playtesting where players stop ideating and building to switch to playing the game. After the teams have played their game a few times, they can start the fifth phase: iterating. At this stage, players will continually play and improve their game. Near the end of the time, teams will swap members so that they have to explain their game to a new player. Finally, we come together as a class to discuss what we learned.

Exercise 2: Hot Topics

In the weeks where we are not playing *Root of Play*, students participate in Hot Topics. Hot Topics are student-led lightning talks with four goals: focus course content on student interest, practice rapid research, practice rapid prototyping, and practice presentations. The most recent topics were meetings, story, progression, and meaningful play. Once the broad topic is given, students break into teams for the four stages of Hot Topics: topic selection, research, presenting, and support/reach. In topic selection, teams race to select a sub-topic of their choice. The first team to come to the front with a viable sub-topic secures that topic for their presentation. The mild competitive aspect provides motivation for teams to move past ideation quickly. The topic takes the form of a research question: "Are shorter or longer meetings more effective?" The instructor gets a chance to quickly iterate research questions with each team to make sure they are asking questions that can be answered in the allotted time and with the available resources. When all teams have an approved sub-topic, teams proceed to the research stage. Because the "research" questions are broad, there are a number of guiding questions provided to help narrow their research goals. Their explicit goal in the research phase is to answer these questions:

1. What is the leading definition of this topic? Are their credible, competing definitions and what are the limitations of these competitors?
2. What are the main issues of this topic? Why do people seek help/information on this topic?
3. What is the best tool to address this topic? Are their credible, competing tools and what are the limitations of these competitors?

This list of questions was built on student challenges. In previous courses, students had difficulty defining key terms and defending those terms, getting to the "why" of why people are interested in this topic, and finding and defending a solution. In this phase, teams are also practicing their digital literacy skills on how to find and evaluate sources. As teams research, they will also be preparing for the presentation phase. In the presentation phase, each team gives a 10 minute presentation summarizing the results of the previous phase. Students in the audience are asked to make notes for the fourth phase: support and reach. In the final phase, students are purposefully asked to move beyond critique of the other teams. As fellow educators will know, basic critique is the most accessible feedback, and it can be a challenge to find constructive things to say. In this phase, students are faced with that same challenge. The explicit goal of support and reach is to help other students get better. Support focuses on what was useful about the presentation and what was exciting. Reach begins to ask what more could be done, if we assume that the team had no other barriers. While barriers to improvement are mentioned in the assignment description and in the in-class introduction to this phase, they are not the subject of the student comments. The comments should focus on what could improve this presentation in a perfect world. Providing the space for barriers, without dwelling on them, has allowed for some critical comments to be absorbed and applied without too much defensiveness.

Exercise 3: Scrum-style meetings

The beginning of the second class in each week is devoted to a meeting with the whole class. Each team member reports on what they did last week, what they plan to do this week, and what, if anything, is blocking them from completing their work. A Scrum Master and a Product Lead were

brought in from local companies to describe the purpose, structure, and feel of a Scrum meeting. With their advice in hand, the class followed the form of a Scrum meeting, but it was not a perfect fit. It was a challenge to build the rapport that is required to make this kind of meeting work. For example, even toward the end of the semester, very few students felt comfortable enough to report to the class about what was blocking them, and many students kept their comments vague, even in the face of direct requests for more detail. Fortunately, there were a few important incidents where the meeting served its purpose and either inter-team synergies were found or silent challenges were made public and were dealt with. As instructors, our evaluation of the final benefit of this assignment was neutral. We were willing to try it again, but we were unsure of how to improve it. Fortunately, we simply asked the class, and they suggested that while it took some time to find their feet, the exercise was useful at times, and those key times made the whole effort worthwhile.

THE MAJOR PROJECT

The next 7 activities are all part of the Major Game Project assignment that comprises the remaining 60% of the term mark.

1. Project charter

Each team prepares a document that describes the roles of each member, processes for changing those roles, processes for handling disputes, and anything else the team feels is relevant. The final page of the document is for the signatures of all team members agreeing to the charter. This exercise forces the students to have difficult conversations about who is doing what and how disputes will be resolved well before things start to go sideways. This signed document has been useful in resolving serious disputes that arise later in the term.

2. Game concept and genre analysis

As indicated by the title, there are two main goals in this assignment. The first is to move each team from ideation to production by making them decide on a game concept early in the semester (usually within the first week or two). The game concept includes the overall goal of the game both in terms of the players and in terms of what the team hopes to accomplish. The concept also includes inspiration, core mechanics, controls/gameplay, plot, art direction, audio direction, engine selection, SWOT analysis, and finally, an analysis of where their game sits in the landscape of video game genres. This assignment encourages students to think about their game in the context of other games and decide early on the direction their game will go within that context. After the game concept and genre analysis are submitted, each team does a ten minute presentation to the class that summarizes this assignment.

3. Game prototype

For this assignment, teams are expected to submit a working game at the end of the first month to show their current progress. Students have reported that in other classes prototypes are "vertical" slices of their game that are not a finished product but are a finished part of the project and are representative of how the final games will look. The intent of the vertical slice is to show a complete section of the game. The concept of vertical slices is present in game development circles and in agile development circles, and it has been noted in academic literature (Winget and Walker, 2011). However, the four month game design task is a special one. In this context, we encourage an agile-

style prototype that is a minimum viable product (MVP) which includes a beginning, an end, the main mechanics, the main story, and some fun. This MVP style of prototype was chosen to teach good working habits. In previous classes, students generally jam in most of the work at the end. With a complete game early in the semester, the work changes from madly finishing at the end to calmly adding key improvements to a finished product. We require a prototype that is accompanied by a fulsome walkthrough that showcases all of their work and not just take the shortest path to completion. Finally, students present their prototype to the rest of the class after it has been submitted.

4. Game demonstrations

Every two weeks after the first prototype presentation, teams present their current playable prototype. This presentation is intended to be a live demonstration of the game that allows fellow students to play it as the team is describing their progress and challenges. There are three of these demonstrations that start near the end of the first month and finish at the end of the third month. The purpose of these presentations is twofold. From a pedagogical perspective, the demonstrations provide the familiar presentation practice and opportunities for teams to engage with each other's games. Operationally, the demonstrations encourage students to stay on track and provide the instructor with a convenient method of providing regular feedback on their developing projects such that the grading of the final project holds no surprises.

5. Launch / Pitch

At this stage, teams are experiencing presentation fatigue. The purpose of this assignment is to relieve students of the burden of a formal presentation. The instructions for this presentation are simple: show off your game to potential investors, potential players, crowdfunders, or some combination of the three and have some fun. In general, this is the best presentation each team gives all semester, and the teams get very creative. Some teams have created a game trailer; some teams styled it more like a pep rally with merchandise and chants; and other teams aim for an Electronic Entertainment Expo-style launch presentation. Whatever they choose, the energy and enthusiasm in the room is sorely needed as the semester draws to a close.

6. Final game

Each team submits their final game with a detailed walkthrough. Again, the purpose of the walkthrough is not to take the instructor through the game quickly but rather to showcase the work the team has done.

7. Self and team assessment

Students are asked to evaluate themselves and each team member on their performance throughout the semester. The evaluation is mostly focused on project work, but many teams include a discussion of team performance in class participation exercises. Currently, each member is asked to evaluate using a quantitative measure and a qualitative discussion of performance. Performance includes difficulty of tasks assigned, quality of work completed, punctuality, contribution to ideation, communication, and any other aspects that students think are important. There are two ways that the assignment affects students' grades. First, they are marked on the quality of their evaluation. Quality is assessed based on how detailed, reasoned, and honest the evaluations are. Second, the cumulative

assessment of each team is applied to each member, and it can affect their final grade. To give an extreme example, one team gave a member very low marks, and the under-performing member rated their own performance poorly, citing a busy semester and focus on other projects. The team got an excellent mark for an excellent game, but the under-performing student was assigned only half of what the rest of the team got to reflect their performance.

COURSE ASSESSMENT

- Participation (40% of total grade)
    - Class discussions
    - *Root of Play*
    - Hot Topics
    - Scrum-style meetings
    - Game project (60% of total grade)
- Project charter (10% of project mark)
    - Game concept and genre analysis (10% of project mark)
    - Game prototype (10% of project mark)
    - Game demonstrations (10% of project mark)
    - Launch / Pitch (5% of project mark)
    - Final game (50% of project mark)
    - Self and team assessment (5% of project mark)

EXPANDED COURSE OUTLINE

Week 1: Course Introduction

Class Topics

- Welcome and housekeeping
- Purpose of the class
- Project management
- Scoping
- Team formation (begins)

Activities/Assignments

- Ice Breaking exercise: students create an ice breaking game

Week 2: Team formation and interaction

Class Topics

- Team formation (ends) and takeaways
- Guest speakers on Scrum-style meetings

Activities/Assignments

- Regular Scrum-style meeting
- 1. Project Charter due

Week 3: Game concepts

Class Topics

- Game concept presentations
- Introduce Hot Topics
- Guest speakers on rapid research

Activities/Assignments

- Hot Topic: meetings
- Regular Scrum-style meeting
- 2. Game concept and genre analysis

Week 4: Working with less

Class Topics

- Introduction to hand games (e.g., rock-paper-scissors or clapping games like Mary Mack)

Activities/Assignments

- Root of Play: hand game mechanic constraint
- Regular Scrum-style meeting

Week 5: Narrative

Class Topics

- Introduction to game narrative
- Game prototype presentation

Activities/Assignments

- Hot Topic: game stories
- Regular Scrum-style meeting

- 3. Game prototype

Week 6: Audience

Class Topics

- Introduction to audience analysis

Activities/Assignments

- Root of Play: illiterate or pre-literate audience constraint
- Regular Scrum-style meeting

Week 7: Progression

Class Topics

- Introduction to game progression
- First game demonstration

Activities/Assignments

- Hot Topic: game progression
- Regular Scrum-style meeting

Week 8: Mystery mechanics

Class Topics

- Introduction to unknown information in games

Activities/Assignments

- Root of Play: Treasure hunt mechanic constraint
- Regular Scrum-style meeting

Week 9: Difficulty

Class Topics

- Introduction to game difficulty
- Second game demonstration

Activities/Assignments

- Hot Topic: game difficulty

Week 10: Difficulty

Class Topics

- Playtesting discussion

Activities/Assignments

- Root of Play: Players age 5 to 16 audience constraint added to Treasure hunt game
- Regular Scrum-style meeting

Week 11: Meaningful play

Class Topics

- Introduction to meaningful play
- Third game demonstration

Activities/Assignments

- Hot Topic: meaningful play and serious games
- Regular Scrum-style meeting

Week 12: Guest Speakers

Class Topics

- Speaker from games industry
- Speaker from consulting

Activities/Assignments

- Regular Scrum-style meeting

Week 13: Launch and Cleanup

Class Topics

- Game launch presentations
- Missing topics
- Course improvement

Activities/Assignments

- Live course-improvement session

COURSE BEST PRACTICES

The key to this class is creating opportunities for learning rather than projecting learning from the front of the room. We spend most of our time facilitating and asking teams questions that will push

them forward. We encourage an arm's-length approach where teams try to solve problems internally before reaching out to the instructor. Other than evaluation which is constant throughout the course, the activity we do most is reminding teams of the time remaining and the scope of their projects. Inevitably, teams will try to build a game one level at a time, which leads to stressful final weeks and unfinished projects. The course is structured to encourage good time management and reasonable scoping, but we are fighting against several years of bad habits for this kind of senior-level course. Possibly the best idea we developed was hiring a few good students from previous iterations of the course to be Executive Producers for each team. The producers say the same things the instructors say ("watch your scope," "it's time to stop coming up with new ideas and get building," and "it's time to start making some mistakes"), but when the instructions come from a fellow student, it seems easier to hear them. In addition, the students are more likely to discuss challenges the team may be facing with the Executive Producers as they often tried to hide challenges from the instructors for fear that it may impact their course mark.

We have experimented with various structures in the course, ranging from an open structure that provides significant latitude with regard to assignments and projects (a more emergent approach) to highly-directed versions with tightly controlled activities and deliverables. Both of us have tried both approaches. For example, one year, Sean organised the course activities such that each week students created different levels and stories that worked towards a complete Dungeons & Dragons adventure. This year, Matt adopted the more open structure that kept the weekly assignments but students set the weekly goals and tasks. Both approaches struggled with the challenge of fitting into a single class the exploration of a game design topic, such as positive feedback loops, into a game design exercise that required frequent iteration. This goal becomes difficult to manage when class time must also include presentations and team feedback on the various stages of the major game project. As such, we are moving to splitting the capstone course into two courses – one that focuses exclusively on the production of a single game, and one that develops numerous game experiences that address key game design features.

Another challenge was the repeated use of *Root of Play*. It is an extremely abstract game, and we initially thought that changing the constraints would make the game playable several times over the semester. By about the fourth playthrough, however, it was clear that the teams were extremely fatigued. Student feedback has suggested two avenues for improvement. The first is to extend each session. When the *Root of Play* sessions went long enough for teams to get into the playtesting and iterating in a more serious way, the reports on learnings became much richer and more varied, and the discussions that were caused by the reports were filled with good learning exchanges. The second change is to substitute new game-making games. Two examples are building a text adventure using *Quest* (textadventures.co.uk) and balancing a dueling game with *World of Rulecraft* (Librande, 2014).

We will close this advice section with a brief description of a few of the games that have been created in this class. Each game came with its own challenges and learning opportunities for each team.

- Cowboy Saloon Simulator allowed the player to manage the local saloon for a few weeks, using various bar-related mini- and microgames to keep patrons happy and to generate income.
- Another team tried the minigame direction with The Silver Serpent Ring, but in this case,

players were experimenting with alchemical recipes to slowly reveal an underlying narrative.

- Slime Universe was a cooperative, top-down shooter like *Enter the Gungeon* (Dodge Roll, 2016) and *Nuclear Throne* (Vlambeer, 2015) with an engaging narrative about mistaken identity, experiments on aliens, and revenge.

FUTURE COURSE PLANS

One of the challenges in coming up with an activity similar to *Root of Play* is that few things are as accessible as board game design. Most players already have a shared language of classic board games they have played. That shared language offers those students an entrée into thinking about mechanics, how they work together, and how they make the players feel. In addition to the language and mechanics, the physical act of creating a board game including a board, cards, pieces, etc. is also accessible as long as participants have access to sticky notes, index cards, markers, scissors, and easel paper. We are looking for game design activities that engage with video games more directly, but there is always a sacrifice in accessibility. For instance, players could create something with *RPG Maker* (ASCII, 1992), but they would have to build a shared language around RPGs, learn the technology, manage any issues with accounts and sharing, and struggle with the program's lack of robust version control functionality. In the future, we can imagine the shared game language increases as the stigma against playing games lowers, and people play more and different kinds of games. We can also imagine the technological barrier for entry will steadily lower such that instead of building a board game in twenty minutes, players can create a playable first person shooter in that time. These changes would allow other types of game design exercises to be done during class and would expand the conversation about mechanics and gameplay dynamics present in those other types of games.

Students have asked for a little less work to do. Some have asked for a lot less. As our fellow educators will know, it can be difficult to remove work without compromising pedagogical goals. If in-class time could be devoted to their game project, teams could push their games further, and they would need to devote less out-of-class time to their projects. A reasonable way to do that is to add topic-specific activities after covering those topics in class. For example, after playing *Root of Play* with an audience prompt and doing an audience-based Hot Topic, teams could do an audience analysis for their game. Such an analysis could help resolve disagreements on features or narrative while giving students valuable practice with an industry-relevant skill.

Moving online represents less of a challenge for this course as it does for many courses. The in-class exercises translate well to a virtual space, and the assignments are all electronic, which makes it easier to collaborate remotely. For example, playing *Root of Play* in class has simply moved to technologies like Miro (miro.com) and Google Jamboard (jamboard.google.com), which are both free, virtual collaboration spaces that can be used to quickly make a board game while videoconferencing or even over the phone. At this stage, the biggest challenge with online learning has been student scheduling. When students are coming physically to class, they tend to leave a lot of flex time in their schedules. This allows for a quick chat with an instructor after class or a coffee with friends. However, when organizing their calendars for a life lead virtually, students seem to schedule their time much more tightly. We see this through a marked increase in complaints about availability and difficulties for groups to meet regularly. With in-person classes, these complaints were almost non-existent, and in the online version of the class, these complaints are present in every group. As

mentioned above, the general direction of the class is to use a bit more class time for activities that move students forward in their course-long project, and this tactic will help to address the scheduling problem also. In addition, we have started staying in our virtual classrooms for a few minutes after class, just as we would for in-person classes, and we have received fewer panicked emails about last-minute questions, and it has also helped foster a sense of community that helps the class through the inevitable difficulties of group course work.

There are also a few large movements in the game industry that will likely change the course: monetization, independent development, and multi-developer online game platforms like Steam (steampowered.com). At the moment, we do not examine monetization in detail for this class. The topic does come up as it is on the minds of players and aspiring game developers, but there are no lectures or exercises devoted to the problem of monetization. A part of educating game developers is breaking down binary positions into more complicated discussions. For example, many students come in with a strong feeling about *Dark Souls* (FromSoftware, 2011). Some players feel strongly that *Dark Souls* is a fantastic game and the difficulty of the game is a strength. Other players feel the game is ableist and not difficult but badly designed. Our in-class discussions lead students to diverge from these poles to find middle ground and complexity. A discussion exercise for monetization that challenges students to think beyond "monetization is evil" or "monetization is the only profitable model" would be an excellent addition to the course going forward. Most students imagine themselves being an independent developer in their spare time, so they are already thinking about the impact independent development has had on the games industry. However, a conversation between an experienced independent developer and an employee at a major game company would challenge some student assumptions about both careers. Finally, multi-developer online game platforms represent a new, powerful faction in the game design space. A structured debate as an in-class exercise would encourage students to dig into where platforms enrich the games and where they weaken them, and it would get the next generation of developers to think about who should be in control of the games they make.

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CHAPTER 3.

TECHNICAL GAME DEVELOPMENT I (IMGD 3000)

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Course Title: IMGD 3000: Technical Game Development I
Course College/School: School of Arts and Sciences
Course Department/Program: Interactive Media and Game Development
Course Level: Undergraduate
Course Credits: 3
Course Length: 7 weeks
Course Medium: Face-to-face
Course Keywords: game engine, programming, C , object-oriented, design patterns

CATALOG DESCRIPTION

This course teaches technical Computer Science aspects of game development, with the focus of the course on low-level programming of computer games. Topics include game engines, resource management, graphics and rendering, player input, collision detection, debugging, performance tuning and AI. Students will implement a game engine from scratch using C and make a complete game using their own engine.

COURSE PURPOSE AND OBJECTIVES

The purpose of the course is to provide a hands-on, in-depth exposure to technical (programming and software design) concepts related to game development, which a specific focus on the game engine. The course is intended to combine concepts learned in previous classes – such as data structures, algorithms, software design patterns, and game design – by applying them to a game and game engine. This combination and application of previous concepts provides both re-enforcement of topics learned earlier and also illustrates a holistic view of technical game development. In doing so, the course is to provide experience creating a large code base from scratch, as and experience working on teams on a game development project. Lastly, the course also intends to provide a bridge to

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additional technical content on game development (i.e., senior-level game development and computer science classes).

The objectives of the course are for students to:

- Understand the structure and design of a game engine.
- Understand the trade-offs between complexity, fidelity, and interactivity in game engines.
- Demonstrate understanding of a game engine from a game programmer's perspective by extending a simple game.
- Use a game engine to create a complete, original game from scratch.
- Use iterative design and development practices to create a playable game.
- Understand how software engineering techniques can be applied to creating the parts of a game engine.
- Gain experience and develop skills in working in a team on a software project of significant size, with a short deadline.

COURSE CONTEXT

At WPI, this class is intended primarily for juniors seeking a B.S. degree in Interactive Media and Game Development. Such students are required to take at least 11 Computer Science (CS) classes en-route to the degree, and most have taken at least half of their required CS courses before IMGD 3000. While the only pre-requisite is a systems programming course, most students will have also taken at least introductory programming, objected oriented design, and an algorithms course. About half the students will also have taken computer architecture and software engineering, and somewhat fewer students will have taken operating systems, database systems and human-computer interaction. Nearly all students will have done one or more introductory courses in the game development process, game design, critical studies of interactive media and games, and storytelling and games.

COURSE PEDAGOGY

The goal of this course is to have students learn the fundamentals of a game engine and core game technology by building and engine (and a couple of games using it) themselves.

In doing so, the intent is for students to gain an in-depth understanding of a game engine – not only know how a game engine is implemented, but also *why* it is implemented the way it is, understanding choices required to achieve general purpose functionality to support a variety of games. Students should also gain an understanding of programming from the game programmer's point of view, being able to differentiate functionality in game code versus functionality provided by the game engine. This understanding is reinforced by making a game using full-featured, fully functional game engine.

The course arose from the desire to convey details on how a game engine works, both to provide the technical acumen to create and understand existing engines and to train better game programmers. The idea of building a game engine from scratch was inspired by MINIX, a Unix-like operating system (and precursor to Linux). With MINIX, a student could study an entire operating system, even building it if desired, since the whole system was about 12,000 lines of C-code. From this inspiration

arose the idea to create a MINIX-like experience for operating systems, but in this case for game engines.

Throughout the course, the requirements for a game and game code are discussed, design rationales are explored to figure out how and why a game engine might support the requirements, and students implement their designs, step by step, for a fully working engine. The use and understanding of the engine (as well as some additional game development topics) are book-ended by two games students make using the from-scratch engine, thus solidifying their use and understanding of a game engine.

As a bonus, students have the opportunity to use materials produced in the class (e.g., the engine and a game) as part of a portfolio, a showable record of what they can do. The built-from-scratch engine itself can be shown with one or more games demonstrating its functionality, and with the potential for an in-depth conversation (say, with a potential employer) about how, exactly, the engine and game(s) are implemented.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

The only required book is:

- Mark Claypool. "Dragonfly – Program a Game Engine from Scratch", *Interactive Media and Game Development*, Worcester Polytechnic Institute, 2014. Online: https://dragonfly.wpi.edu/book/index.html

The book is freely available online in separate chapters. It can also be purchased (for a modest price) as a complete ebook, black and white print or color print.

Students need access to a computer (Microsoft Windows, Apple MacOS, or Linux are all supported) with a suitable programming environment. Supported environments include: 1) Windows with Visual Studio, 2) MacOS with XCode or Homebrew and the GNU compiler, and 3) Linux with the GNU compiler and a text editor. All the development software mentioned is freely available. Students are free to choose whichever platform they prefer and they only need to develop with one target platform.

Setup and configuration guides for each operating system platform are provided online: https://dragonfly.wpi.edu/engine/index.html#setup

COURSE ASSIGNMENTS

The individual projects can be found online at: http://www.cs.wpi.edu/~claypool/papers/dragonfly-projects. Point breakdowns and grading rubrics are also provided for each project.

Project 1 – Catch a Dragonfly

The first project is for students to get used to Dragonfly, typically their first exposure to a text-based, 2d game engine. Students work through a tutorial that has them make a simple, "stock" game using Dragonfly. This helps students better understand a game engine by developing a game from a game programmer's perspective, providing the foundational knowledge needed for building their own Dragonfly game engine in project 2, and designing and developing their own game from scratch with it in project 3.

In project 1, students:

- Visit the Web page (https://dragonfly.wpi.edu/) and briefly familiarize themselves with the contents. The Web page includes a download of the Dragonfly game engine (compiled – no source code), documentation with details on the classes and methods for the game programmer, and links to games and utilities that may be helpful for subsequent projects.
- Download the Dragonfly game engine for the environment of choice (Windows, MacOS, or Linux) and setup their development environment. This means ensuring all the needed external libraries are in place (e.g., SFML: https://www.sfml-dev.org/), installing the Dragonfly libraries and header files in an appropriate place (root/administrator privileges are *not* required), and testing a simple program to be sure development can proceed. The same basic setup is used for the students' own game engine development in project 2.
- Complete the tutorial, available from the Dragonfly Web page: http://dragonfly.wpi.edu/tutorial/. The tutorial has students build an arcade-style shooting game, called *Saucer Shoot*, where the player flies a space ship into combat against an ever-increasing number of enemy saucers. The tutorial has all the sprite files and sound files needed for development as well as working sample code for students to reference.
- Extend the Saucer Shoot game in a meaningful way by adding 10% or more functionality. For example, student's may add additional weapon types or enemies, health and/or multiple lives, a high score table, or something entirely of their own creation. The actual 10% extension done is up to each student, but s/he indicates what is done with brief documentation when submitting the assignment.

Students work alone for project 1. When done, students turn in a source code package with all code necessary to build their games, including header files and any needed additional sprites (depending upon their extension). In addition, each student includes a Makefile for compiling their game, a README file explaining their platform, files, code structure, and anything else needed to understand (and grade) their game, and a GAME file providing a short description of the additional 10% functionality extension to the Saucer Shoot tutorial game, including indicating the code written.

Grading

Breakdown

Tutorial – 40% : Doing the tutorial without any additional customization is worth just under 1/2 the grade. While doing the tutorial will provide a substantial amount of knowledge about the Dragonfly game engine, it will by itself demonstrate an in-depth understanding of the engine principles.

Customization – 50% : Extending or modifying the tutorial game with custom work is worth 1/2 the grade. Doing so will begin to flex technical muscles and show mastery of the basic concepts of the Dragonfly game engine. This is essential in moving forward.

Documentation – 10% : Not to be overlooked is including the documentation provided, as well as having that documentation be clear, readable and pertinent to the assignment. This includes the README described above as well as the GAME document. Having well-structured and commented

code is part of Documentation, too. Getting in the habit of good documentation is important for large software projects, especially when done in teams (e.g., project 4).

Rubric

100-90. The submission clearly exceeds requirements. The tutorial game works without problems. The custom extensions exhibit an unusually high degree of effort, thoughtfulness, technical ability and insight. Documentation is thorough and clear.

89-80. The submission meets requirements. The tutorial game works without problems. The custom extensions exhibit substantial effort, thoughtfulness, technical ability and/or insight. Documentation is adequate.

79-70. The submission barely meets requirements. The tutorial game may operate erratically. The custom extensions exhibit marginal effort, thoughtfulness, creativity and/or insight. Documentation is missing details needed to understand the contributions and/or to build the programs.

69-60. The project fails to meet requirements in some places. The tutorial game may crash occasionally. The custom extensions are of minor scope, or exhibit perfunctory effort, thoughtfulness, technical ability and/or insight. Documentation is inadequate, missing key details needed to understand the contributions and/or to build the programs.

59-0. The project does not meet many of the requirements. The tutorial game crashes consistently. The custom extensions exhibit little or no evidence of effort, thoughtfulness, technical ability and/or insight. Documentation is woefully inadequate or missing.

Project 2 – Dragonfly

In the second project, students build their own version of the Dragonfly game engine. Project 2 is broken into three parts: A) *Dragonfly Egg*, B) *Dragonfly Naiad*, and C) *Dragonfly*, that build upon each other to end with a fully functional, full-featured game engine. Since it is critical that game engine code be easily understood (from the game programmer's perspective) and, equally importantly, robust, the three projects are structured such that completing parts A and B provides for a fully functional, if somewhat limited, game engine. This level of proficiency enables students to proceed to project 3, where they make a game using their engines. Completing part 2C provides for a full featured game engine, with functionality that makes it easier to create a broader range of games.

For timing and grading, the due dates are staggered so that most of the time is allocated for part A and part B, but there is still time for completing part C for the top students in the class. In addition, points are allocated such that completing part B is sufficient for earning a "B" grade for project 2, while fully completing part C provides an opportunity for earning an "A" grade for project 2.

Students are informed that it is much better to have tested, trusted robust code that only implements part A and part B than it is to have buggy, partially working code that attempts to get into part C. Since students make use of their own engine for project 3, most tend to heed this advice.

Students work alone for all of project 2. While group work is important for many aspects of software engineering, including game development, developing the engine solo ensures students have complete

and deep understanding of both the game engine and the programming skills needed to develop it — there is no way to "hide" behind a more experienced teammate. That is not to say students are alone, however — discussing the project with other students is encouraged (e.g., via Slack or Discord), even for help in debugging each other's code. The line is drawn at not allowing sharing of code in that each student must write all the engine code him/herself.

All development is done in C . Students are expected to be familiar with C from earlier computer science classes, but are not expected to be experts in the language. While development is done as "homework" outside of class, the requirements and design of Dragonfly are presented in class, with discussions of design rationale, implementation choices and alternatives, and more advanced features.

Individual classes, with high-level descriptions of attributes and methods, are provided in the project writeup at: http://www.cs.wpi.edu/~claypool/papers/dragonfly-projects/proj2/.

Project 2a – Dragonfly Egg

Part A of the project is to construct the foundations of a game engine that provides the following capabilities:

1. Game initialization: Start and stop gracefully.
2. Logging: Write time-stamped messages to a file.
3. Object support: Add and remove game objects. Objects support 2d game world positions for objects.
4. Game loop: Run a game loop with: a) A fixed update rate (e.g., 30 Hz), and b) updates sent to all objects each loop

To implement this functionality, students develop, code and test about a dozen base classes.

No visual depiction of the game is required for part A. Instead, all output is done via printing to the screen or to a log file via the logfile manager functionality built into the game engine. As suggested above, at the successful completion of part A, students do *not* have a game engine. Instead, they have a robust, foundational code base they can build upon to get a functional game engine in part B.

Project 2b – Dragonfly Naiad

Part B is to continue construction of the game engine, each student using their own code base from part A, adding the following additional capabilities:

1. Output: Support 2d, text characters with color. Provide a clean refresh each game loop.
2. Input: Accept non-blocking keyboard and mouse input. Send input to interested game objects.
3. Object Control: Support "velocity" for game objects with automatic updates.
4. Collisions: Provide a "solid" attribute for game objects. Detect collisions between solid objects. Send an event to both objects involved in a collision.
5. Misc: Provide deferred, batch removal of game objects. Provide support for an "altitude" attribute for game objects to support layered drawing. Signal game objects that travel out of

bounds with a custom event.

All of the above capabilities must be thoroughly tested, bug-free and ready for a game programmer to make a game (the students themselves, in project 3).

Project 2c – Dragonfly

Part C is to continue construction of the game engine, each student using their own code base from part A and part B, adding the following additional capabilities:

1. Sprites: Provide multi-character frames. Associate one or more frames with a sprite. Play sprite frames in sequence to achieve animation. Support "slowdown" of animation to less than one frame per game loop.
2. Resource Management: Read sprite data from files. Provide bounding boxes for game objects. Allow game objects to be larger than a single character (for movement and collisions). Associate bounding boxes with sprites.
3. Camera Control: Allow the game world to be larger than the screen, providing a "viewport". Enable free viewport movement around the game world, including the ability to follow one object (e.g., the player's avatar).
4. View Objects: provide an alternative (to game objects) object that supports "heads-up display" functionality for UI elements.

As for project 2B, all of the above capabilities must be thoroughly tested, bug-free and ready for a game programmer to make a game (the students themselves, in project 3).

For each part, students turn in a package with all code necessary to build their game engine, including header files and a Makefile for building their engine. Game programmer code (i.e., code someone would write using their engine) is required to demonstrate the full functionality of what they have built (so far). This can be more than one program, if needed. Documentation is required to explain the platform, files, code structure, how to compile their engine and game code, and anything else needed to understand (and grade) their game engine.

Grading Rubric

Below is a general grading rubric:

100-90. The submission clearly exceeds requirements. The functionality is fully implemented and is provided in a robust, bug-free fashion. Full functionality is clearly depicted in one more more samples of game/test code and through clearly provided logfile messages. Documentation is thorough and clear.

89-80. The submission meets requirements. The basic functionality is implemented and runs as expected without any critical bugs. Functionality is depicted in one more more samples of game/test code and through logfile messages. Documentation is adequate.

79-70. The submission barely meets requirements. Functionality is mostly implemented, but may not be fully implemented and/or may not run as expected. There may be a few bugs, none critical.

The functionality is depicted in sample game/test code, but full representation is not shown. Documentation is inadequate, missing key details needed to understand the engine and/or to build the programs.

69-60. The project fails to meet requirements in some places. The game engine is missing critical functionality and/or what is there has bugs. The engine may crash occasionally. Game/test code demonstrating the engine is missing or incomplete. Documentation is clearly inadequate, missing key details needed to understand the engine and/or to build the programs.

59-0. The project does not meet core requirements. The engine cannot compile, crashes consistently, or is lacking many functional features. The sample game/test code is missing or incomplete. Documentation is woefully inadequate or missing.

Project 3 – Dragonfly Spawn

In project 3, students use the Dragonfly game engine they built in project 2 to make their own, original game from scratch. The end result is expected to be a robust (bug-free), playable, and balanced game (it may even be fun).

Like a typical large game development effort, the project is broken into several milestones: plan, alpha and final. Each milestone is submitted and graded separately, while all apply towards the total project 3 grade. The intent of the milestones is to provide production guidance to yield a fully-functional, complete, playable game built with their own game engine.

Students work in teams of two for project 3. Students are free to partition the work among the team as they see fit, but all team members are encouraged to help (say, with design and debugging) and be knowledgeable (in terms of how the game code executes) for all parts of the game.

Development must be in C using their game engine from project 2. Under exceptional circumstances (e.g., both partners not completing project 2b), students are allowed to use the pre-made Dragonfly engine from project 1. No engine source code is provided, however, only the pre-compiled engine.

Plan

Student teams provide a game plan within the first 1/4 of the project. The plan document provides a detailed description of the game they plan to build, including the technical challenges it entails, a bit about any significant artistic aspects of the game, and the timeline to successfully complete development in the time provided. In planning, students are asked to draw upon experiences from other classes (e.g., other game development courses), to inform the creation of the plan document. While the actual length of the plan is not a requirement, as a guideline the plan is expected to be approximately 2-3 pages – much less and students have probably have not supplied enough details.

For the plan submission, students turn in a written document.

Alpha

At alpha stage, the student games have all of the required features implemented, but not necessarily working completely correctly. Game code must be tested thoroughly enough to eliminate any critical gameplay flaws, but minor bugs or glitches may be present.

Games must compile cleanly and be runnable, even if all aspects of gameplay are not available from one program. Separate features of the game may be demonstrable from separate game code programs (e.g., separate game programs illustrating a kind of weapon or a specific opponent).

Games are likely not yet fully balanced nor the levels designed for all experiences (beginning to advanced) of the game player.

Games may contain some placeholder art assets. For example, in the alpha release, a simple, non-animated square may be used for an opponent with the intent of creating a figure and frames of animation for the final version.

For the alpha submission, students hand in a package with all the source code necessary to build their game engines and their games. All header files must be included, as well as Makefiles for building the games.

Final

The final version of all games has all game content complete – design, code and art. Games must be tested thoroughly for bugs, both major and minor, removing all visual and gameplay glitches. Game code must compile cleanly and be easily runnable. Upon startup, instructions for the player on how to play must be readily available, and with clear indications on how to begin play. Gameplay must be balanced, providing appropriate difficulty for beginners and/or early gameplay, with increased difficulty as the game progresses. Games must have a clear ending condition (i.e., winning or losing) and the player must be able to exit the game easily and cleanly.

For the final submission, students submit their engine and game, with necessary support files and Makefiles. The typical READMEs are required, as well as DESIGN documents providing all the details in the plan, but updated to reflect the games as actually built. For example, the functionality, milestones and work responsibilities need to be updated from the plan to reflect the development. Major deviations from the original plan must be be noted.

Grading

Under most circumstances, both team members receive the same grade. Students will, however, be given the chance to provide your own feedback (e.g., a grade) on their project and on their partner privately to the professor when the project is complete.

Note, for the final release, the grade will be based on the version of the project submitted online by the due date, not on the version presented in class.

Breakdown

- *Plan* – 10%
- *Alpha* – 25%
- *Final* – 40%
- *Design* – 10%
- *Presentation* – 10%

- *Promotional materials* – 5%

Rubric

100-90. The submission clearly exceeds requirements. The game is fully implemented, playable from start to finish in a robust, bug-free fashion. Gameplay is balanced throughout, providing appropriate difficulty for beginners while getting more challenging as the game progresses and/or the player obtains skills. Instructions are provided in-game for how to play. The required documentation (plan and design) is thorough and clear. The group presentation is well-organized, well-rehearsed and introduces the team and game in a fun, yet professional manner. The promotional material is clear, complete, and very presentable.

89-80. The submission meets requirements. The game is implemented and playable from start to finish, in a mostly bug-free fashion. Gameplay is mostly balanced, providing adjusted difficulty for beginners and more advanced players Instructions are provided in-game for how to play. The required documentation (plan and design) is complete. The group presentation is organized, rehearsed and effectively introduces the team and game. The promotional material is clear, complete, and presentable.

79-70. The submission barely meets requirements. The game is implemented and playable but may have some minor bugs or glitches. Gameplay is balanced, but may have some aspects that are too easy or too hard for either beginners or advanced players. The required documentation (plan and design) is intact, but may be unclear and/or missing some sections. The group presentation introduces the team and game, but may suffer from lack of preparation or organization. The promotional material is presentable, but may have shortcomings in appearance or substance.

69-60. The project fails to meet requirements in some places. The game is playable, but has minor to moderate bugs or glitches. Levels are incomplete or gameplay is unbalanced, and there are aspects that are too easy or too hard for either beginners or advanced players. The required documentation (plan and design) is unclear and incomplete or missing sections. The group presentation is not well-organized and suffers from lack of preparation. The promotional material is incomplete or not very presentable.

59-0. The project does not meet core requirements. The game may not compile cleanly or has major bugs. Levels are incomplete or not even playable. The required documentation (plan and design) is incomplete or missing. The group presentation is poorly organized and suffers greatly from lack of preparation. The promotional material is missing, or incomplete and of low quality.

COURSE ASSESSMENT

Projects (*80%*) – The bulk of the course grade involves programming projects. The grading policy for each project is provided at the time the project is assigned. In general, for each project there is a basic objective for the majority of the assignment points. There may be an extended objective for demonstrating additional work and understanding. Projects, including all data and source code, as appropriate, are to be turned in online as specified in the writeups.

Quizzes (*15%*) – There is a quiz at the start of almost every class. These are designed to test important

class concepts from the previous class(es), especially concepts that may not have been adequately demonstrated in the programming projects. Quizzes are closed book and closed notes, unless otherwise indicated. All quizzes have an equal weight, except for the two lowest scores which are dropped.

Participation (*5%*) – Showing up to class is worth much of a class participation grade, but so is being engaged in the class material through asking and answering questions and participating in group exercises.

EXPANDED COURSE OUTLINE

The below outline assumes a 2 hour class taught twice per week.

In general, each class is about 1/2 lecture and 1/2 group work plus discussion. Lectures are short to medium – 5 to 30 minutes long – and are interspersed with active learning exercises. These active learning sessions have the students work in small groups to engage with game engine design and similar concepts talked about in the lecture. Students start by working solo, then in pairs or slightly larger groups, finally bringing material together with class discussions, facilitated by the course instructor and teaching staff.

Module 1 – Introduction

Objectives

1. Provide an introduction to the course as a whole.
2. Give a definition of a game engine, including examples.
3. Provide reference to foundations for building a game engine.

Materials

Chapter 1

- Book: https://dragonfly.wpi.edu/book/pdfs/1-introduction.pdf
- Slides: https://dragonfly.wpi.edu/book/slides/ch1-introduction.pptx

Length

2 classes

Module 2 – Setup

Objectives

1. Introduce software and libraries used for development in the course.
2. Guide student in setup of the development environment they will use for all projects.

Materials

Chapter 2

- Book: https://dragonfly.wpi.edu/book/pdfs/2-setup.pdf
- Slides: https://dragonfly.wpi.edu/book/slides/ch2-setup.pptx

Length

1/2 class

Module 3 – Tutorial

Objectives

1. Provide an overview of Project 1 (Catch a Dragonfly).
2. Give some hints for setup and planning for Project 1.
3. Motivate text-based (ASCII) graphics for use by the engine and games.

Materials

Chapter 3

- Book: https://dragonfly.wpi.edu/book/pdfs/3-tutorial.pdf
- Slides: https://dragonfly.wpi.edu/book/slides/ch2-setup.pptx

Length

1/2 class

Module 4 – Engine

Objectives

1. Provide the design and design rationale for the Dragonfly implementation.
2. Give "tips" on C coding, game engine implementations and large-scale software development.
3. Provide an overview of Project 2 specifics (Dragonfly Egg, Dragonfly Naiad and Dragonfly) at appropriate times.

Materials

Chapter 4

- Book: https://dragonfly.wpi.edu/book/pdfs/4-engine.pdf
- Slides: https://dragonfly.wpi.edu/book/slides/ch4-engine.pptx

Length

8 classes

Module 5 – Misc

Objectives

1. Provide an overview (and in some cases details) on technical game development topics that are not covered in the Dragonfly implementation.
2. Where appropriate, provide specific details on how the topics would be implemented in Dragonfly.

Topics

- AI for games
- Finite State Machines
- Pathfinding
- Scene graphs
- Game engine performance
- Testing

Length

3 classes

Module 6 – Closing

Objectives

1. Have students give a formal presentation of their final games (Project 3).
2. Use the remainder of the class as a "game fest" where students mingle, playing each others' games.

Length

1 class

Module – Groupwork

Groupwork sessions are 5-20 minutes in length, total. Generally, students do: 1) introductions and icebreakers, 2) think of the answers themselves, 3) share their answers with each other, and 4) report back to the class with their groups answers during discussion.

Objectives

The goal of the groupwork is to:

1. Help students meet and work with other students in the class and IMGD program.
2. Promote active learning.
3. Break-up class lectures.

Materials

- Online: https://web.cs.wpi.edu/~imgd3000/b20/groupwork/
- Note, answer keys for the instructor can be obtained by replacing the handout.html string in the URL with key.html. e.g., https://web.cs.wpi.edu/~claypool/papers/imgd3000-chapter-21/groupwork/2-log-manager/key.html

COURSE BEST PRACTICES

Students tend to come into the course with a variety of programming backgrounds. Most have been exposed to C but are not necessarily proficient. Most are well versed with Java but have not necessarily implemented a medium or large sized project in it. In order to help boost students to the same level, the student teaching assistants (TAs) offer recitation-type sessions (once per week) during the first three weeks of the course on topics such as: differences in C versus Java, Object-oriented Design, Development Environment Setup, and Testing and Using a Debugger. This can be a good professional development experience for the graduate student TAs, too, and help get students used to interacting with the TAs.

Each class usually starts out with a daily quiz (about 10 minutes) which is gone over immediately after. This serves as both an assessment and a quick review of material covered in the previous class.

Students have created a variety of innovative games using the Dragonfly engine, from RTS and platformers, to puzzle and horror. A sample of their game trailers can be found online: https://dragonfly.wpi.edu/games/index.html#trailers. These same trailers are shown to students before they make their own games (Project 3) in order to provide inspiration for the breadth and depth possible for their game implementations.

Extending Dragonfly has proved useful for seniors doing their capstone projects and graduate students in their research. Given that it is a small code base but still provides a full-functional engine, it can be fairly easily extended to study networking aspects (e.g., latency compensation) and performance aspects (e.g., scaling with numbers of objects).

An online version of this course has been taught successfully (as measured by comparing objective course outcomes for the online versus inclass versions). In general, the online version involved synchronous components for the lectures taught over Zoom, with groupwork done in breakout rooms. All class Zoom sessions were recorded and made available online for students that missed the class. Supplement help sessions were provided online via synchronous Zoom and screen sharing. It seems likely that the recorded lectures could be provided in a "flipped" manner, leaving synchronous class time for project questions and the groupwork.

FUTURE COURSE PLANS

Rather than implement the entire Dragonfly engine from scratch, engine components can be provided (e.g., the LogManager) in compiled form, saving the students implementation time. This time savings can be used by students to implement other technical game aspects, such as pathing or enhanced collision detection.

Pathfinding is currently taught as a concept only. Future plans may include incorporating pathfinding into the engine. This would require students to program an A* algorithm – an industry standard.

Scene graphs are currently taught as a concept only. Future plans are to have students implement scene graph elements (e.g., a quadtree) and evaluate the performance.

The two dominant forms of collision detection in game engines are *overlap testing* and *intersection testing*. The course currently describes overlap testing, which the students implement in their engines. Future plans are to incorporate intersection testing and have students evaluate the tradeoffs versus overlap testing.

The Dragonfly engine can be extended to 3d by extending the 2d Vector class that is part of the engine. Such an extension would stretch students to enhance the graphics in the display manager, useful for including advanced graphics topics.

Networking and general online connectivity is increasingly important for games. Future plans are to incorporate networking and networking materials into the second course in this sequence, *IMGD 4000: Technical Game Development II*.

REFERENCES

Mark Claypool. "Dragonfly – Program a Game Engine from Scratch", Interactive Media and Game Development, Worcester Polytechnic Institute, 2014. Online: https://dragonfly.wpi.edu/book/index.html

Andrew Tanenbaum and Albert Woodhull. "Operating Systems, Design and Implementation – The MINIX Book", 3rd edition, Pearson, 2007. ISBN 0131429388. Online: https://tinyurl.com/1izggtsf

CHAPTER 4.

LEARNING JAVA WITH GAMES (CSXXXX)

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Course Title: CSxxxx: Learning Java with Games [2]
Course College/School: College of Science and Mathematics[3]
Course Department/Program: Department of Computer Science and Information Systems
Course Level: Undergraduate
Course Credits: 6 (Two terms)
Course Length: 16 weeks each term
Course Medium: Face-to-face
Course Keywords: Java programming language, OOP (Object-Oriented Programming), UML (Universal Modeling Language), Game programming, Three-Layer Structure for games, game in-text, game based on event-driven, game based on animation, serious game.

COURSE DESCRIPTION

Java is an object-oriented programming language with rich event handlers and graphics capabilities. Games are full of objects, interactions among objects, graphics (Ammeraal, L. 1998), images, event control, and so on. Therefore, Java features (Liang, Y. D., 2005) are very suitable for realizing games and games will fully demonstrate the features of the Java language (Fan, J., Ries, E., and Tenitchi, C. 1996). For making Java learning more interesting and more effective, this course will teach Java based on the process of analyzing, constructing, and implementing games. Starting from a story of a game, the course takes the advantages of UML (Universal Modelling Language) to look for objects, apply event handlers to treat interactions among objects and apply graphics or images to illustrate objects with event-driven or animation techniques. Games stimulate problem-solving. The course goes through games' logic analysis, state chart illustration, algorithm design, and loosely coupled

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2. This is a new developed course based on the book "Learning Java with Games" (Xu, C.-w., 2018).
3. The new name is College of Computing and Software Engineering since 2015.

software structure for introducing the Java as well as OOP programming knowledge and skills in the way of "learning by doing."

The original course "CS4491 Game Programming in Java" was offered by CS department as an optional course for junior, senior, and graduate students during the period of 2005-2011. Java is the prerequisite of the course. In other words, the course was designed to apply Java for game programming.

Is it possible to migrate the original course "Game Programming in Java" to be a course for the first year (freshman) or second year (sophomore) level students to learn Java programming? Following this idea, the original course was developed to be "Learning Java with Games" to let students (1) master Java programming with games; (2) apply the OOP (Object-oriented Programming) for developing a general architecture for games; (3) enhance the ability forward analyzing problems and solving problems.

This chapter describes the syllabus for the newly designed course "Learning Java with Games." Other optional courses could also be derived from this syllabus by skipping some topics in Java language to focus on game programming or skipping some games and focusing on Java learning.

COURSE PURPOSE AND OBJECTIVES

The main purpose of this course is for learning Java language including OOP programming knowledge and skills. Instead of listing the features of Java, we are going to learn these features through game programming since game programming always dynamically promotes students to analyze, imagine, and solve new challenges. In addition, game programming is an experiential learning and inquiry-based learning with the advantages of self-efficacy, goal setting, and cooperation (Zyda, M., 2006, 2007; Mayo, M., 2007). We can say, games are really a well pedagogical media, which will help students not only to deeply understand the Java language itself but also to greatly enhance the ability of analysis and synthesis.

The learning process closely follows games' analyzing, modeling, and constructing. The course roughly divided games into four categories for gradually introducing Java features and its programming knowledge and skills.

- The first category of games is game-in-text. After briefly introducing the needed hardware and IDE, the principles of programming in general and game programming in particular, the elements of Java and its most popular data type of String are introduced with the projects HelloWorld and PrintXmasCard. And then, apply the data type of String to implement the games of GuessInt in-text and WheelOfForture in-text for showing the concepts and essential programming knowledge of Java and the fundamental control statements, such as, "if-then-else", "while", "for", and the like. Meanwhile, the UML is introduced to illustrate the structure of games and the abstract game model is covered to "glue" multiple objects (classes) as a system.
- The second category of games is based on event-driven. As we know, GUI is a unit that games "must have" and the dynamic behaviors are the spirit of games. The project PaintXmasCard starts the learning of Java's graphics packages and the project CalculatorApp uses Java's components for proving an action-event chain, and then a project ImageSlider further

discovers a discrete action-event-update-repaint chain. Continuously, the game Blackjack clearly exhibits the abstract game model that sets apart the game GUI from the game logic but linkages them together through event listeners and event handlers. Finally, so-called low-level events generated by the key and the mouse are explored. The famous game Sudoku describes the keys control, and the card game Agnes illustrates the ability of the mouse control.

- The third category of games is animation-based games. As long as a discrete action-event-update-repaint chain becomes continuous, the consequent update-repaint actions form an illusion of animation, which drives some components, termed as sprites, of a game continuously and independently animated. The interactions of animated sprites cause collisions, which in turn trigger new events that dynamically change the scenes of the game. The game players attempt to guide or avoid collisions for reaching the goal of the game. A DigitalClock and an AnalogClock introduce Java's built-in class Thread that can be used to construct a game loop for animating sprites. The game loop consists of three steps: updating attributes of sprites, repainting the updated sprites, and pausing for a while. Immediately, the game WheelVideo merges visualization, event-driven, and animation for enhancing the game WheelOfForture_in-text. Then, the game Pong explores the principle of collisions. Based on these techniques and the OOP properties of inheritance, abstract class, and polymorphism, a Three-Layer Software Structure for games is formed. This Three-Layer Software Structure for games accommodates the dynamically changes of the number of sprites and their behaviors, as well as the complexity of games. It works as a template for developing new projects, such as SymBall, Tornado, and new games, such as Breakout, Worm, and Othello, etc. These projects and games not only prove the adaptability and the stability of the Three-Layer Software Structure for games, but also show the power of Java language and OOP technique.
- The fourth category of games is the so-called Serious games (Serious game, 2018). Serious games are simulations of real-world events or processes designed for the purpose of solving a problem. Two topics in CS courses, the algorithms of array sorting and the conversions and calculations of binary numbers, were taken as examples for illustrating what serious games are and how to animate them with the game programming. Since these examples deal with the knowledge of algorithms and architecture of computers, they are optional for this course.

Through these games and projects, the features of Java are gradually discovered and studied in analyzing new games and solving unfamiliar problems raised by new topics and new projects. When the Three-Layer Software Structure for games is constructed based on the OOP techniques, it becomes a template for developing new games and new projects.

COURSE CONTEXT

This course could be adapted for diverse groups of students. When the course is selected as a required course for the first-year or second-year students in a degree of Computer Science or Information Technology or other related fields, this course could be a foundation course since it is designed for teaching the first programming language Java. In this case, one potential problem may occur. It is that when the course selected as a required course, if a student does not like game stuff, then an

uncomfortable situation might happen. Similarly, if a teacher does not like game stuff, then he/she may not accept the assignment for teaching this course.

Alternatively, this course could also be adapted as an elective course for junior, senior, or graduate who have enough background of Java as the prerequisite of the course. Under that case, students will study Java more deeply and practice to apply Java for solving real problems.

In fact, the game programming is not only an excellent pedagogical approach for teaching Java but also a special tool for enhancing other courses. Some examples are described as follows.

After the Java course, the following course usually is "Data Structures," which intends to introduce various kinds of data structures, such as Arrays, Stacks, Queues, Linked List, Trees, Hash Tables, Heaps, Graphs, and related algorithms, such as Sorting, Recursion, Tree manipulations, and the like (Lafore, R., 1998). Often, quite a few students felt abstract and "unseeable" about these topics. A better approach is to let students "see" them. It is a useful place of game programming. Either the teacher "shows" these data structures and algorithms to students or students themselves to make them visible. After students learned game programming and the Three-Layer Structure for games, they can apply the game programming knowledge and skills to design serious games for making the abstract algorithms and various data structures to be "visible" and "touchable." The fourth part of the book "Learning Java with Games" (Xu, C.-w., 2018) shows two examples of serious games, one of them is the animated sorting algorithms. After the animated sorting algorithms and another animated recursive algorithm "The Towers of Hanoi" were displayed to students, many of them responded, "much clear about these topics now."

The idea of serious games can also be applied to other different courses, such as "Computer Organization and Architecture." When the course touches the topic of binary computations, a few students felt confusion and they did not have confidence on their own computation results. For solving these problems, a project "Visualizing binary computations dynamically as video games" was developed and posted on the Web. All of computations are step-by-step visualized just as on a blackboard. Students can watch the demonstrations of binary computations repeatedly. Meanwhile, the computation results made by the project can be used to verify the computation results make by students themselves.

This idea was also adopted for learning "Web Service." The game Othello played by two players was developed as a networked game. Two players used two computers to play the game. The data that reflect the states of the two separated game GUIs on the two computers went through a communication link made by Web service to keep the two GUIs identical. This networked game is not only a game but also illustrates the software structure and functionalities of Web service clearly (Xu, C.-w., Lei, H., and Xu, D., 2010).

A group of students also interested in developing these kinds of serious games. They developed tree accesses algorithms and unbalancing tree structure in one of "Data Structures" course. These efforts guided them study remarkably and deeply.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

This course requires regular hardware (a computer with the capability for programming) and

software (Java SDK) for Java programming. The NetBeans is recommended as the IDE for programming since it is a light IDE, easy to learn and use. Other IDEs for Java programming are also suitable.

The required textbook is "Learning Java with Games," Springer (Xu, C.-w., 2018). The book details all the contents and goals of this course with many figures, such as, UML class diagrams, UML sequence diagrams, UML state machine diagrams, GUI pictures, and so on. These figures are valuable materials for students and teachers to understand the design and the structure of related games. The book also cited a bunch of source codes for explaining the programming knowledge and skills. Every chapter attached self-review questions and related project exercises. In addition, the publisher Springer completely supplies all of the source codes, images, and soundtracks for readers and PPT files for teachers.

A few related reference books are listed in the reference and the reading list.

COURSE ASSIGNMENTS

The major assignment of the course is the term project. The course asks students to join a team (3-4 students) for developing a term project. Every term project needs to be presented by the team for the entire class. Every student in the class listens, questions, and submits a score for every presentation. The teacher prepares a grading sheet for every student before the presentation starts. (A predefined grading sheet will be displayed in the following section Course Assessment as a reference). The grading sheet has 10 predefined aspects, which also give every student a clue what criteria their term projects should meet.

According to experiences, the average of the scores given by students in the class on each term project is remarkably close to the teacher's expectation. In some cases, the teacher may adjust the average score for some projects if necessary.

In general, students designed and implemented many interesting games by themselves. Almost all of the students enjoy this process. The presentations also give every student a chance to enhance their ability of presentation organization and speaking art. After practicing the entire process for designing and implementing their own game, every student is better at understanding and recognizing game features and shortcomings presented by other teams. It gives students a valuable chance to learn from each other.

Weekly assignments are listed in the expanded course outline below, which includes a set of questions and a project for every week.

COURSE ASSESSMENT

Every week the teacher selects 10% of students to turn in their project exercise for grading (since time limitation). The grading criteria for both project exercises made by the individual student and term projects conducted by a team are listed below. The assessment of term projects is based on the evaluations of all students in the course and the instructor.

Every student in the course follows the proposed grading criteria below for evaluating every team's

project:

1. Creativity and/or innovation (new, specific features …)	0	2	4	6	8	10
2. Difficulty (complexity, number of objects …)	0	2	4	6	8	10
3. UML class diagram and sequence diagram	0	2	4	6	8	10
4. GUI and Player's instruction (splash sheet? ...)	0	2	4	6	8	10
5. Structure of the program (inheritance, communication …)	0	2	4	6	8	10
6. Players' controls (comprehensive, flexible, …)	0	2	4	6	8	10
7. Sounds and images (rich, beautiful, …)	0	2	4	6	8	10
8. Presentation preparation (PPT, load among members …)	0	2	4	6	8	10
9. Presentation quality (clear, meaningful …)	0	2	4	6	8	10
10. Do you learn something from this presentation?	0	2	4	6	8	10
11. Do you have any suggestions or comments? (no score for this question)						

The entire semester has two-three quizzes. The quiz times are randomly decided. A quiz includes 2 or 3 questions selected from the weekly assignments or a new question that discussed in a recent class time.

Every term has only one final exam. It includes multiple choices, fill in blanks, literal questions, algorithms, code tracing, and simple coding questions.

The final total score is based on the following components:

1. Exercises: 5%
2. Quizzes: 10%
3. Term project: 35%
4. Final exam: 50%

EXPANDED COURSE OUTLINE FOR THE FIRST TERM

Week 1: Course content

Class Topics/Activities

- Syllabus and course arrangement
- What is programming?
- Required hardware and software
- Programming languages and Java
- A programming flow and pattern in Java
- Why selected games as programming target
- The first program HelloWorld

Assignments

- Installation of JDK

- Installation of IDE Netbeans
- Answer the following questions: (Read all of questions in Chapter 1)
    - What is a computer? What major hardware units does a computer have?
    - Why do we need programming languages?
    - What is an object-oriented programming (OOP) language?
    - Why Java language is suitable for game development?
- Implement the following project: (The project 7 in Chapter 1)
    - Write a Java program for showing the following pattern.

Week 2: Variable, type, method, and class

Class Topics/Activities

- Basic syntax, semantics, and conventions in Java: revisit HelloWorld
- Variables and types: project HelloWorld2
- Methods and constructor: project HelloWorld3
- User-defined class: project ShowMessage
- Adding an input part: project ShowMessage2
- Designing and implementing a new project: PrintXmasCard
- Using a permanent storage (File): project PrintXmasCard2
- Method, parameter, and return value
- Try-Catch blocks
- Primitive and reference data type
- Type Casting

Assignments

- Form teams for term projects
- Answer the following questions: (Read all of questions in Chapter 2)
    - What are the major components of a class?
    - What is a variable? What is the scope of a variable?
    - What the major function does a constructor method perform?

    - What are three major parts of a Java program?
    - A method also has three parts. What is its input, output, and computation part?
- Implement the following project: (The project 4 in Chapter 2)
    - Design and implement a Java program for printing a Birthday Card.

Week 3: OOP principle and game in-text

Class Topics/Activities

- Story of the game in-text: game GuessInt1
- OOP is based on objects: game GuessInt2
- Getting a random integer: random number generator
- Control statements: "if-then-else" and "while"
- Passing data using function invocation
- Verifying input data: game GuessInt3
- Advantages of Try-Catch approach
- Principal strategy for an OOP program
- Java operators: Arithmetic, Relational, and Logical
- More control statements: "switch" and "for"

Assignments

- Answer the following questions: (Read all of questions in Chapter 3)
    - How to generate a random number in a required range, say [9, 88]?
    - What difference between a "while" loop and a "for" loop?
    - What is the output of the following "for" loop?

```
int count = 5;
for (int i = 0; i < 5; i++) {
    System.out.println((i * count++) + " " + ++count);
}
```

    - Convert the "for" loop above to be a "while" loop.
    - What should be the output of the following println() statements?

```
What should be the output of the following println() statements?
    int anInt = 11;
    System.out.println("The output = ", anInt++);
    System.out.println("The output = ", ++anInt);
    System.out.println("The output = ", anInt--);
    System.out.println("The output = ", --anInt);
```

- Trace the output of the following piece of code:

```
        System.out.print("The output = ");
        for (int i = 0; i < 3; i ) {
      for (int j = 2; j < 5; j ) {
      for (int k = 4; k < 7; k ) {
System.out.println((i j k) "—");
}
}
}
        System.out.println();
```

- Implement the following project (The project 9 of Chapter 3)
    - Design and implement a project NumberCrunching that continuously provides a mathematical computation (+,-, *, /) for the user to answer the result, for example, 4 + 5 = ?. The project also counts the correction rate (correct answers / total number of computations issued)

Week 4: The Unified Modeling Language (UML)

Class Topics/Activities

Introducing the Unified Modeling Language (UML)

- Story of the game WheelFortune in-text
- Linear data structure: Array and ArrayList
- Initializing the game: game WheelFortune1
- Three players: game WheelFortune2
- Initializing board and wheel: game WheelFortune3
- Unusual cases and error cases: game WheelFortune4
- Driving force and termination of the game

Assignments

- Answer the following questions: (Read all of questions in Chapter 4)
    - What are similarities and what are differences between the game WheelFortune and the game GuessInt? Apply the UML class diagrams to describe them.
    - The game uses both Array and ArrayList data structures. What differences between them?
    - How to select a word among 4 existing words by using

JOptionPane.showInputDialog()?

- Which is valid, which is invalid in the following definitions?

```
String aStr = 12.34;

String aStr = "12.34";

String aStr = "" 12.34;

String aStr = String.valueOf(12.34);
```

- What is the meaning of "static variable"? May we define all of variables as static? Why do you say so?

- Implement the following project (The project 12 of Chapter 4)
  - Design and Implement the following game DiceFortune. The story of the game says, "Two players are initially assigned the same amount of money, say 100 dollars. When a 'play' starts, the two players throw two dices interchangeably five times. The player whose average value of the five throws is larger wins this 'play.' The loser pays the amount of money that equals the average value of his/her five throws to the winner. Once a player gets a throw value of 12, he/she can stop the throw and his/her average value of five throws counts as 12. The other player continues his/her throws. If the other player also gets a throw value of 12, this 'play' is finished with no winner. Otherwise, if the other player does not have any value of 12, the former player wins this 'play'. Whenever one of players loses all the money, the game is terminated." The design stage should include a UML diagram and a pseudo code.

Week 5: GUIs of games and graphical drawing

Class Topics/Activities

- Java provides a rich capacity for GUI (Graphical User Interface)
- Building up a GUI foundation: project PaintXmasCard1
- Computations involved: project PaintXmasCard2
- Aligning substrings: project PaintXmasCard3
- Adding an image: project PaintXmasCard4
- Decorating: project PaintXmasCard5

- Superclass and subclass
- Access modifiers: Private, Public, and Protected
- Constructor super() and keywords “Super” and “This”
- Override and overload method

Assignments

- Answer the following questions: (Read all of questions in Chapter 5)
    - Why do we need the built-in classes FontMatrics and StringTokenizer of Java?
    - Could you add two family photos into a Christmas card?
    - What differences between the “overload” and “override” methods?
    - Use the UML class diagram to illustrate an inheritance hierarchy with three layers.
    - What is the functionality of the built-in class StringTokenizer?
- Implement the following project (The project 8 of Chapter 5)
    - Design and implement a birthday card in using a GUI.

Week 6: Java software components and event handling

Class Topics/Activities

- A GUI consists of Java software components: project CalculatorApp
- Arranging components using layout managers
- A UML sequence diagram illustrates an action-event chain
- The register-trigger-execute makes an action-event chain
- Major semantic events and their event listeners
- Flexibility of event handling: project ImageSlider
- Showing a static scene: project ImageSlider1
- Adding dynamic behaviors: project ImageSlider2
- Abstract method and abstract Class
- Software components: JRadioButton and JCheckBox

Assignments

- Answer the following questions: (Read all of questions in Chapter 6)
    - What are software components? Make four examples of them.
    - What are layout managers?
    - What is an event, an event listener, and an event handler?
    - What is an inner class? How to use an inner class to implement an event listener?

    - What other alternative approaches for implementing an event listener?
    - What is an action-event chain and an action-event-update-repaint chain, respectively?
    - What is an Interface? Why do we need to define Interfaces?
    - What is an "abstract class"?
- Implement the following project: (The project 3 of Chapter 6)
    - Extend the project CalculatorApp to add a function of mod (%) operation.

Week 7: Event-driven game and the GUI

Class Topics/Activities

- Story of the game Anagram (Anagrams (game), 2018)
- A text version: game AnagramText
- Adding a GUI: game AnagramGUI
- Class PlayerPanel.java implements actions
- Class Board.java displays the scrambled word and the guessed word
- Class GameCanvas.java sets up communication paths among classes
- Dynamic activities: game AnagramGUI

Assignments

- Answer the following questions: (Read all of questions in Chapter 7)
    - On the GUI, the board and the playerPanel are two pieces. How to make them work together?
    - What communication paths are needed in the project AnagramGUI?
    - The class Board.java involves three repaint() calls for painting different parts of the board. What are they?
    - Write down the sequence of method invocations for illustrating the action-event-update-repaint chain in the
    - game AnagramGUI.
    - Draw a UML sequence diagram to illustrate the dynamic behaviors of the game WheelFortune in-text
    - developed in Chapter 4.
    - Searching and Browsing the Internet for finding out the differences between the components JTextField and JTextArea.
- Implement the following project: (The project 2 of Chapter 7)
    - Apply the logic and GUI of the game AnagramGUI for designing and implementing a game with the name of GuessWord. The game displays a word with some missing characters and asks the player to guess the word with a complete and correct spelling.

The game may provide three difficulty levels, such as easy, medium, and hard. The different difficulty levels imply missing different percentages of characters in a given word.

Week 8: Event-driven with an update-repaint chain

Class Topics/Activities

- Story of the game Blackjack (Blackjack, 2018) and its design
- Preparing a deck of cards: game Blackjack1
- Adding players and applying game rules: game Blackjack2
- Adding chips for betting: game Blackjack3
- GUI and event-driven in the game Blackjack3
- Deciding "when to show what" by using truth tables

Assignments

- Answer the following questions: (Read all of questions in Chapter 8)
    - Why both dealer and gambler may share one class Player.java?
    - How to handle Aces that have two different face values?
    - How to calculate the amount of money the gambler has in considering all of cases?
    - What different data should be displayed on the board at different times?
    - Could you make the classes Card.java and Deck.java reusable in other card games?
    - Draw a UML sequence diagram to illustrate the dynamic behaviors in the Blackjack.
- Implement the following project (The project 1 of Chapter 8)
    - Assume that a card game has four players. Write a program to prepare a deck of cards and deal the deck of cards into four hands with face-up and show them on a board for the four players sit on the four directions of EAST, SOUTH, WEST, and NORTH.

Week 9: Key control

Class Topics/Activities

Story of the game Sudoku (Sudoku, 2018)

- Two-Dimensional Array
- A composite class Board.java: game Sudoku1
- Applying the Brute-Force algorithm for populating the board: game Sudoku2
- Key event and key event listener
- Implementing the Key-Event-Update-Repaint chain: game Sudoku3

- Inner class MyKeyAdapter inside the class GameCanvas.java
- Creating a new class CursorMark.java to implement a cursorMark

Assignments

- Answer the following questions: (Read all of questions in Chapter 9)
- How to declare a 2D array? How to initialize the 2D array? How to print out the contents of the 2D array?
- The class Board.java is a composite class. What does "composite class" mean?
- Why do we need to have the 1D array alreadyTested when we validate the row, column, and mini-board?
- How to set up the "focus" for using key controls? Why is it necessary?
- May we replace all of key commands by using Java software components?

Implement the following project (The project 2 of Chapter 9)

- Implement a project of a 4×4 Sudoku.

Week 10: Mouse Control

Class Topics/Activities

- Story of the card game Agnes (Hamlyn, 2014; Agnes (card game), 2018)
- Preparing cards: game Agnes1
- Cards on the GUI form a "Layout" and a "Foundation": game Agnes2
- Mouse event and mouse event listener: projects TestDrag, TestDrag1, TestDrag2, and
- TestDrag3
- Dragging a set of cards: game Agnes3
- Game rules: games Agnes4 and Agnes5
- Adding a Class PlayerPanel.java: game Agnes5
- Always showing the dragged cards on top: game Agnes6

Assignments

- Answer the following questions: (Read all of questions in Chapter 10)
    - What are the definitions of the Interface MouseListener, MouseMotionListener, and MouseWheelListener?
    - What is the definition of the class MouseAdapter? What difference between listener and adapter?
    - What is the functionality of the event handler mouseDragged()?
    - What functionality is implemented in the event handler mouseReleased()?

    - What is a data structure of "array of ArrayList" for the "layout" structure of the game Agnes?
    - Why do we need to have two nested "for" loops for dealing cards into the "layout"?
    - Draw a UML class diagram and a UML sequence diagram for the project Agnes6.
- Implement the following project (The project 2 of Chapter 10)
    - Imagine that "mouse drag" is equivalent to "mouse pressed mouse moved." Could you apply this idea to replace the mouseDragged() method in the game Agnes? Write a test program to verify your ideas.

Week 11: Summarize important topics and answer questions

Class Topics/Activities

- Java programming
- Game programming
- Abstract model for games
- UML, class diagram, sequence diagram
- Games in-text, event-driven games
- Event-driven-update-repaint chain
- GUI and graphical drawing
- Components, key control, and mouse control

Assignments

- Each team selects a game as the term project
- Review all of questions and prepare for the final exam

Week 12: Prepare term project

Class Topics/Activities

- Make sure teams and members for term projects
- Propose a list of possible games for students to be selected as term projects
- Discuss term projects' grading rules and grading approach
- Answer questions
- Students start term projects

Assignments

- Each team submits a report about the preliminary idea for the term project

Week 13, 14: Students work on their term projects

Class Topics/Activities

- Students discus ideas or questions about term projects with the teacher

Assignments

- Every team works on its term project

Week 15, 16: Term project presentation

Class Topics/Activities

- Every team presents its term project for entire class
- Students listen, question, and grade every term project presented by every team
- Teacher makes a review for the final exam

Assignments

- Polish the term project if necessary
- Turn in the term project

Final exam

- Take a final exam according to school's schedule

Course outline for the second term

Week 1: Animation programming

Class Topics/Activities

- Continuous and dynamic behaviors
- How to tick: projects ADigitClock1 and ADigitClock2
- The Java built-in class Thread and its usage
- Applying Thread for ticking the digital clock: project ADigitClock3
- Trail and flicker problems: projects ADigitClock4 and ADigitClock5
- Animation technique
- GUI of an analog clock: project AnalogClock1
- Constructing a superclass: project AnalogClock2
- Applying animation to tick the Analog Clock: project AnalogClock3
- Setting clock time Automatically: project AnalogClock4

Assignments

- Answer the following questions: (Read all of questions in Chapter 11)
    - What is the frame-based animation?
    - What is the sprite-based animation?
    - What is the principle of the animation technique?
    - Give an example in your daily life to explain what concurrency is and what simultaneity is.
    - What are the major three steps in a "game loop"? Why do we need the three steps?
    - What are the major differences between the project ADigitClock and the project AnalogClock?
    - How to derive a superclass based on existing subclasses?
    - How to derive a subclass from a superclass?
- Implement the following project (The project 5 or 7 of Chapter 11)
    - Design and implement a Banner board that moves a set of banners from right to left. The board has a control panel to allow the users to add or delete banners, to change the font name, font size, font style, and the color of each individual banner.

Week 2: Merging visualization, event driven, and animation

Class Topics/Activities

- Adding a GUI to the Game WheelFortune in-text and constructing the wheel with a special painting: project WheelVidio1
- Rotating the wheel with the animation technique: project TestWheel
- Collaborating all of classes: project WheelVideo2 (Wheel of fortune (American game show), 2018)

Assignments

- Answer the following questions: (Read all of questions in Chapter 12)
    - How to paint a string along the radius direction?
    - What is the principle of a game loop?
    - How to control the speed of a game loop?
    - How to stop the game loop and how to re-start the game loop?
    - How to paint the complete wheel with 10 sectors?
    - How to draw a UML sequence diagram for describing dynamic interactions among classes?
- Implement the following project: (The project 3 of Chapter 12)
    - Design and implement an animated solar system. The system consists of three objects:

the sun, the earth, and the moon. The earth revolves around the sun in an orbit; at the same time, it also revolves on its own axis. The moon revolves around the earth on another smaller orbit.

Week 3: Sprites and collisions

Class Topics/Activities

- Story of the game Pong (Pong, 2018)
- Constructing the GUI: game Pong1
- A brief introduction on JavaBeans model
- Animating the ball sprite: game Pong2
- Allowing the player to move the paddle with keys: game Pong3
- Adding a score counting mechanism: game Pong3
- Increasing the playing difficulty: game Pong4

Assignments

- Answer the following questions: (Read all of questions in Chapter 13)
    - How to animate an object? Make an example with a piece of code for illustrating it.
    - What is a "game loop"? What are the major steps in the game loop?
    - Why collisions are important in a video game? Make an example to explain it.
    - What are the advantages of the JavaBeans model?
    - What differences between the event-driven and animation? Do they have similarity in certain points?
    - Why do games usually have a score counting mechanism?
- Implement the following project: (The project 6 of Chapter 13)
    - Modify the project Pong4 by changing the sleepTime for increasing the speed of the bouncing ball.

Week 4: Multiple Screens of games

Class Topics/Activities

- A game usually has multiple screens
- Applying the CardLayout for structuring multiple screens
- Organizing screens with an extra "Container": project TestCardLayout1
- Using one of the existing screens as the "Container": project TestCardLayout2
- Adding a splash screen: game Pong5
- Formatting texts on the splash screen: game Pong

- Increasing number of ball sprites: game Pong7
- Modifying the game story for catching the ball sprites: game Pong8

Assignments

- Answer the following questions: (Read all of questions in Chapter 14)
    - Why does a game usually have multiple screens?
    - What function are usually implemented in each of the screens?
    - How to organize multiple screens?
    - What should be done in order to switch between the game canvas and the splash screen?
    - Why is the "extension" important in the development of a game?
    - What extensions does the game Pong have? Are there any other new extensions?
    - Why do we say the class PaintStrBean.java is a reusable software unit?
- Implement the following project: (The project 6 of Chapter 14)
    - Add a new screen SettingPanel.java in the game Pong. The setting panel allows the player to set some parameters for the game, such as the initial speed, the number of balls, the thresholds for increasing the ball speed, and the like.

Week 5: A Three-Layer Software Structure for games

Class Topics/Activities

- What if more types of sprites are needed?
- Inheritance converts diverse types of sprites to be the same type
- Applying abstract classes for constructing a sprite inheritance hierarchy
- Constructing a Three-Layer Software Structure framework for games
- Applying the Three-Layer Game Structure: game PongStruTwo
- The sprite layer defines an inheritance hierarchy
- The canvas layer defines all of controlling functions
- The frame layer defines multiple screens structure
- Why the Three-Layer Software Structure for games?

Assignments

- Answer the following questions: (Read all of questions in Chapter 15)
    - How to define an inheritance hierarchy that can accommodate various sprites involved in a game?
    - What OOP techniques are required for building up the sprite inheritance hierarchy?

    - How can we use one linear data structure and a single "for" loop to animate different kinds of sprites?
    - What three major methods are required for animating a sprite?
    - Draw an UML class diagram to illustrate the three-layer game structure.
    - What advantages of the three-layer game structure?
    - How to apply the three-layer game structure for implementing a game?
- Implement the following project: (The project 1 of Chapter 15)
    - Apply the three-layer structure for games to re-implement the project Pong8.

Week 6: Usage of the Three-Layer Structure for games

Class Topics/Activities

- The outline of the project Symball
- Applying the Three-Layer Software Structure for a new project: symball1init
- One thread supports two different animation tasks: symball2toright
- The sprite inheritance hierarchy eases adding new sprites: symball3torl (to right and left)
- Every sprite has a thread to change its color randomly: symball4twinkle
- A new project tornado
- Making a ball sprite circulating along an oval: the project tornado1
- Dividing the y-axis into 13 sections: the project tornado2

Assignments

- Answer the following questions: (Read all of questions in Chapter 16)
    - What are the eight steps for adding the balls to make the initial pattern?
    - How to animate objects of balls after finishing the initialization of components?
    - How to twinkle the balls with randomly changed colors?
    - What idea does the project Tornado illustrate?
    - Is there any better algorithm for initializing the objects for making the scene of a Tornado?
    - What is the computation principle for making the circulating objects?
    - What advantages of the three-layer game structure in making these projects?
- Implement the following project: (The project 7 of Chapter 16)
    - Modify the project SymBall3ToRL to be SymBall3ToUD. That is, change the animation directions from right/left to up/down.

Week 7: Image sprite, UML State Machine

Class Topics/Activities

- The game Breakout (Breakout, 2018) could be understood as an extension of the game Pong
- A new image branch in the sprite inheritance hierarchy
- Arranging all bricks in a 2D format on the GUI: game breakout1
- Detecting collisions by using PropertyChangeEvent: game Breakout2
- Using mouse to control the paddle sprite: game breakout3
- Applying the UML State Machine (Samek, M., 2008) to describe game states

Assignments

- Answer the following questions: (Read all of questions in Chapter 17)
    - What technique is applied for getting images and using images?
    - What does the new sprite inheritance hierarchy for image sprites look like?
    - How to map 1D array storage to 2D array arrangement?
    - How to use the event listener PropertyChangeListener?
    - What advantages and disadvantages in using the PropertyChangeListener instead of other listeners, such as the ActionListener?
    - Draw a UML state machine for the three states discussed in the chapter for the game Breakout.
    - How to dynamically switch from one listener to the other in the game Breakout?
- Implement the following project:
    - Draw a UML state machine for the game BlackJack.

Week 8: Sound effect

Class Topics/Activities

- More steps for completing the game Breakout
- Adding the current score counting and the ball lost counting, adding new abstract methods in the class AbsGameCanvas.java, and adding sound effect: game Breakout4
- Constructing a composite sprite, modifying the communication path, and improving the control of the ball sprite: game Breakout5
- A GameStruTemplate model
- More extensions of the game Breakout5
- Other games that could be understood as an extension of the game Pong

Assignments

- Answer the following questions: (Read all of questions in Chapter 18)
    - Why do we need to add the current score counting mechanism?
    - What are advantages and disadvantages of the new designed composite sprite over the original design?
    - What different communication mechanisms among classes do we have applied?
    - What are the major steps for adding sounds into a game?
    - Implement the following project: (The project 7 of Chapter 18)
- Implement the game Space Out as an extension of the game Breakout as described in section 18.10.

Week 9: Changing the structure of sprites dynamically

Class Topics/Activities

- Story of the game Worm (Worms, 2018)
- Constructing the class worm.java as a composite class
- Painting a worm and a treat statically on the GUI: game Worm1
- Animating the worm along the x-axis: game Worm2
- The player controls the game through keys: game Worm3
- Adding another worm for extending the game: game Worm4
- Adding sound effects: game worm4
- Some extensions of the game Worm (Davison, A., 2005)

Assignments

- Answer the following questions: (Read all of questions in Chapter 19)
    - How to animate a worm that has a fixed length?
    - How to insert new body unit dynamically into the body of the worm?
    - What is a circular array? What difference between a circular array and a regular array
    - How to determine the moving direction of the worm wormAuto?
    - Is the three-layer structure for games powerful for developing a new game, such as, the game worm?
    - Are there new features that can be added to extend the game Worm?
- Implement the following project: (The project 3 of Chapter 19)
    - Add a third sprite, say an eagle, into the game Worm for competing the treat.

Week 10: Chess-like games

Class Topics/Activities

- Revisiting the abstract model of games
- Story and its UML State Machine of the game Othello (Reversi, 2018)
- Initializing the game with a board and four pieces: game Othellol
- Building up a mouse control mechanism for players: game Othello2
- Implementing the playing rules: game Othello3
- Linking the rules with the sprites on the GUI: game Othello3

Assignments

- Answer the following questions: (Read all of questions in Chapter 20)
    - Draw the UML class diagram of the Othello3.
    - What are the two major dynamic behaviors in the game Othello?
    - What are the communication chains for the two major dynamic behaviors?
    - What event listeners are employed in the game Othello?
    - Describe the structure of the playing rules.
- Read Chapter 21 for understanding the ideas of changing two plyers to one player.

Week 11: Summarize important topics and answer questions

Class Topics/Activities

- Animation technology
- Apply animation for games
- Construct a Three-Layer Software Structure for games: sprite layer, canvas layer, and framelayer
- Apply the Three-Layer Structure for designing and implementing games
- Single-player games and double-player games

Assignments

- Each team selects a game as the term project
- Review all of questions and prepare for the final exam

Week 12: Prepare term project

Class Topics/Activities

- Make sure teams and members for term projects
- Propose a list of possible games for students to be selected as term projects

- Discuss term projects' grading rules and grading approach
- Answer questions
- Students start term projects

Assignments

- Each team submits a report about the preliminary idea for the term project

Week 13, 14: Students work on their term projects

Class Topics/Activities

- Students discus ideas or questions about term projects with the teacher

Assignments

- Every team works on its term project

Week 15, 16: Term project presentation

Class Topics/Activities

- Every team presents its term project for entire class
- Students listen, question, and grade every term project presented by every team
- Teacher makes a review for the final exam

Assignments

- Polish the term project if necessary
- Turn in the term project

Final exam

- Take a final exam according to school's schedule

COURSE BEST PRACTICES

This section will discuss the following four ideas.

Avoid similar term projects

General speaking, as students, they have a limited ability for creating brand-new games. Many term projects referred to some existing games. Simply copying existing games does not make learning. Therefore, every term project is needed to follow the Three-Layer Software Structure for games and to design and implement the term project step-by-step (version-by-version). The presentation materials, as well as the submitted project source codes, should also be divided into step-by-step (version-by-version). In addition, some special requirements are issued, such as using Java Beans (Doherty, D., Leinecker, R., et al., 2000) to implement reusable units, to draw UML class diagram,

sequence diagram, and state machine, etc. These demands avoided copying and also enhanced students' learning.

Develop new courses

Besides teaching Java game programming, A course with the name of "CSIS 4491 Games on Handheld Devices." was developed to covered Java ME (Java 2 Micro Edition) game programming (Wells, M.J. 2004; Flynt, J.P., Wells, M.J., 2008). The course name "handheld devices" refers to cell phones, personal digital assistants (PDAs), etc. Although the course involves the latest technologies at that time, such as mobile networks, limited resources and functionalities of the devices, and so on, the course was successfully accepted by students.

Later, iPhone and iPhone games were getting popular. Students are interested in these types of games. A new course for teaching iPhone games (Mark, D. and LaMarche J., 2009; Bakhirev, P., Cabrera P.J., Marsh I., Penberthy, S., Smith, B.B., and Wing, E., 2010) was proposed as a response. More than 40 students registered for this course. Unfortunately, since the following two problems (1) The majority of students had only Windows PC and our department did not have a lab with Apple machines (2) Some students did not have enough background of the Objective-C programming language, they gradually withdrew from the class. When the term finished, the class only 13 students remained.

The different results of these two courses gave me a warning that investigating the required hardware and software as well as the background of students before developing a course is important. It also indicated that learning game programming is interesting, but it is not easy.

Individual projects vs. collaborative and team assignments

A term project is a major assignment for this game course. The term project is a collaborative work completed by a team. Collaborative work has many advantages. However, it also has some shortcomings. The major problem is that it is not easy to balance the working load among team members. That is some team members are busy, but some others may have no chance to involve or learn technical content. If the term project is an individual project, it may be too heavy for some students due to the limitation of time and technical ability. I tried once to let students complete 6 small projects individually in one term instead of a term project. Definitely, these individual projects could not be complicated, and everyone did the same thing so that the results were almost identical. This approach limited students' imagination and could not raise their interests.

It is not easy to find a perfect judgment over the individual and collaborative approaches. I prefer collaborative team projects. As a remedy for the working load unbalancing, I asked every student to carefully study the completed project by their own team such that everyone should understand and learn all the techniques for designing and implementing the project. Meanwhile, the final exam not only have conceptual questions but also have more fundamental technical questions.

Some examples of term projects implemented by students (from 9 courses)

Among these term projects, part of them is exiting games with partially creative; some are created by students.

Magic Square, Asteroid, Othello, Slider Puzzle, Word Quest, Blackjack, Under Contract, Worm, Ping-

pong ball, Mine, Tetris, Breakout, Volleyball, Pac-Man, Tank Shooter, Galaxy, Escape, Karate, Saucer, Space Impact, Dragon Hunter, Sudoku, Deepsea, Little mouse, Labyrinth, Tic-tac-twirl, Multiplayer Checkers, Hungry Worm, Centipede, Enhanced Worm, Space Invaders, Monkey Math, Maze, Worm Race, Broken Arrow: LA, Chain Reaction, Campus Invaders, Improved Worm, Minotaur, Heart Finder, Peg Board Puzzle, Alien Attack, Wizard of Wor, 31 (a card game), Brick Destroy, Football, Snooker Game, etc.

FUTURE COURSE PLANS

Today, quite a few students are interested in iOS gaming. Depending on the population of Apple computers and the programming language Swift with its SwiftUI, the contents of game courses may be switched to this direction. However, teaching iOS games may deal with some difficulties, such as teacher's training, teaching load, learning curve, student's availability, and so on.

Using Python for game programming is also a trend today. Similarly, if Python is the second language in the degree, then the same difficulties listed above are also possible.

Networked game is an attractive aspiration. However, the rapid evolution of web technologies sometimes causes difficulty in the choice of communication channels. It requires a course for covering the web technologies after students learned the game programming.

Recently online courses become popular since pandemic. Actually, our courses for graduates were online during 2005-2013 (?). The software system recorded the entire course as videos, which also included the teacher's posture and his/her writing. During the course period, students can come to the classroom or remotely join the course, raise questions, and attend discussions. These videos allow students to repeatedly listen to the course at any time. Students can also present their term projects remotely. It was a nice system. Whether adopting this kind of system depends on the decision of the administration and the resources.

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CHAPTER 5.

GAME DEVELOPMENT (CS 4335; CS 6335)

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Course Title: CS 4335 & CS 6335: Game Development
Course College/School: Science, Engineering and Technology
Course Department/Program: Computer Science
Course Level: Undergraduate and Graduate
Course Credits: 3 semester hours
Course Length: 15 weeks (plus a week for presenting to industry experts)
Course Medium: Blended/Hybrid; meet 4-5 times for 2.75 hours with the rest of the work online
Course Keywords: computer game development, computer gaming, evaluating games, game coding, game design, game developer manual, game playing, storyboarding

CATALOG DESCRIPTION

A study of computer games and computer game development including evaluating, designing, and developing a computer video game with appropriate documentation *(storyboard design, in code comments, developer's game manual).* Prerequisites: C or better in object oriented programming.

This course is typically taught in a hybrid format, meeting a few times during the semester with the rest of the work online in the St. Mary's University learning management system, Canvas. The course is offered for undergraduates under the course number CS4335 and graduate students under the course number CS6335. Recently, this course has been cross listed with a mobile programming course in order for both classes to have enough students. In that course, the students are asked to develop a mobile game for their main project in the class. If they really want to create a different kind of mobile app, the professors will work with the student.

COURSE PURPOSE AND OBJECTIVES

The main purpose of this class is to have students develop a good computer game as well as to immerse themselves in the field of gaming. During the course, the students will learn about and be able to

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- evaluate games by playing and assessing them,
- design a computer game (with at least 5 levels/rooms/quests) with storyboards,
- develop the game (with whatever tools and languages they choose), and
- write the corresponding documentation with in-code comments and a game manual.

Graduate students will also research and report on a topic within the computer gaming field. A student can take this course at the undergraduate level and later in the graduate level where the student would work independently to design and develop a much larger game as well as report on research in a gaming topic.

Students are required to read presentations and files each week in the online content along with small assignments, such as posting in a discussion about a game-related movie they saw. These assignments are not graded directly, but points are taken off the larger assignments if they are not completed. These smaller assignments prepare them to do the work of the larger assignments and serve to get the students in the world of gaming.

COURSE CONTEXT

The Game Development class at St. Mary's University is offered as a computer science (CS) elective class. The undergraduate computer science majors must take one or more CS elective classes in any of the four degrees that we offer. The undergraduate version of the class is required for any student who is in the Bachelors of Science in CS with the game development track. The graduate version of the course is required for any student in the Certificate in Educational Computer Gaming program. The Masters in Computer Science and Masters in Computer Information Systems students also take at least 3 CS elective classes, so they can take the graduate version of this class to count as one of their CS electives.

Since most students are computer science majors and the course prerequisite is object oriented programming, they already know how to program and can use multiple development tools. The students in the class can develop a game with the languages and tools that they already know, or they can learn a new language and tool if they can do it quickly. Many students will learn how to use a new tool such as GameMaker or Unity in the first half of the semester while they are doing the other work of the class to play games, evaluate games, and design a game. They need to spend a good amount of time during the second half of the semester developing a game with some substance, typically with at least 5 levels or rooms or quests. The online course content includes links to tools and tutorials for many game development tools.

Students are not required to have played any computer games in order to take this class. While about half of the students who have taken this class call themselves gamers, there have been a few students who had never played a computer game. There are a number of assignments early in the course to help students discover what the gaming field is like whether they play computer games or not. Students who identify as gamers tend to make their games too hard, especially at the beginning of the game, and they often have to be reminded to make the start of their games easier.

COURSE PEDAGOGY

I fundamentally believe that anyone can learn anything. Some people may need longer or more work than others, but I have worked with people from many walks of life and many different capabilities including extreme learning differences. We have been able to work together to get to learn something in the area, even in mathematics, a common subject to hear people say "I can't do math." In this Game Development course, I can assume the students can write computer programs, but I cannot assume they have played or know much about computer gaming. Since it is such a fun field, even the students who call themselves gamers don't mind playing more games, a requirement in the early weeks of the class. Some of the Game Development course content has also been used for camps and summer programs with PREP (Prefreshmen Engineering Program, https://future.utsa.edu/pre/prep/) and Upward Bound (https://www.stmarytx.edu/outreach/upward-bound/) for high school students as well as Girls Code/Camp Code (https://tinyurl.com/y4stvdql) for middle school students. These students were taught the GameMaker tool. All students were able to make some sort of game, as long as they put in the work during the camp or program.

In any class, I usually give students all the pieces that they need to do something, and they have to modify and put together or apply the pieces to complete assignments. In our upper level and elective courses such as Game Development, we tend to have the class be project-based where students learn about the area and then apply what they have learned to develop their own product. Other classes we offer like these include Artificial Intelligence, Computer Graphics, ELearning and Gamification, Internet/Web Development, Mobile Programming, Oracle Programming, and Python for Data Science. I also believe that any issue can be worked through in communication. It is very important that students let me know about any problems they encounter so that we can work together to re-scope an assignment or delay a deadline for the student, if needed. In order to maintain engagement, students are assigned small weekly assignments, such as post what games they played in a discussion, in the first half of the course. These assignments also serve to maintain communication as a class and get them engaged in the gaming world.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

The textbook for this class has changed a few times over the years. It usually is a book that generically covers the whole game development process, is not too long, and is easy to read since the students are expected to read it all in the first half of the semester. There are many game development books that focus on one aspect of the field such as level design, a specific tool for games, or artificial intelligence in gaming. The book used most recently is a bit dated, but again it is one of a few that cover the whole process and is not about a specific development tool. The students are assigned to read about 3 chapters each week. The table below shows the progression of books that have been required over the years. From 2000 to 2004, a CD-ROM was created by the CS department with materials from the professor that students purchased in the book store because there was not a good book that fit the needs of the class. Then, the following books have been adopted over the last 15 years.

- Rabin (2005), **Introduction to Game Development**, MA: Charles River Media
- Rabin (2009), **Introduction to Game Development** (2nd Edition), MA: Charles River Media
- Chandler & Chandler (2010), **Fundamentals of Game Development**, MA: Jones & Bartlett

Learning

- Novak (2011), **Game Development Essentials** (3rd Edition), MA: Cengage Learning

Because we require a Windows-based machine or a dual boot with Windows in our early classes, most students choose to develop on their Windows laptops. However, there is not a specific hardware or software requirement for the development or delivery of their games. Students have used languages and development tools such as C/C , GameMaker, Godot, Java, Javascript, Pico-8, Pygames with Python, RPG Maker, Tiled, Unity with C#, Unreal Engine, and Visual Basic. The most popular tool to use currently is Unity which can deliver to multiple platforms. Students have developed for many platforms from Windows PCs, Mac PCs, Android devices, iPhones, HoloLens, and any device that can run a Web browser. We recommend that the student acquire any textbook or reference that the student may need to learn about and use whatever tools they select to develop their game.

COURSE ASSIGNMENTS

Reading and reviewing PowerPoint presentations and book chapters, as well as other posting activities, are accomplished in the first half of the semester so students can spend the rest of the time developing their games. Students are expected to spend 8-10 hours a week on development for most of the second half of the semester.

The first major assignment is a **game evaluation** document with descriptions and assessments of 5 different games. There must be at least 2 genres and 2 platforms that the games play on in the set of 5 games so that there is some variety. When students are playing games to evaluate them, they need to pay attention to the quality of the graphics and game play, as well as note what the physical actions they take to do things within the game – what player input gives what results in the game. They then have to write about the actions in order to prepare themselves to think about and write storyboards with the actions a player would take in their games. For the write up of the game evaluations, there should be a cover page and table of contents, then for each game a write up with these sections:

- Game name and description including actions the player does (with images)
- Ratings within a 0-10 scale with reasoning for each of
    - multimedia, design, depth, support, overall appeal
- The good and the bad – summary of parts the student disliked and liked

The next large assignment for students to complete is a **storyboard** document with the design of the game that they want to make. After a cover page, there is an overview with a description and background about the game, and a flow chart to illustrate how a player will likely navigate through the game software showing how the levels/rooms/quests/states of the game relate to each other. The chart could be very linear, one room after another, or cyclical by going to complete a quest and come back to a home base, or another type of organization. Finally, there will be many pages showing storyboards with a title and image for each scene, a description below the scene, and a list of the actions a player can do with the resulting things that happen in the game after each action. There should be a storyboard page for the start of each room/level/quest, and others for main activities showing what changes. Here is a template given to the students. Students are also shown example

documents from past students. After students show a flow chart, the professor suggests how many storyboard pages with scene images each of the students should have in their document.

Image 1: Storyboard page template

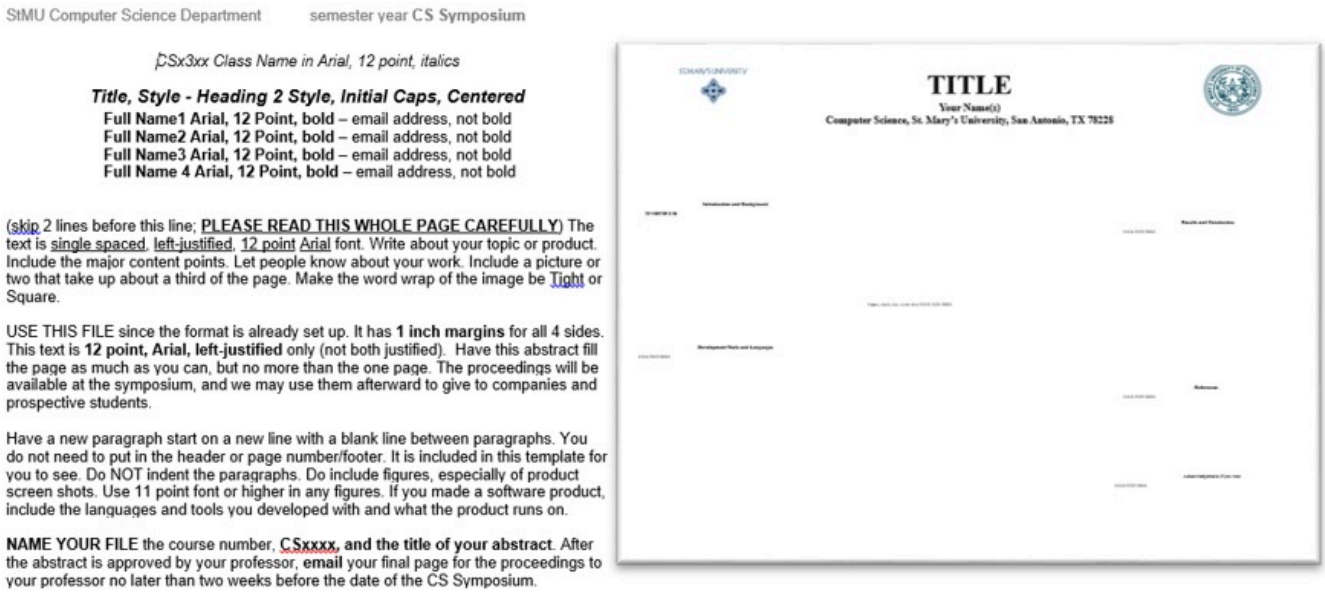
Graduate students need to pick a topic within the gaming field to **research** and present to the class. They need to read about 10 articles or chapters, take notes, and create a PowerPoint presentation. Some suggested topics include: **hyper casual** games; **conferences** such as GDC and E3; esports; game definition languages; games of a certain type or platform; history of games; graphics for games; current design concepts; current development practices; educational game effectiveness (*deeper than in the class*); a game **company;** commercial game industry; game **addiction;** ARGs (alternate reality games); game piracy; gamification; ALGAE (adaptive learning game design.

Graduate students create a notes file that has all the content that they read (10 articles minimum of varying length) and write summary notes and possible points for each reference. The points might be included in their presentation. The notes file and PowerPoint are turned in for a grade. The presentation file should include an explanation of what the topic is as well as some specific examples.

The next 3 assignments are all due near the end of the semester since the games they make need to be close to completed to do the assignments. The first of these assignments have two parts that are required for the CS Symposium that is run by the Computer Science department at the end of fall and spring semesters. At this event, upper level undergraduate and graduate students present

their work from the semester to a group of industry experts that judge their work and give feedback to the professors. The **abstracts and posters** are put into an electronic proceedings that the judges see during project presentations. The abstract instructions and poster template are shown here. The poster information should include

- background, purpose and goals of the game,
- what the game was developed in and runs on,
- design/flow chart with description,
- lots of screen shots including in the development tool
- sample of interesting code,
- conclusions, and
- main references.


StMU Computer Science Department semester year CS Symposium

CSx3xx Class Name in Arial, 12 point, italics

Title, Style - Heading 2 Style, Initial Caps, Centered

Full Name1 Arial, 12 Point, bold – email address, not bold
Full Name2 Arial, 12 Point, bold – email address, not bold
Full Name3 Arial, 12 Point, bold – email address, not bold
Full Name 4 Arial, 12 Point, bold – email address, not bold

(skip 2 lines before this line; PLEASE READ THIS WHOLE PAGE CAREFULLY) The text is single spaced, left-justified, 12 point Arial font. Write about your topic or product. Include the major content points. Let people know about your work. Include a picture or two that take up about a third of the page. Make the word wrap of the image be Tight or Square.

USE THIS FILE since the format is already set up. It has **1 inch margins** for all 4 sides. This text is **12 point, Arial, left-justified** only (not both justified). Have this abstract fill the page as much as you can, but no more than the one page. The proceedings will be available at the symposium, and we may use them afterward to give to companies and prospective students.

Have a new paragraph start on a new line with a blank line between paragraphs. You do not need to put in the header or page number/footer. It is included in this template for you to see. Do NOT indent the paragraphs. Do include figures, especially of product screen shots. Use 11 point font or higher in any figures. If you made a software product, include the languages and tools you developed with and what the product runs on.

NAME YOUR FILE the course number, **CSxxxx, and the title of your abstract**. After the abstract is approved by your professor, **email** your final page for the proceedings to your professor no later than two weeks before the date of the CS Symposium.

TITLE

Your Name(s)

Computer Science, St. Mary's University, San Antonio, TX 78228

Image 2: Templates for CS Symposium abstract and poster

In the last class in which we meet, preferably physically, students demonstrate their **game** to the class and another student from the class will play it. If the game takes longer than 10 minutes or so to play through, the student may need to put in software cheats to show all the pieces/rooms/levels/quests of their game.

The game **manual** is the last assignment that should be written after the game is completed. Sometimes this assignment is turned in with the game demonstration, but other times it can be turned in by the time there would normally be an exam for the class. The game manual has the following sections after a cover page and table of contents:

- Overview and Background
- Requirements (hardware and software for a player and the developer)
- Design (flow charts, data structures, and updated storyboard pages to how the game actually

is)

- Installation (where and how to get the files, how a player and a developer installs the software)
- Using the System/game (how to start it, how to play – basic actions, activities and goals)
- Sample Sessions (screen captures with explanations)
- Modifications (how code is organized to make changes; what might future versions have?)
- Troubleshooting (a table with problem/issue – possible causes – possible solutions)
- References (*author name, title of publication, publisher, location of publisher (URL), dates*)
- Appendix – source code listing (with comments) and images of the development screens

COURSE ASSESSMENT

The grade for the class is out of 1000 points in total. There are five major assignments plus an additional one for graduate students. The smaller assignments such as posting in a discussion are not graded but are expected to be completed. Points may be taken of the major assignments if a minor assignment is not done. The scoring is a little different for the game manual between undergraduate and graduate students to account for graduate student research assignment.

Assignment Scoring	Undergraduate	Graduate
Game evaluations	200	200
Storyboard design and presenting	200	200
Research notes file and presentation	--	100
CS Symposium abstract and poster	100	100
Game and demonstration	200	200
Game manual	300	300

EXPANDED COURSE OUTLINE

The first half of the semester has weekly readings and/or activities including the two major assignments of evaluating games and writing the design of a game with a storyboard document. The second half of the semester is mostly about the development of the game along with writing documentation of the game. All the assignments and activities expected of the students are listed in the table below along with the topics covered in the course by week. ***MEET*** is a recommended time to have a synchronous time together either physically or electronically. ***Post*** means to add to a discussion that is in the course content on the learning management system (LMS). ***Submit*** means to send an assignment usually into an assignment area in the LMS or by email.

The Friday of finals week, the CS Department holds the CS Symposium (https://www.stmarytx.edu/academics/set/events/) where upper class and graduate students present some of their work from the semester to a panel of industry experts. The projects are judged by these experts through presentations with demonstrations and posters. The students have turned in **abstracts** and **posters** a week before so a proceedings can be created and given to the judges. The winning projects from each category or course are announced that evening, and the students are given a cord they can wear at

their graduation. The CS Department receives feedback from the experts about what work is done in our classes to try to better meet the skills and capabilities they need for their companies. Freshmen and sophomores are invited to attend so they can see what they will be doing later. Families and friends are invited as it is open to the public. Sometimes prospective students will attend to see what CS students are doing in classes and what they might get to do as a CS major at St. Mary's. Below is a week by detailed schedule of the Game Development class.

Week 1: *MEET* Course overview; Game history, types and systems; Evaluating games

Class Topics/Activities

- Read through the syllabus details
- Introductory presentation about computer games – history, evaluating games
- Group quizzes on game systems and characters; what kind of gamer are you

Assignments

- **Submit** alternate email address
- **Post –** who you are/short bio about you
- **Read chapters 1-4** of: Novak (2011). **Game Development Essentials.** Boston, MA: Cengage Learning. (https://www.jeannie.com/gde).
- **Play games!** Every week

Week 2: Game design; Game development languages and tools

Class Topics/Activities

- View presentation on design and tools
- Watch a game-related move
- Go to a gaming institution to observe or play games (any from Chucky Cheese, to Dave & Busters to a gaming cybercafé)

Assignments

- **Submit** your list of 5 games you plan to play and evaluate
- **Post –** what movie you saw and a description showing the connection to a game

Week 3: Educational games; Gamification

Class Topics/Activities

- View presentation on educational gaming
- Pick a document in the Gamification of Learning and Instruction module to review
- Visit and search for a topic: www.EducationalComputerGaming.com
- Start game evaluations

Assignments

- **Post –** the basic idea of the game you might create – goals, setting, play
- **Read chapter 5**-7 of: Novak (2011). **Game Development Essentials.** Boston, MA: Cengage Learning.
- Graduate students – submit the topic you want to research

Week 4: Game graphics and modeling (math and physics)

Class Topics/Activities

- View presentation on graphics and modeling
- Search for graphics for the game you will make (for settings and objects)
- Optional: View the presentation on the mathematics of modeling in gaming

Assignments

- ***Post** – constructively comment on others' game ideas; give suggestions*
- ***Read chapter 8-9** of:* Novak (2011). **Game Development Essentials.** Boston, MA: Cengage Learning.

Week 5: Evaluations due

Class Topics/Activities

- Finish game evaluations

Assignments

- Submit your game evaluations document

Week 6: The business of games

Class Topics/Activities

  - View the presentation on game business
  - Read trends in gaming – https://www.theguardian.com/technology/2015/jul/23/16-trends-that-will-change-the-games-industry

Assignments

- **Post** the game you will make: name, platform, tools, description, flow chart of rooms/levels/quests
- **Read chapter 10-12** of: Novak (2011). **Game Development Essentials.** Boston, MA: Cengage Learning.

Week 7: MEET Show your storyboard screens

Class Topics/Activities

- Present and watch other student presentations of storyboards/game designs

Assignments

- **Submit** storyboard document

Week 8: Artificial Intelligence in gaming

Class Topics/Activities

- View presentation on AI in gaming and multiplayer gaming
- Watch clips from A Beautiful Mind and Numb3rs

Assignments

- **Post** on other students' game submissions

Week 9: (work on developing your game)

Class Topics/Activities

- Work on developing your game

Week 10: MEET See research; show progress

Class Topics/Activities

- Graduate students present research topic of an area in gaming
- Show progress on your game by running it

Assignments

- Graduate students: ***Submit*** *research notes file and presentation file*

Week 11: (work on the development of your game)

Class Topics/Activities

- Work on developing your game

Week 12: (work on development of your game; MEET with anyone who was behind)

Class Topics/Activities

- Work on developing your game

Week 13: Draft CS Symposium documents

Class Topics/Activities

- Work on developing your game
- Write CS Symposium abstract and poster

Assignments

- **Submit** draft CS Symposium abstract and poster

Week 14: (finish developing game; start manual)

Class Topics/Activities

- Work on developing your game
- Start the game manual

Week 15: MEET Demonstrate your game to class

Class Topics/Activities

- Present a demonstration of your game
- Have another student play your game in class
- Finish the game manual

Assignments

- **Submit** final abstract and poster
- **Submit** game source code and executable, if possible

Week 16: CS Symposium

Class Topics/Activities

- Present game at CS Symposium

Assignments

- **Submit** game manual

The following links are given on the Canvas LMS for general gaming and development reference:

Some websites with lots of **games**, most of them free:

- www.addictinggames.com
- www.agame.com
- www.armorgames.com
- www.bgames.com

- www.bigfishgames.com/online-games
- www.freeonlinegames.com
- www.games.com
- www.gamesgames.com
- www.kongregate.com/games
- www.miniclip.com/games/en
- www.pogo.com

Some places to find educational computer games:

- 7GernerationGames.com
- ABCya.com
- AnatomyArcade.com/games/games.html
- Arcademics.com/games
- BBC.co.uk/bitesize
- BrainPop.com
- BreakOutEdu.com
- CoolMathGames.com
- DuckieDeck.com/play
- Education.com/games
- Educational-Freeware.com
- EducationalGames.NobelPrize.org
- FunBrain.com
- GamesForChange.org/games
- HighlightsKids.com/games
- Hippocampus.org
- HoodaMath.com
- HowStuffWorks.com
- Internet4Classrooms.com
- KidsGames.com
- KnowledgeAdventure.com
- Kids.NationalGeographic.com
- Kongregate.com
- Learn4Good.com/games/kids.htm

- LearningGamesForKids.com
- MiniClip.com
- Mission-US.org
- NickJr.com/games
- PBSkids.org/games
- PlayGen.com/play
- PlayKidsGames.com
- Poptropica.com
- SoftSchools.com
- TryEngineering.org/students/games
- TurtleDiary.com
- TwinBeard.com/games

Some game organizations and conferences:

- **E3**: https://e3expo.com
- **Entertainment Software Association**: www.TheESA.com
- **Foundation of Digital Games**: http://www.foundationsofdigitalgames.org
- **Gamasutra**: https://www.gamasutra.com
- **Game Developer**: https://www.gamasutra.com/topic/game-developer
- **Game Developers Conference**: www.gdconf.com**Games for Change**: www.gamesforchange.org
- **Games for Change game award winners**: http://www.gamesforchange.org/festival/awards
- **Game Developers**: www.gamedev.net
- **International Simulation & Gaming Association**: www.isaga.com
- **Learning Games Network**: www.learninggamesnetwork.org
- **Serious Games Society**: https://seriousgamessociety.org

Game development **tools**:

- **Buildbox**: www.buildbox.com
- **Construct 2**: www.scirra.com/construct2
- **eAdventure**: http://e-adventure.e-ucm.es
- **Game Salad**: www.gamesalad.com
- **Games for Change**: www.gamesforchange.org/toolkitflash
- **GameMaker Studio**: https://www.yoyogames.com/gamemaker

- **Gamestar Mechanic**: www.gamestarmechanic.com
- **GDevelop**: www.gdevelop-app.com
- **jMonkey**: engine (Java) https://jmonkeyengine.org
- **Kilobolt**: (Java) http://www.kilobolt.com
- **Kodu**: www.KoduGameLab.com
- **Marmelade**: https://www.marmaladegamestudio.com
- **Metaverse Studio – AR games for iOS or Android**: https://studio.gometa.io/landing
- **Play Canvas**: www.PlayCanvas.com
- **PyGames**: www.PyGames.org
- **RPG Maker**: www.rpgmakerweb.com
- **Scratch from MIT**: http://scratch.mit.edu, http://info.scratch.mit.edu/Video_Tutorials
- **Stencyl**: www.stencyl.com/developers
- **Torque 3D**: http://www.garagegames.com
- **Unity**: www.unity.com
- **XNA**: http://www.microsoft.com/downloads/details.aspx?FamilyID=80782277-d584-42d2-8024-893fcd9d3e82&displaylang=en

iPad game development tools: **Codea, Hopschotch, Pixel Press, Sketch Nation**

Articles and videos on educational gaming and game influences:

- 10 Lessons from Video Gaming that have Helped my Career
    - https://www.techrepublic.com/blog/10-things/10-lessons-from-video-gaming-that-have-helped-my-careeer/?ftag=TREe09998f&bhid=228147068853724308082409575584 63
- Call of (civic) Duty: Action games and civic behavior in a large sample of youth
    - https://www.sciencedirect.com/science/article/abs/pii/S0747563210003249?via=ihub
- Computer Games Making a Difference
- Gaming Can Make a Better World
- The Game that Can Give You 10 Extra Years of Life
- When Gaming is Good for You
    - https://www.wsj.com/articles/SB10001424052970203458604577263273943183932

Articles on AI and games:

AI and chess

https://www.wired.com/story/defeated-chess-champ-garry-kasparov-made-peace-ai

- AI and poker
    - https://time.com/5624968/facebook-ai-beats-professional-cardplayers/?utm_source=newsletter&utm_medium=email&utm_campaign=the-brief&utm_content=20190823&xid=newsletter-brief
- Algorithmic Multiplayer gaming and AI
    - https://www.aaai.org/Papers/AAAI/1986/AAAI86-025.pdf
- Deepmind and multiplayer gaming
    - https://www.techexplorist.com/deepminds-ai-taught-itself-play-multiplayer-games-beat-humans/23726
- Gamemakers Inject AI to Develop more Lifelike Characters
    - https://www.wired.com/story/game-makers-inject-ai-develop-more-lifelike-characters
- How Computer Chess Changed Programming
    - https://spectrum.ieee.org/slideshow/computing/software/how-computer-chess-changed-programming?utm_source=techalert&utm_medium=email&utm_campaign=101111

COURSE BEST PRACTICES

In general, go over with the students what the assignment write ups are and past assignment examples well before the assignment is due so they know what to work on and how the end result should look. Also, students should make a game individually for this class given the purpose that they can make a game. From time to time, two students have worked together to create a larger game as long as it was clear that each student had a good chunk of the code to write.

This game development course is not a computer graphics course. There is usually a whole course for creating computer graphics and learning how those tools are made. Students should borrow graphics for their games and cite where they got the graphics from. However, they should not try to sell their games with borrowed graphics. If they want to try to sell their games, they will need to make their own graphics, but they should not spend a lot of game development class time on graphics.

One of the best activities in this class, besides playing games of course, is the requirement to comment in discussion posts on each of the other students' proposed game to be created. The students are instructed to be constructive and specific, such as to write what you think is good about the ideas or write how something might be modified or expanded. The students come up with some really great ideas and will catch potential issues in other students' concepts and designs.

One year, we worked on a wiki together of educational computer games where there was an organization and a template provided to add game information. There was not much filled in and there was no coherency in the page. If there were a document for everyone in the class to edit, it seems to work best if there is either a simple list being created or a table of information filled in.

If you have to teach this course in the midst of a pandemic or are just choosing to offer the course all

online through a tool such as Zoom, there are some good practices to follow such as asking students to have their camera on or, if for any reason they cannot, have a picture of their face in the Zoom profile so that it shows during a Zoom meeting. To keep students engaged, ask them questions that can be put in the chat such as a short impression about something. Use the react to respond to a yes (or not) such as who has ever played a particular game or a game of a certain type. Use a raise hand for voting and for asking questions (or just have them unmute and ask). Breakout rooms can be great for working on short tasks or peer review of assignments during the class or week before the assignment is due such as for the storyboard document. Students can share their screen to present their storyboards to everyone in the middle of the semester and to demonstrate their game at the end of classes.

Some of the games that have been developed in this class or as a result of taking this class are shown below. Some of the students who have taken this class have gone on to make a game for either a software engineering class project, senior project, or graduate comprehensive project. Also, since this course is part of a graduate certificate in educational computer gaming, the students in that program must make an educational computer game. Other students sometimes elect to create a game that is educational as well.

A common game quest is to have a piece or player make it through a maze and either collect or avoid objects. Soap Bubble Labyrinth has 10 levels of mazes to avoid popping your bubble piece and was developed in 2008 by Omar.

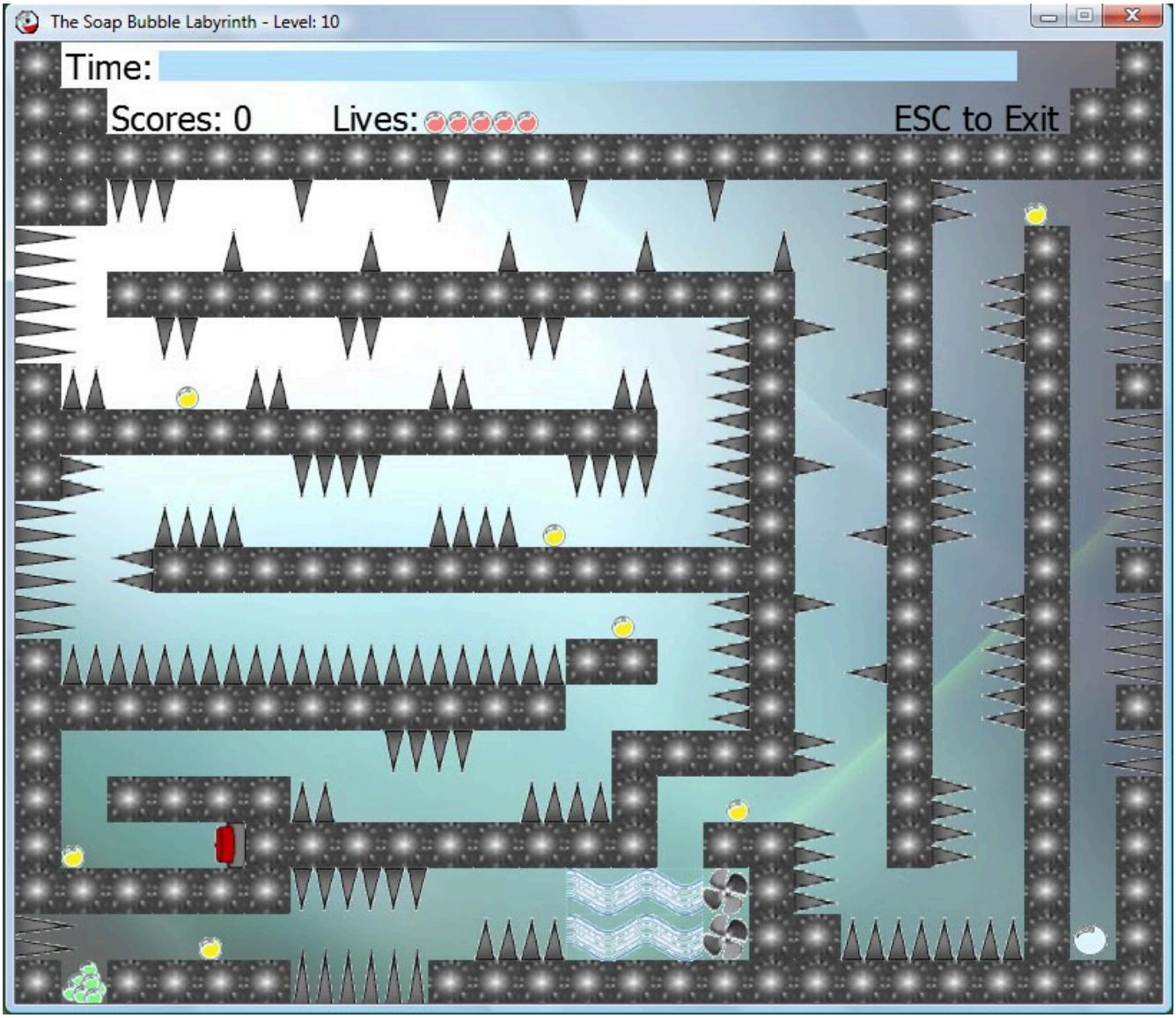


Image 3: Soap Bubble Labyrinth

A popular theme or setting is outer space and a common activity is shooting. The Nextech game had both and including original music, made by Aaron and Adrian in 2008.

Image 4: Nextech

Another common shooting game is one against zombies. This example game is called Shikari – The Shooter by Samman Tyata in 2020, and a level of play is shown in the Unity development tool.

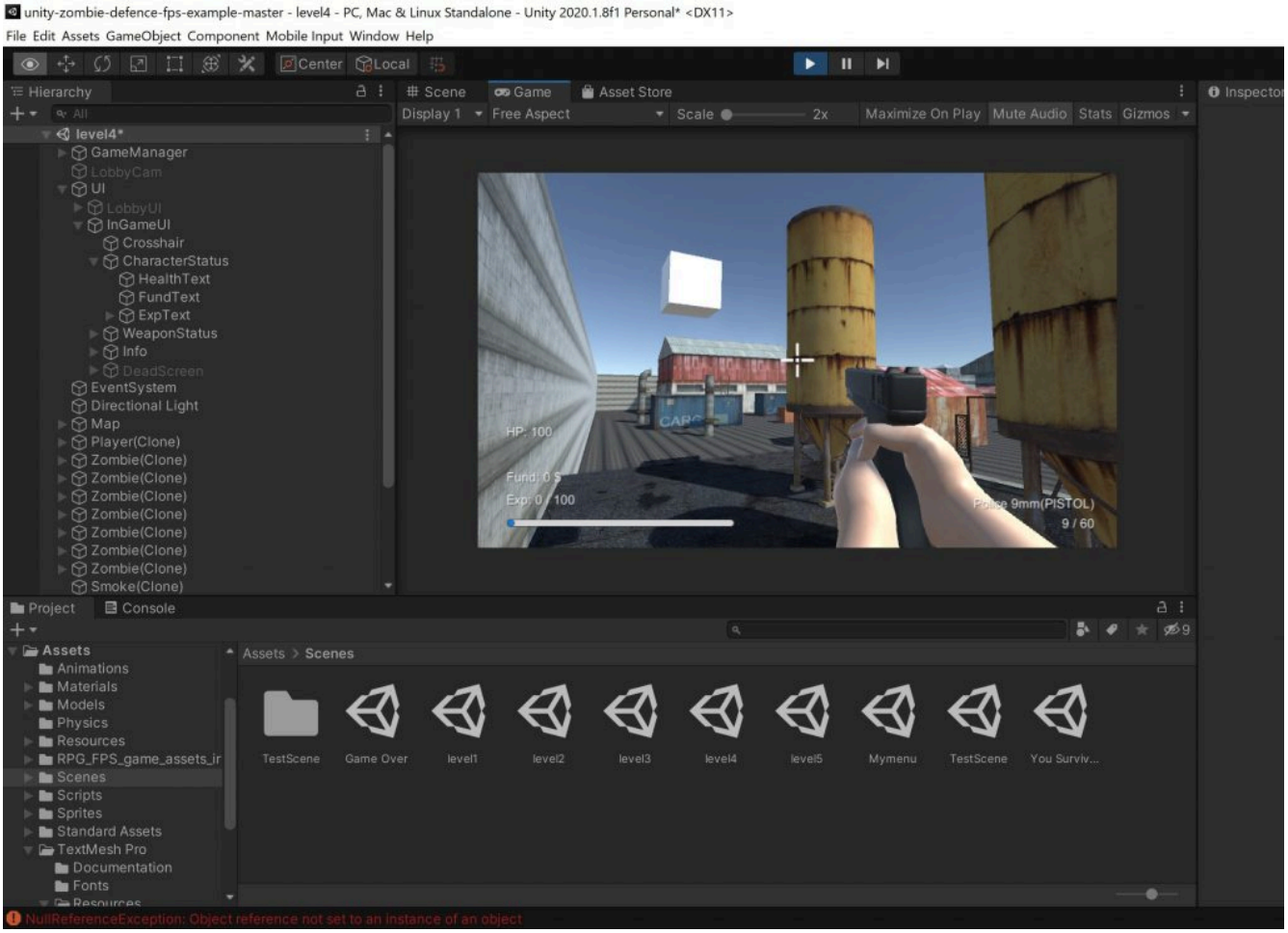


Image 5: Shikari – The Shooter in Unity

Sometimes a game is made to copy an existing board game. Math Snakes and Ladders was developed in 2013 by Ahmed.

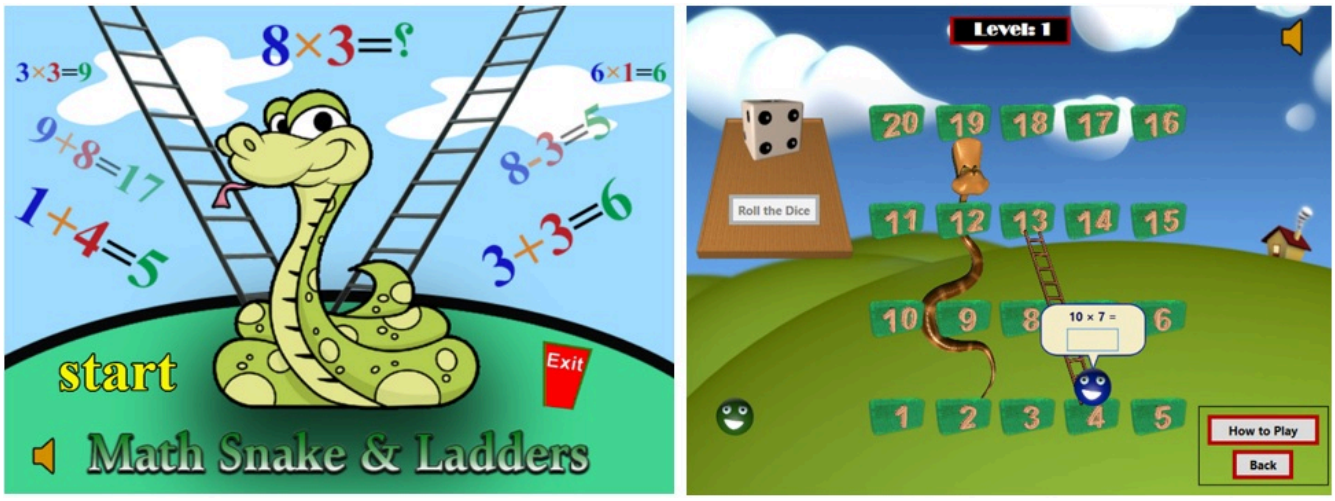


Image 6: Math Snakes & Ladders

A popular type of game is having a vehicle race on a track while gathering points and power ups, avoiding obstacles, and getting to the finish line before time runs out. The following two games show

how games are made with more 3D graphics now. On the left is Wrong Way by Varun from 2017, and on the right is Rattler Racer by Mujeeb in 2020.

Image 7: Wrong Way (left) and Rattler Racer (right)

Platformers are also a common game type. Two such games were recently developed in one class. On the left side is Nova (*get your robot out)* by Alex Montes, and on the right is Right on Time (*to the bus and school)* by Nixon Pastor Guzman, both in 2020.

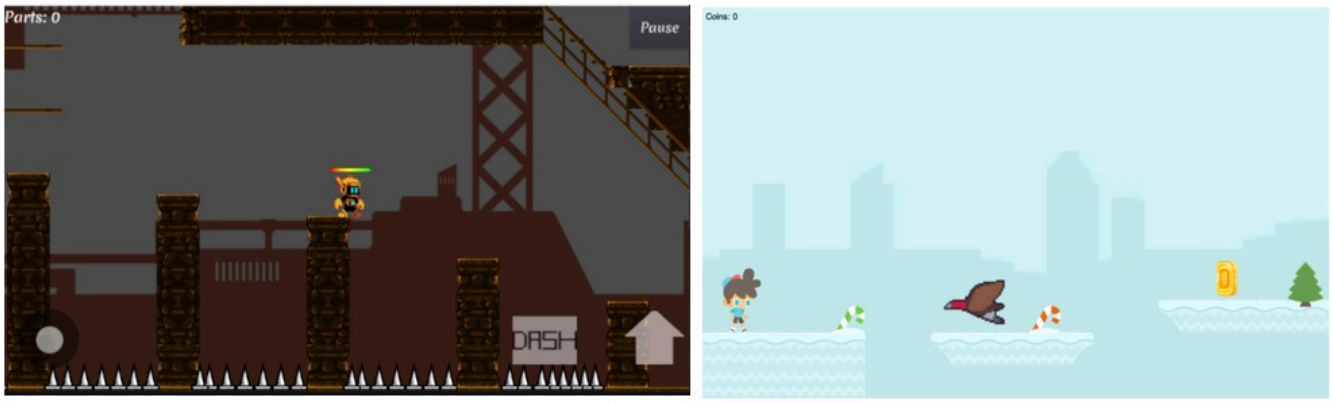


Image 8: Nova (left) and Right on Time (right)

Another theme is for the player to find themselves inserted in a situation and have to escape that world. The Grove by Joe Flores requires a player to find clues that are on pieces of paper throughout the rooms and levels to get out.

Image 9: The Grove

Below are some educational game examples. Some tend to be more quiz like with gaining points or other items to reach a goal or trade in for something, but some do take on a good amount of game play while learning concepts along the way. First is Spot it by Rana in 2015 to locate continents, oceans, countries and landmarks, and second is International Flags to identify country flags by Suchaya in 2015. The third is called Arabic Sign Language by Mohammed in 2017.

Image 10: Spot

Image 11: International Flags

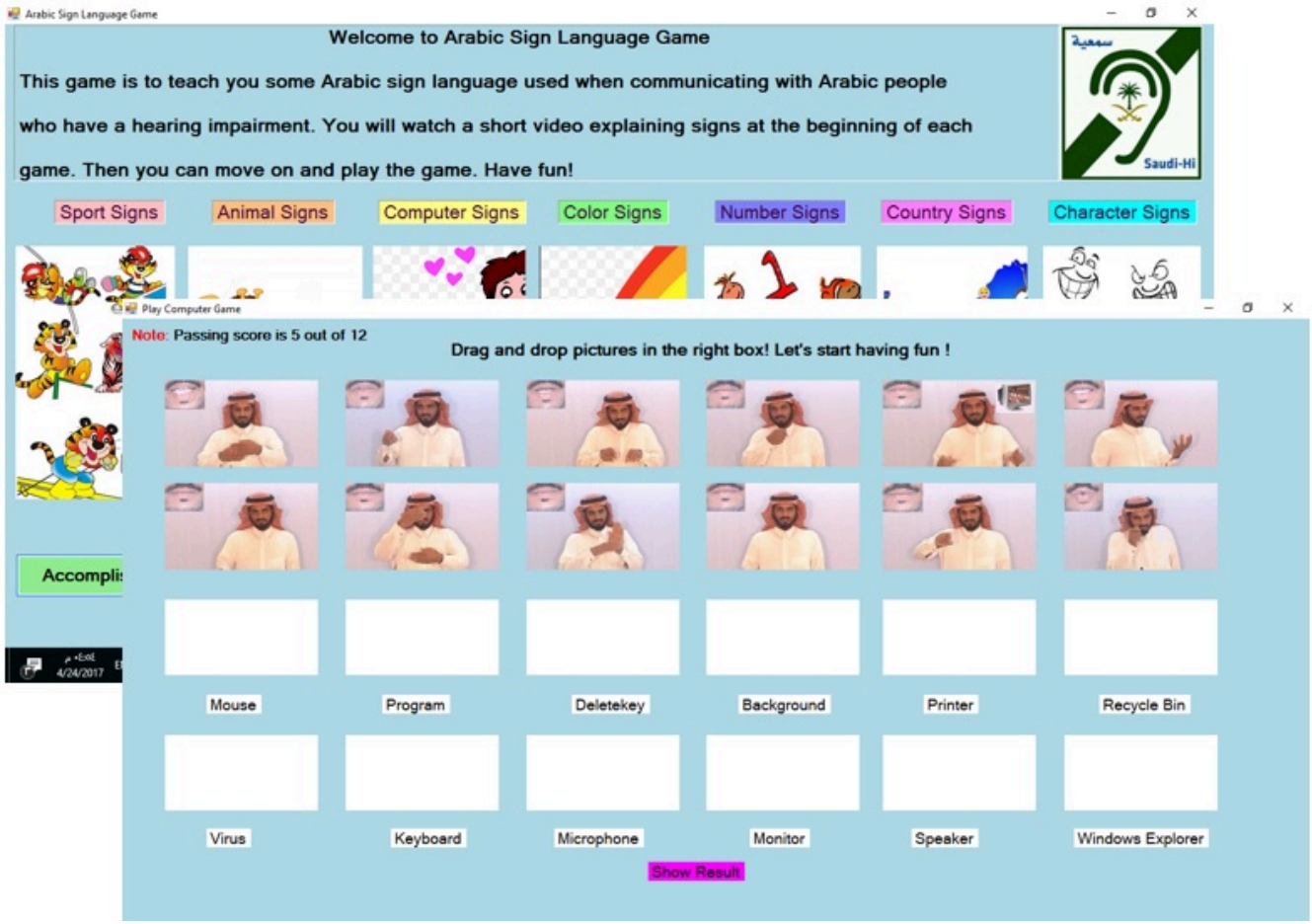


Image 12: Arabic Sign Language

Even global issues such as climate change can be addressed in games. A mobile app called Climate Clean Up, by Breanne Ludovice in 2020, is a game about climate restoration and how carbon dioxide can be taken out of the atmosphere. This game will be expanded in a senior project in 2021.

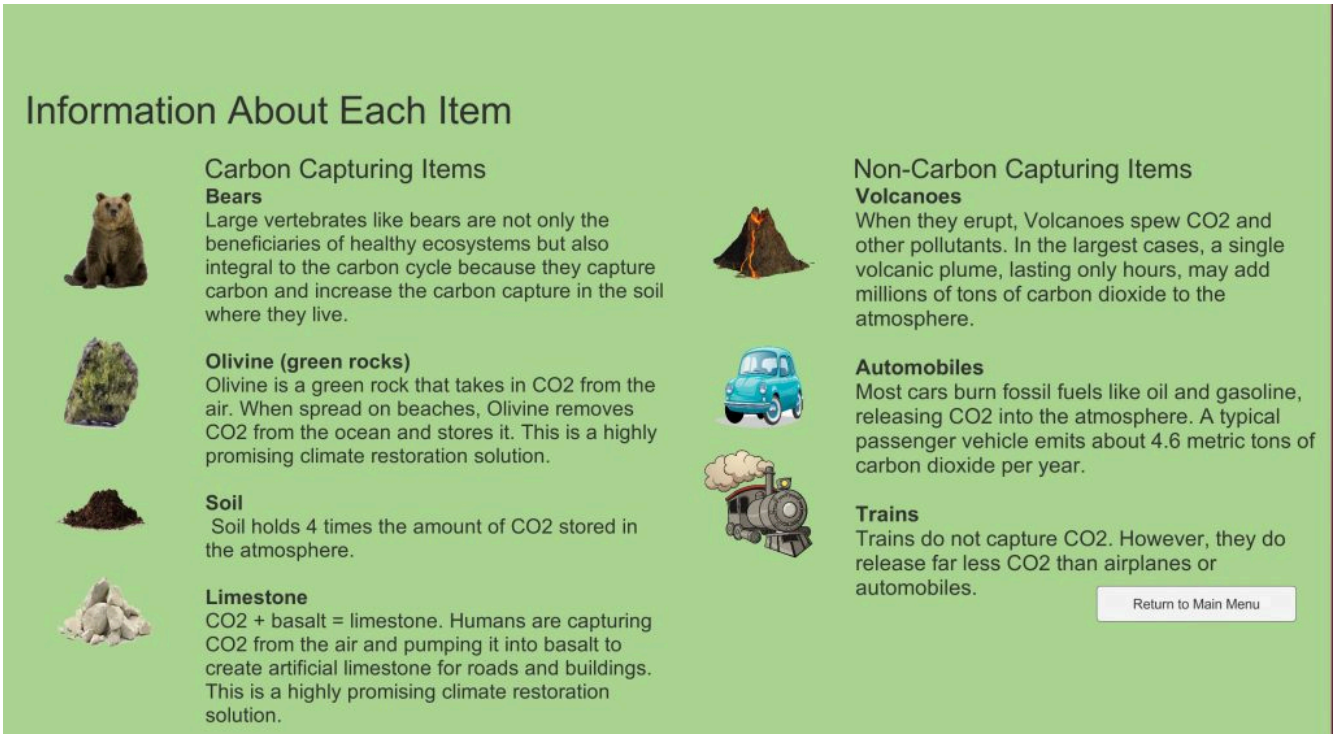


Image 13: Climate Clean Up capture items

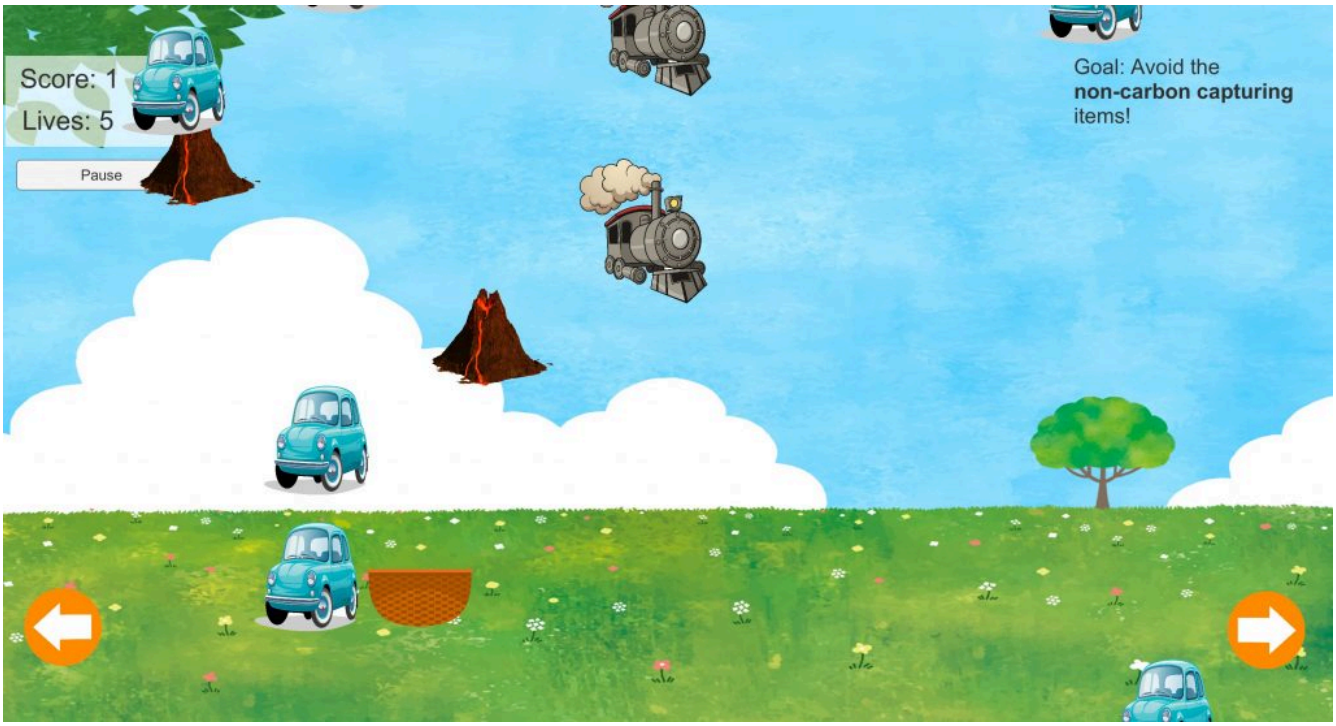


Image 14: Climate Clean Up game play

Students will sometimes make their games available at the Google Playstore or other repository for anyone to download. Currency Collector VR was one of those games. It was developed by Henry in 2017 and expanded in 2018 to include collecting currency from other countries for his graduate comprehensive project.

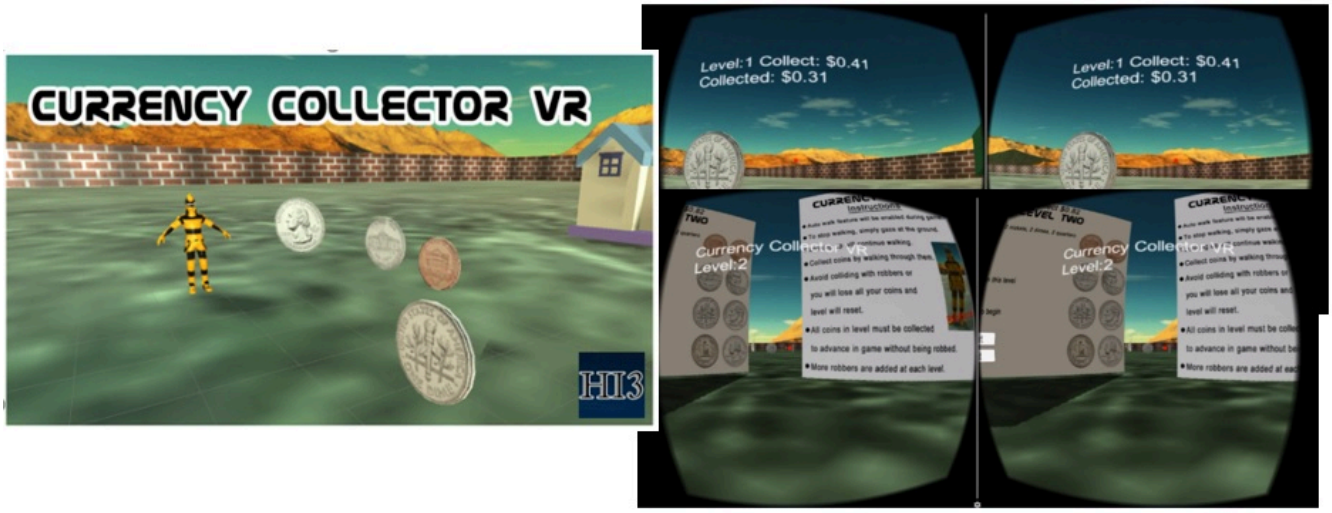


Image 15: Currency Collector VR

Space Explorer by Carlos in 2007 was first created in the game development class and expanded in 2008 for his graduate comprehensive project. That project is shown here by the flow chart of levels, the starting screen, and one of the levels.

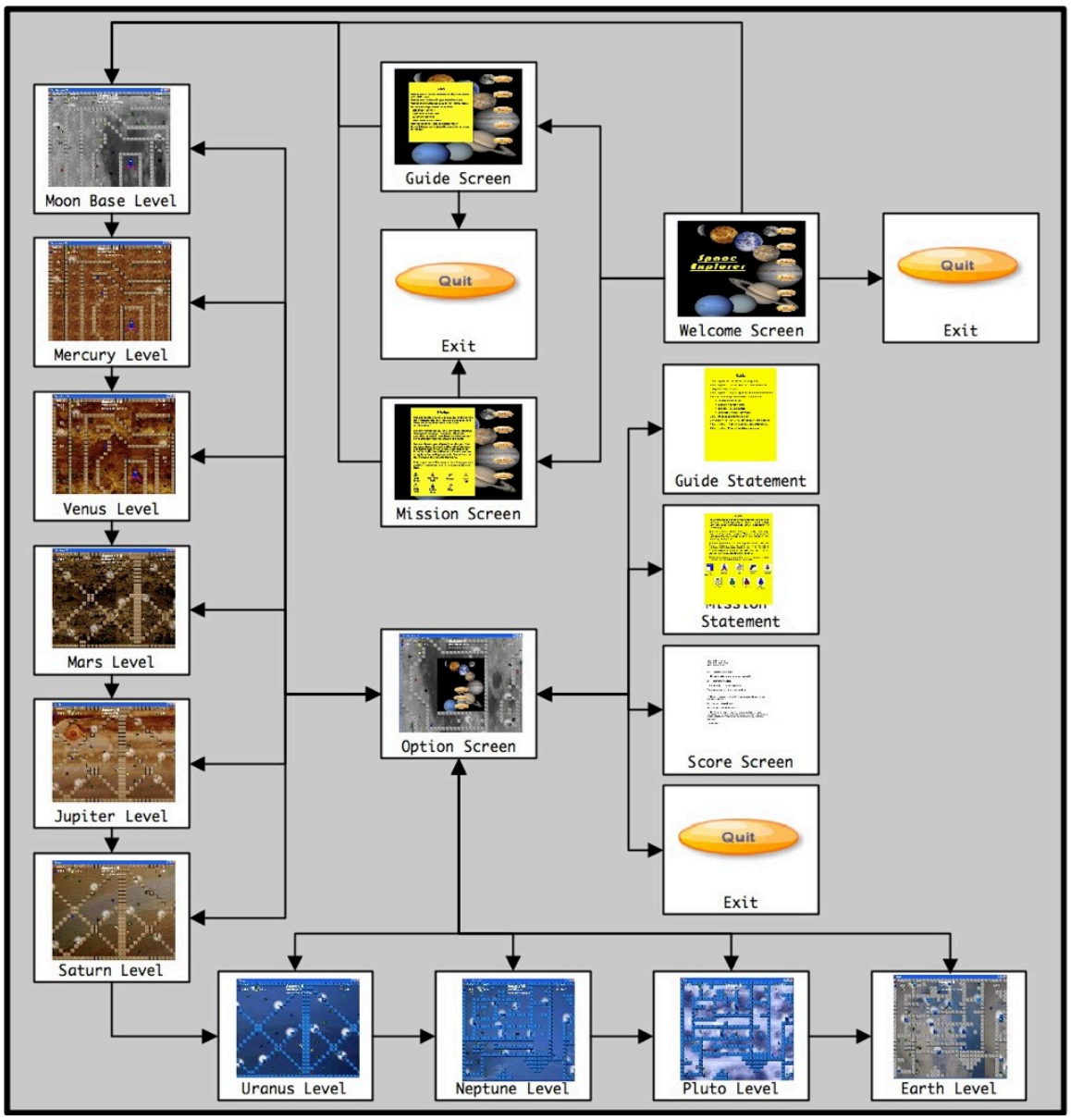


Image 16: Space Explorer flow chart

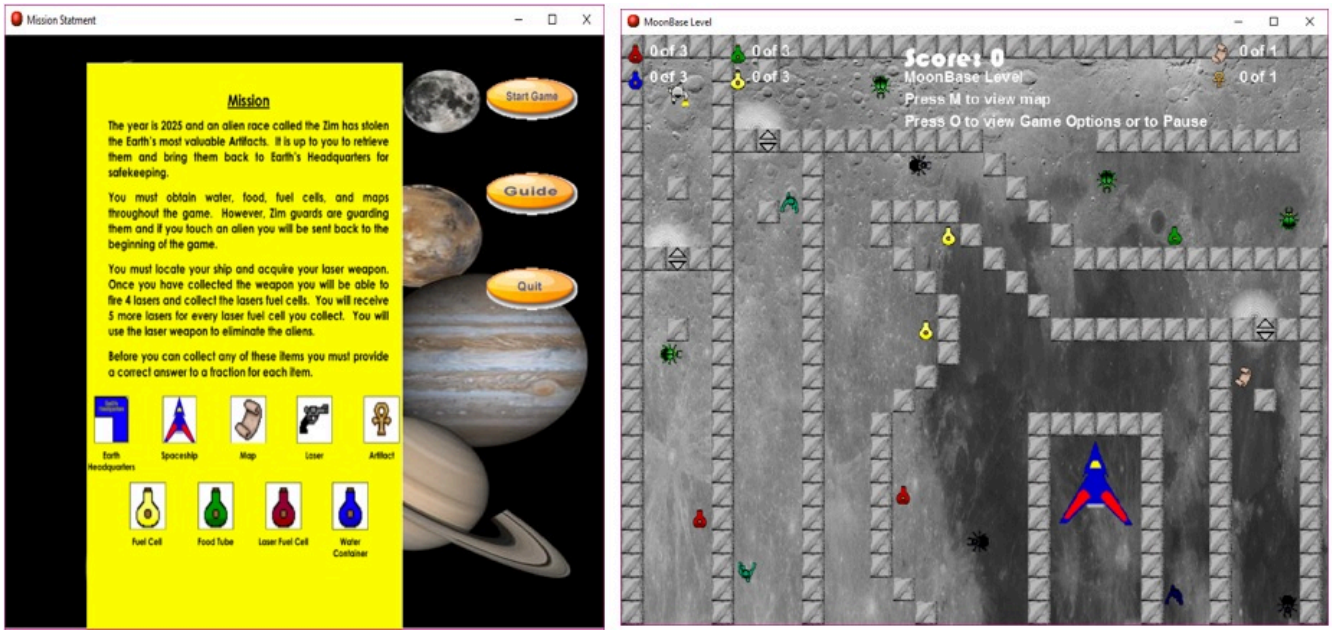


Image 17: Space Explorer start and game play

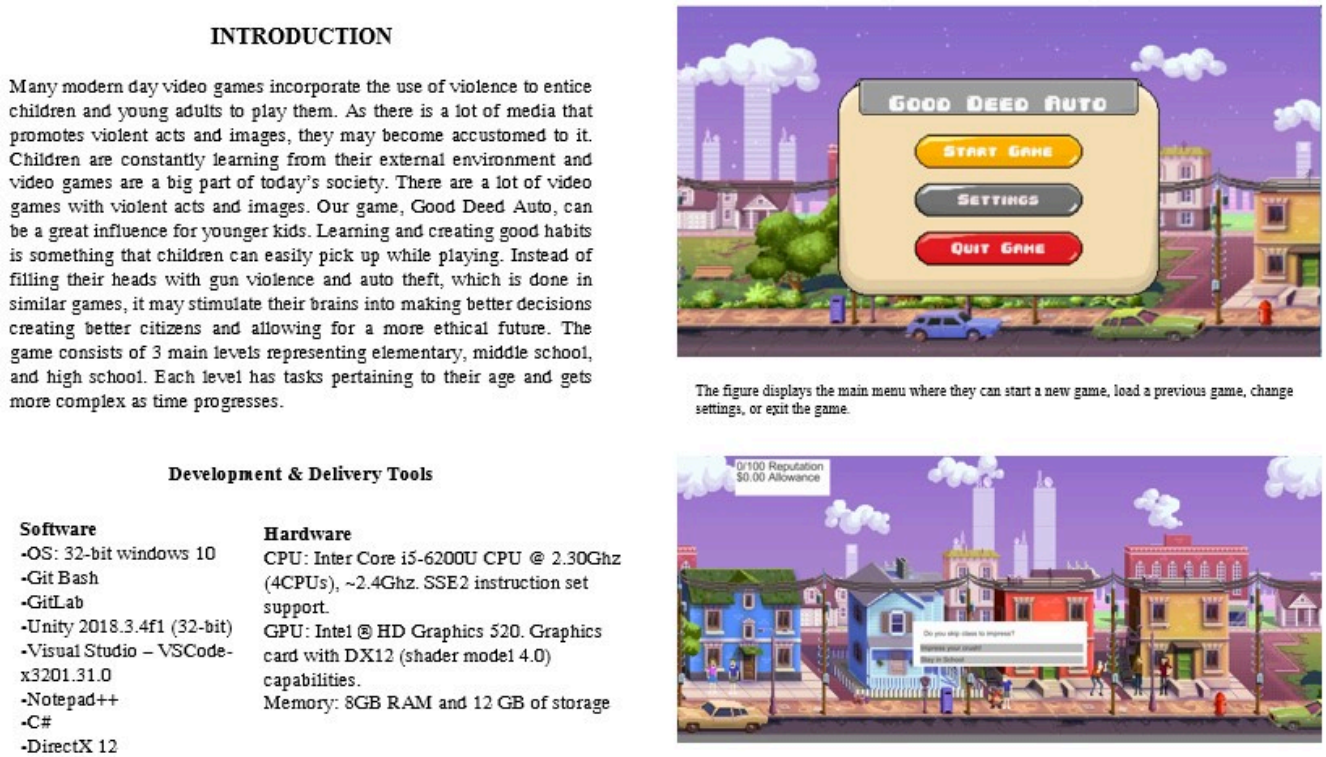
FUTURE COURSE PLANS

The Game Development course will continue to be offered about every other year at St. Mary's University as it is required for an undergraduate track/concentration and a graduate certificate. As we continue to add other tracks and specializations such as data science and artificial intelligence (AI), this course could be modified to be offered as an elective in some of those tracks and programs. For example, there already is an AI component in the current course content.

The most recent popular platform to develop for is Android devices. Mobile devices will continue to be common including Android and iOS systems. Also, with more and more virtual reality (VR) technologies, more students will probably develop games for VR platforms. The CS department already has 2 HoloLens, 3 Oculus Go, and various Google Cardboard and foam board boxes that students may use. Some of our students have even developed games for HoloLens already.

This course will likely continue to be offered with a cross listing of either mobile programming or even our Web development course so that there will be enough students for the class to be offered (*there are currently about 85 CS majors and 20 graduate students; 10 is typically the minimum for a class to make*). Both mobile programming and Web development can use the same framework as the Game Development course, but with the evaluating mobile apps or websites, designing a mobile app or website, creating the mobile app or website, and documenting the product. In computer science, we care about the quality of the software and product, not necessarily the delivery platform.

The course will continue to be a part of the mission of St Mary's University which includes educating for service, peace and justice. A good number of students have taken what they learned around this course to other projects that reflect this vision. For example, a software engineering group wrote Good Deed Auto, an attempt to make a game like Grand Theft Auto positive and reward players for doing good deeds. Below is some information about that game made in 2019.



INTRODUCTION

Many modern day video games incorporate the use of violence to entice children and young adults to play them. As there is a lot of media that promotes violent acts and images, they may become accustomed to it. Children are constantly learning from their external environment and video games are a big part of today's society. There are a lot of video games with violent acts and images. Our game, Good Deed Auto, can be a great influence for younger kids. Learning and creating good habits is something that children can easily pick up while playing. Instead of filling their heads with gun violence and auto theft, which is done in similar games, it may stimulate their brains into making better decisions creating better citizens and allowing for a more ethical future. The game consists of 3 main levels representing elementary, middle school, and high school. Each level has tasks pertaining to their age and gets more complex as time progresses.

The figure displays the main menu where they can start a new game, load a previous game, change settings, or exit the game.

Development & Delivery Tools

Software
-OS: 32-bit windows 10
-Git Bash
-GitLab
-Unity 2018.3.4f1 (32-bit)
-Visual Studio – VSCode-x3201.31.0
-Notepad++
-C#
-DirectX 12

Hardware
CPU: Inter Core i5-6200U CPU @ 2.30Ghz (4CPUs), ~2.4Ghz. SSE2 instruction set support.
GPU: Intel ® HD Graphics 520. Graphics card with DX12 (shader model 4.0) capabilities.
Memory: 8GB RAM and 12 GB of storage

Image 18: Good Deed Auto

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PART IV.

EDUCATION

CHAPTER 6.

GAME-BASED LEARNING - SPECIAL TOPIC (TLT 462)

DENISE M. BRESSLER[1]
LEHIGH UNIVERSITY

Course Title: Teaching, Learning, and Technology (TLT) 462: Special Topic—Game-Based Learning
Course University: Lehigh University
Course College/School: College of Education
Course Department/Program: Teaching, Learning, and Technology
Course Level: Graduate
Course Credits: 3.0
Course Length: 6-week summer course (2 class meetings each week; 3 hours each)
Course Medium: Face-to-face
Course Keywords: engagement, collaboration, fun, play games, analyze games, design games, play-test games; game-based learning

CATALOG DESCRIPTION

Learning games are designed through a combination of instructional and motivational design principles. Through playful, hands-on experiences, this course will address the theory, practice, and development of learning games in education. This course will benefit anyone who needs a clearer vision of how games can help us teach and learn. We will explore trends in game-based learning (by playing and discussing a lot of games!) and undergo an iterative development experience with a tabletop learning game. Participants will produce and test student-developed learning games.

COURSE PURPOSE AND OBJECTIVES

Everyone has some experience with games: maybe you are an avid video gamer, maybe you are a casual solitaire player, maybe you just liked playing hide and seek as a kid and that's where it ended. Wherever you are, we will begin there and learn that well-designed games have the powerful potential to engage. To continue our intellectual exploration of game-based learning, we will consider the differences between game-based learning and gamification. To expand our repertoire of gaming experiences, we will examine several tabletop learning games including board games and card games.

1. Dr. Denise Bressler (bresslerd19@ecu.edu) is a Research Scholar in the College of Education at East Carolina University. Dedicated to creating innovative STEM learning experiences that promote student engagement and collaboration, her main research interests include game-based learning, mobile learning, and AR/VR/XR technologies.

Not all games are created equal; therefore, we will analyze what makes for a good learning game. Having developed a keen eye for a well-designed game, we will work in groups to design, develop, and prototype our own tabletop learning game which we will test with our target audience—kids! To experience a popular gaming trend, we will then take a field trip to a local escape room and try our hands at real-time puzzle-solving where we will need to use communication and collaboration in hopes of escaping! Afterwards, we will sit down for a stimulating discussion with the escape room designers themselves in order to learn about game design and the gaming industry. Back in the classroom, we will experience the classroom version of an escape room with BreakoutEDU. In the final part of the course, we will delve into digital games. We will analyze online learning games, immersive learning environments, and mobile augmented reality games. We will conclude with an individual project where each student will design and present a proposal for a learning game! Convince us to invest!

By the end of this course, students will be able to:

1. demonstrate an awareness of many types of game-based learning scenarios.
2. explain why games are engaging, motivating, and excellent examples of powerful learning.
3. demonstrate an ability to effectively create a prototype of a tabletop learning game.
4. analyze (in discussion and writing) designs of tabletop and digital learning games.
5. demonstrate an ability to develop and present an initial design for a learning game.

COURSE CONTEXT

This is a special topic course. It is an elective and it is not taught regularly. Given that interest in the course is somewhat unpredictable, it is taught approximately once every other year in order to bolster enrollment. Over the past few years, it seems that interest in the course is growing. The students in the course are mostly graduate students in education focusing on instructional design or teaching. Many of the students are classroom teachers. They range in age from early twenties to mid-50s. They represent a range of subject areas as well: math, science, English, computers, music, etc. Students generally have gaming experience from their personal lives, but they have not used games extensively in their classrooms. Although, many have experimented with the quiz platform, Kahoot! [Although marketed as game-based learning, I would argue that Kahoot is gamification and that is not the same thing.] Given that Kahoot represents their comfort level, we start there and introduce ourselves to the class by making our introduction into a Kahoot quiz. Since many teachers are there to learn about what can be done with games in their classrooms, I try to introduce them to all kinds of materials that can be purchased off the shelf, downloaded from the internet, or simply accessed online. Although my expertise is STEM education, I try my best to include games representing a range of subject areas.

COURSE PEDAGOGY

To explain my pedagogical beliefs and to set the stage for this course, I begin the first class by introducing the idea of a learner-centered classroom (Bransford, Brown, & Cocking, 2000). For goodness sake, this is a game-based learning class! If the students are not learning by playing games, then I am doing something incredibly wrong. This is not a class where sage on the stage prevails… this is a class where hands-on experience, deep engagement, thought-provoking questions, scaffolded

discussions, and a-ha moments take center stage. Also, I am a firm believer in…if you're not having fun, then you are not truly learning… so I make every attempt to make the class fun. In order to help shift their thinking about games in education and challenge them to consider how game-based learning can be incorporated into their classrooms, the students need to be in the driver seat…minds on. However, I am aware that not everyone has an outgoing personality, and some students will need to reflect on their experience in order to learn. So, I utilize the forum on the classroom course management website. On the forum, students are expected to contribute asynchronously to interesting discussions about games, game design, and how games can be used as tools for learning. Essentially, I am there to teach them about game-based learning because I have experience in designing and researching games for learning, which means I often share those experiences as teachable anecdotes. But the students are gamers in their own right—and I expect to hear their experiences as well. I also want them to know that I can provide them with a solid foundation in game-based learning, but I do not know everything there is to know about game-based learning. Thus, I try to foster an environment of 'we are all in this together' so let's learn together.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

The course has two required books:

Boller, S., & Kapp, K. (2017). *Play to learn: Everything you need to know about designing effective learning games*. Alexandria, VA: ATD Press. ISBN-13: 978-1562865771, ISBN-10: 1562865773

Farber, M. (2017)**.** *Gamify your classroom: A field guide to game-based learning* (2nd ed.)*.* New York: Peter Lang Publishing. ISBN-13: 978-1433135026, ISBN-10: 1433135027

Here is a selection of tabletop games that we play during class:

- EcoChains: https://ecochainsgame.com/
- NatureFluxx: https://www.looneylabs.com/games/nature-fluxx
- ZombiePox: https://tiltfactor.org/game/zombiepox/
- Timeline: https://www.zygomatic-games.com/en/game/timeline-classic/
- Buffalo: https://tiltfactor.org/game/buffalo/

Here is a selection of digital games that we play during class:

- DragonBox https://dragonbox.com/
- Lightbot https://lightbot.com/
- Bad Piggies https://en.wikipedia.org/wiki/Bad_Piggies
- Here is a selection of online games that we play during class:
- Oregon Trail: https://classicreload.com/oregon-trail.html
- Spent: http://playspent.org/
- Quandary: https://www.quandarygame.org/
- Mission US: https://www.mission-us.org/

- The Yard Games: https://theyardgames.org/

Here are some game-based resources that we explore during class:

- Legends of Learning (game portal): https://www.legendsoflearning.com/
- Classcraft (classroom management): https://www.classcraft.com/

COURSE ASSIGNMENTS

Course Readings

Students are expected to purchase the two required texts. Several chapters are assigned as homework and integrated into the assignments.

Forum Posts

To ease into the semester and to start thinking like game designers, students are expected to draw on their personal experience with games and post some information to the online class forum. For the first post, students explain their favorite game using the game terminology used in Chapter 1 of Boller and Kapp (2017). For the second post, students are expected to pick another game that they are familiar with and evaluate it as a learning game using the table from Chapter 3 of Boller and Kapp (2017).

Group Game Prototype

Once students are grounded in the terminology and have started thinking about games with a critical eye, it's time to put them into the role of designer. Groups are teacher-created based on a content area interest form filled out by the students. To kick off the project, class time is provided. Since brainstorming is hard, I ease the transition and get the ideas flowing by randomly handing out cards from *What's Your Game Plan?* (see references for additional information). I also hand out game pieces (e.g. Koplow Games Universal Game Pieces Replacement Set), posterboard, index cards, markers, post-its, etc. I provide all kinds of tangible supplies to get the groups starting to think about the physicality of their game. After all, they will need to create a fully functional prototype that they will test with kids! But testing the prototype is only half the project. Once teams have conducted their initial playtest, they have to reconceptualize their design based on user interactions, feedback, and observations…and put some polish on their prototype before submitting the final prototype for a grade. [By the way, a side note to professors… grading games is so much more fun than grading papers! It also helps to have some family or friends willing to come over and play them with you!]

Personal Game Proposal and Presentation

Towards the end of the semester, students are well-versed in game-based learning. They have played games, discussed games, analyzed games, and designed a functional game. It's time to practice not only conceptualizing a robust educational game design but also pitching it to a funder. Making educational games is not an easy business. Often, you need to secure funding for your project from a governmental agency like the National Science Foundation or possibly a private funder such as the MacArthur Foundation. Crowdsourcing is also an option; Kickstarter has been one venue where educational game makers have found success. In fact, thousands of games have been funded through Kickstarter

with budgets ranging from modest to massive. To secure such funding, you need to put together a strong proposal. You may even need to make a presentation to your potential funder—especially if they are an angel investor. In this project, students work alone. They are given free rein to design a tabletop game, digital game, mobile game—anything that they want provided there is an educational quality to the game. Students prepare both a written proposal and give a pitch presentation to all their classmates on the final day of class.

COURSE ASSESSMENT

Course Readings, Forum Posts, and Sustained Contributions

As indicated above, students have to complete readings in order to participate in the online forum and class discussions. For full participation, students receive 15 points which accounts for 15% of their final grade.

Group Game Prototype

Working with their team, students submit a functional tabletop prototype and an instructional manual. In addition, students submit a short paper and a peer review. The prototype is graded according to a rubric which includes Audience & Difficulty, Engagement, Mechanics & Content, Playability, Visual Appeal, Completeness. Each item is assessed on a 4-point scale where 0 is insufficient and 3 is exemplary. The total possible score for the prototype is 18 points. The game instructions are also graded according to a rubric which includes Basic Information, Game Contents, Game Setup, Game Play, and End of Game. Each item is assessed on a 4-point scale where 0 is insufficient and 3 is exemplary. The total possible score for the prototype is 15 points. The paper is also assessed with a rubric. The rubric contains five areas: Game Overview, Learning Value, Play-Test Reflections, Proposed Usage, and Writing Quality. The same Likert scale is used, and the total possible score is 15 points. In my opinion, the most interesting part of this assessment is the peer review. Every student in a group assesses the contributions of their individual teammates. Using a rubric, they rate their teammates on participation, dependability, listening/discussion, information sharing, and prototype preparation. In their final paper, they list each member's name and a score. The teacher privately tallies each individual's peer score and incorporates it into that individual's final grade.

The project grade is compiled as follows:

30% – tabletop prototype (based on group submission, everyone in group gets same grade)

20% – game instructions (based on group submission, everyone in group gets same grade)

25% – individual write-up (based on your submission, everyone in group gets unique grade)

25% – peer review (grade determined by peers)

For example:

	Your score	Possible	Your percentage	Weight	Adjusted score
Section 1	17	18	0.94	30%	0.28
Section 2	15	15	1.00	20%	0.20
Section 3	13	15	0.87	25%	0.22
Section 4	15	15	1.00	25%	0.25
				Final score	95.00

Personal Game Proposal and Presentation

Working on their own, students submit a paper and present their work to the class. The paper is graded according to a rubric which includes Game Overview, Background, Problem Statement, Proposed Usage, Game Details, Learning Value, Visual Representation, and Writing Quality. Each item is assessed on a 4-point scale where 0 is insufficient and 3 is exemplary. The total possible score for the prototype is 24 points. The presentation is also graded according to a rubric which includes Content of the Presentation, Engagement, Speaking Style/Delivery, Organization of Visuals, and Overall Effectiveness. The same Likert scale is used, and the total possible score is 15 points.

The project grade is compiled as follows:

75% – project proposal

25% – presentation

For example:

	Your score	Possible	Your percentage	Weight	Adjusted score
Section 1	22	24	0.92	75%	0.69
Section 2	14	15	0.93	25%	0.23
				Final score	92.08

Final Grade

The above three components are combined in order to generate the student's final grade.

The final grade is calculated with the following weights:

15% – Course Readings, Forum Posts, and Sustained Contributions

40% – Group Game Prototype

45% – Personal Game Proposal and Presentation

For example:

	Your score	Possible	Your percentage	Weight	Adjusted score
Project 1	94.45	100	0.94	40%	0.38
Project 2	93.75	100	0.94	45%	0.42
Participation	15	15	1.00	15%	0.15
				Final score	94.97

EXPANDED COURSE OUTLINE

Week 1: Game On!

Class Topics/Activities

- Class introductions, build a Kahoot quiz, play an array of tabletop learning games.
- Group discussion on what makes a good game engaging.

Assignments

- Read chapter 1 from Boller & Kapp (2017).
- Forum post #1.

Week 2: Collaborative Games

Class Topics/Activities

- Collaboration is an important 21st century learning skill.
- Take a deep dive into a collaborative game with some classmates. Present the game to the class.

Assignments

- Read chapters 2 and 3 from Boller & Kapp (2017).
- Read chapter 10 from Farber (2017).
- Forum post #2.

Week 3: Game-Based Learning vs. Gamification

Class Topics/Activities

- Class activities and discussions revolve around the distinction between game-based learning (intrinsic motivation) and gamification (extrinsic motivation).
- Work with your assigned group to start making your own prototype.

Assignments

- Read chapters 4 and 5 from Boller & Kapp (2017).

- Read chapter 11 from Farber (2017).

Week 4: Learning from Failure

Class Topics/Activities

- Groups will engage in the Marshmallow Challenge (see References).
- Class activities and discussion will revolve around the powerful learning that comes from failure.
- Time will be given for groups to work on prototypes.

Assignments

- Read chapters 8 and 9 from Boller & Kapp (2017).
- Work on prototype and be prepared to playtest next class.

Week 5: Play-Testing

Class Topics/Activities

- Good game development relies on playtesting and incorporating feedback.
- This is your chance to see what happens when testers play your game!

Assignments

- Work on refining your prototype based on the playtest.

Week 6: Escape Room

Class Topics/Activities

- The recent trend of escape rooms offers interesting educational potential.
- For this class, we will meet offsite at a local escape room establishment.
- Everyone will experience an escape room and then we will debrief with the designers.

Assignments

- Work on refining your prototype based on the playtest.

Week 7: Classroom-Based Gaming

Class Topics/Activities

- So…you escaped the room but what if we took that concept into the classroom? BreakoutEDU is doing just that.
- We will set up and experience this type of classroom-based game and then play some educational mini-games online.
- We will conclude with a discussion about the parameters that classroom-based games place on

design.

Assignments

- Group prototype due

Week 8: Immersive Learning Environments

Class Topics/Activities

- Going beyond educational mini-games, there is a lot of research and development going into immersive learning environments.
- We will experience several such environments and discuss the research that these environments are yielding.

Assignments

- Start thinking about your final project.

Week 9: Mobile Games for Learning

Class Topics/Activities

- Meet offsite with your iPhone and download the ARIS app.
- We will play through *Moravian History Mystery*, an outdoor mobile augmented reality game designed for second graders.
- Then we will discuss immersion, narrative, player roles, collaboration, and flow!

Assignments

- Final project idea requires teacher approval.

Week 10: Not Your Father's Video Game

Class Topics/Activities

- Some games go beyond teaching typical subject areas and try to tackle higher order thinking skills such as systems thinking and coding; some games even try to teach empathy.
- Yet, a critical challenge of games in education is assessment. Some designers are tackling assessment issues.

Assignments

- Work on personal game proposal and presentation.

Week 11: Future of Educational Gaming

Class Topics/Activities

- Where do we go from here? What if students made their own games? How about if classes

were structured like games? What if a whole school incorporated game-based learning?

- Where else can game-based learning go…into museums, into summer camps, into everyday life?

Assignments

- Work on personal game proposal and presentation.

Week 12: Final Presentations and Wrap-Up

Class Topics/Activities

- Students will give a Pecha Kucha presentation (20 slides, 20 seconds each) about their final project.
- Classmates will provide feedback.

Assignments

- Present personal game proposal.
- Submit personal game proposal.

COURSE BEST PRACTICES

Classroom setup

The classroom is rarely set up the same way two meetings in a row. Luckily, the chairs and tables are easily moveable. I make sure to come early and set up the classroom in a way that suits our needs for the day. It keeps things fresh—and keeps the students on their toes!

Grouping students

This class requires a lot of group work and small group discussions. At times, randomization is preferred; I always choose a gameful way of randomly selecting groups. Sometimes, I have students select cards from a deck and the students are grouped by suit. Other times, I have students select game pieces out of hat and the students are grouped by color. When it becomes necessary to group students for their game design prototype project, I like to make sure that they are grouped together with similar interests. Every student fills out an index card with their top three subject areas that they would like to make a game about. I collect the cards and spend an evening forming groups by hand.

Experience is the best teacher

Whenever possible, I put the students into a playful scenario to teach my point. There's just about a game for everything these days. One particular activity that works well and serves several purposes is the Marshmallow Challenge (see References). On one hand, the challenge serves as a group-bonding experience for the teams as they are getting started on making their game prototypes, but it also serves as a great point of discussion. In order to design the best product, you must iterate, iterate, iterate. Generally, research shows that marshmallow challenge teams who are willing to fail early and fail often end up building the tallest towers. Kindergartners have this mindset and actually do really well with the challenge—even compared to adults! The less successful marshmallow teams do

all their thinking on paper and only build their structure once towards the end of the time limit. By putting my students through the marshmallow challenge they are able to experience first-hand, either success or failure, based on their chosen design strategy. But after the classroom debrief, everyone feels comfortable with the concept of iterating as they launch into the game design prototype project.

Bad games are great!

When trying to learn about good and bad game design, why not play some badly designed games? I will not share which games I choose as the bad ones… but in the educational field… there are plenty. Those of us in the industry refer to them as 'chocolate covered broccoli.' You cannot put a game layer on top of a dreadful learning experience and call it a game. If when you peel off the game layer, the activity is still just filling out a worksheet, it's a bad game design. All that being said, there's something to learn from playing bad games. During the course, I ask for a few volunteers who are willing to play a game together in front of the class. We all gather around as the volunteers read the instructions and deal out the cards. Now mind you, I usually have them play well-designed games and I do not share with them my opinion of this dreadful game. So, the group plays a round, maybe two, and the lack of enthusiasm is usually painful. I let it go just long enough before true frustration sets in. I ask "so, what do you think?" As the conversation gets going, it becomes clear they are not enjoying the experience and there is not much to take away from the experience. Then, I reframe the question, "so, how could we make this game better?" A-ha! Everyone eagerly launches into a highly energized discussion of all the things we could do to make it better. Everyone seems to walk away from that class realizing that they do indeed have ideas for how to design learning games.

Class projects

For the collaborative project, students create tabletop games. They work in groups organized by subject area. Every group produces a polished game complete with all game pieces, cards, instructional manual, and game board. One time, I had a science group and they created *Rainforest Animal Quest* which was a trivia game with an exciting board game dynamic! My own kids loved the game so much they were sad when I had to give it back. For the individual project, the variety of game ideas is always so exciting! Students come up with mobile augmented reality games, card games, and even BreakoutEDU experiences. Although the final project does not require students to build their game, I have had several students that were so excited by their BreakoutEDU experiences that they actually built them and implemented them in their own classrooms!

FUTURE COURSE PLANS

Going forward into the future, I have three ideas about how to keep the course feeling fresh. First, as a research scholar, I continue to conduct research on game-based learning so my readings will always be updated with the latest, relevant works. Second, I like to have elements of the course represent the here and now—so while right now we can talk about Kahoot and BreakoutEDU, the go-to technology of the moment will change…and I will do my best to change with it. Third, I like to keep up with cutting edge technology to show my students what is coming down the pipe and may be hitting classrooms in the near future. At this time, I would say that lesson would be a virtual reality experience. Stand-alone headset costs are coming way down and the capacity for multiplayer experiences is upon us. I would love to introduce my students to some educational virtual reality

experiences, spark an interesting classroom discussion about how virtual reality could realistically work in the K-12 space, and brainstorm what types of applications they might like to design.

During the Covid-19 pandemic, many courses had to adapt to an online format. This course was always envisioned as a face-to-face experience, so this version of the course was not offered during the pandemic. To make this course work in an online-only format, some elements can remain the same, but many would have to be reworked and rethought. Certainly, we could interact with the online mini-games (Week 7) and immersive learning environments (Week 8). We could also convert some of our tabletop game-playing from weeks 1 and 2 into the online format by using a browser-based application such as Tabletopia (https://tabletopia.com/). I could even assign students to buy the supplies needed for the Marshmallow Challenge and encourage them to try it at home. However, some elements of this class are very place-based. For example, we go offsite in week 6 to an escape room and in week 8 to play a mobile game that is place-dependent. Some of the elements are also very tactile. Students are given time to work in groups to create a physical prototype of a tabletop game; supplies are given such as dice, spinners, index cards, and poster paper in order to help get the ideas flowing.

Although cutting edge technology is novel and exciting, the bones of this class will always be the tabletop gaming experiences that build the foundation. I think it's important that the first part of the class remains relatively the same. I like to start off in the low-tech environment to show that you do *not* need to rely on technology for highly engaging learning experiences. When you find the right game mechanic to illustrate your learning objective, a low-tech game can be an extremely powerful learning experience. I think that EcoChains and ZombiePox are great examples of this. Also, for the prototype project, the students do not need any software programming experience—this is an important point because the students are unencumbered… they can embody the philosophy of…if I can dream it, I can build it. They can spend all their energy thinking about design and… if I play my cards right… having fun!

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What's YourGame Plan?

http://www.joebisz.com/whatsyourgameplan/

What's Your Game Plan? is a card game that fosters group brainstorming and collaboration with the goal of creating a game-based activity. There are four types of cards: Lesson, Game, Mechanic, and Action. The Lesson cards are concepts that students need to learn such as 'taking notes' or 'problem-solving.' The Game cards reference specific popular game titles such as Monopoly and Checkers. The

Mechanic cards offer suggestions on what type of game mechanic to work into your prototype such as board spaces or trivia questions. Lastly, the Action cards indicate some type of action that can be included during gameplay such a trading or performing. Once each group has randomly selected a card from each pile, they have some basic game components to start thinking about and they can start brainstorming from there.

Marshmallow Challenge

https://www.tomwujec.com/marshmallowchallenge

Teams are given 20 sticks of raw spaghetti, one yard of masking tape, one yard of string, and one marshmallow. The goal is to build the tallest freestanding structure measured from the table surface to the top of the marshmallow. That means the structure cannot be suspended from a higher structure, like a chair, ceiling, or chandelier. The entire marshmallow must be on top. Cutting or eating part of the marshmallow disqualifies the team. Teams can use as much or as little of the materials. They can break up the spaghetti, string or tape. This is a timed activity that lasts for 18 minutes.

BreakoutEDU

https://www.breakoutedu.com/

BreakoutEDU is a kit which includes a number of locking mechanisms and boxes that can be locked. With platform access, you can use premade games in both physical and digital form. You can also use the kit to create your own games. Generally, games have some type of backstory and the goal of the game is to break into the final box. Along the way, students are exposed to critical thinking, collaboration, and a fun way to learn! As a fun holiday party game, I set up a BreakoutEDU game for my son's 4th grade class. The story was that Dobby the elf (from Harry Potter) had stolen the principal's keys to the school and locked them away. No one could leave for winter vacation until the keys were reclaimed and the principal could safely lock the school! Games are generally aligned to subject areas and cater to students of all grades from kindergarten through high school.

CHAPTER 7.

FOUNDATIONS OF GAME-BASED LEARNING (EDUC 510)

LARYSA NADOLNY[1]
IOWA STATE UNIVERSITY

Course Title: EDUC 510: Foundations of Game-based Learning
Course College/School: Iowa State University
Course Department/Program: School of Education
Course Level: Graduate
Course Credits: 3
Course Length: 15 weeks
Course Medium: Blended, online synchronous and asynchronous
Course Keywords: Graduate, Game-based Learning, Game Design, Game Research, Survey Course

CATALOG DESCRIPTION

Theories, principles, and best practices of utilizing games in educational environments. Topics include the theoretical foundations of learning games and gameplay, identity development in online environments, and assessment of learning in and out of games.

COURSE PURPOSE AND OBJECTIVES

This course is designed to provide the student with a broad overview of game-based learning in educational contexts. It is an introductory course at the graduate level and, therefore, focuses on developing foundation knowledge on game theory, research, and practice. Course participants engage in a professional community on the use of games for learning, synthesize current research on game-based learning, and create a game rooted in research best practices.

EDUC 510 is an online course with synchronous and asynchronous components. Students work on weekly assignments at their own pace and attend live meetings every two weeks using video conferencing software. This flexible approach has shown great success in meeting the needs of working graduate students while maintaining a live component for rich discussions and lectures.

The course is divided into four sections, answering four essential questions:

1. Larysa Nadolny, lnadolny@iastate.edu. Dr. Larysa Nadolny is an Associate Professor at Iowa State University and Game2Work project lead. Her research examines the design of game and gamified environments for student engagement and motivation.

1. What is game-based learning?
2. Who are the learners in game-based learning?
3. What are the characteristics of a game-based learning environment?
4. What are the trends in game-based learning research?

These broader questions frame the readings and discussions within each module and prepare students for more advanced coursework on games and learning. Learning objectives are woven throughout the course focused on higher levels of cognitive learning, in particular the Analyze and Create levels of Bloom's Revised Taxonomy (Anderson and Krathwohl, 2001). Students will:

1. Participate in a professional learning community and collaboratively critique research on game-based learning.
2. Synthesize current research on game-based learning.
3. Develop and create a game applying research and theory within the game-based learning literature.

COURSE CONTEXT

EDUC 510 is a graduate-level elective course. Although all students across campus can enroll, the course is a listed elective in the School of Education and Human Computer Interaction graduate programs. This leads to the majority of students coming from one of those two areas. The diversity of backgrounds (e.g., a practicing teacher or a computer engineer) provides a wide variety in content and context for discussions and game development. Most students in the course are interested in games, but only a few each semester would be considered heavy gamers. The course content's interdisciplinary nature provides an advantage for a diversity of opinion, experience, and expertise.

COURSE PEDAGOGY

Two pedagogical concepts guide the design of this course. First, the course design prioritizes learning with and from each other. The work of Vygotsky supports a social constructivist view of education in that knowledge is constructed through interactions with others (Verenikina, 2010). The collaboration between all learners, that social element, is a core component of development (Davydov, 1995). Games are highly personal experiences, and the course participants discuss how their current knowledge frameworks are similar and different and how the research literature supports them. To meet this objective, teachers and students connect through weekly discussion boards, collaborative assignments, a team project, and live meetings. These technology-facilitated experiences contribute to the social foundations of the course.

Second, the content is scaffolded to go from simple to complex and general to specific. Scaffolding occurs when support of learning is reduced over time and the responsibility is transferred to the students (Van de Pol, Volman, & Beishuizen, 2010). Initial assignments in the course provide learners with detailed tasks and introductory readings, and over the semester, these assignments become more open, individualized, and complex. At the beginning of the course, we talk about game-based learning in general, and by the end, we have a more nuanced and complex understanding of how the research

on games connects with gaming practices. The scaffolding supports novice learners in organizing knowledge as they develop expertise (National Research Council, 2000).

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

The course relies heavily on academic research articles provided to the students through the university library system. These articles are the foundation for the online discussions and critical analysis during live lectures. We also reference videos, TED talks, and research presentations on game-based learning (see Expanded Course Outline).

Students play games each week that exemplify the essential questions in the course. As an online course, not all students will have access to the same digital tools or funds to purchase multiple games. As such, students can choose two of four discussion topics each week for participation. For example, the Week 9 discussion includes an option to purchase and play the game Epistory or explore the transmedia materials for the game Inanimate Alice. Overall, the required games in the class balance cost, platform, and medium. Games included on the discussion boards are listed below.

Games List

- Oregon Trail
- Loneliness
- Dragon Box Algebra (5 or 12)
- Pokémon Go
- Alt-Frequencies
- GoldieBlox
- Minecraft
- Fold.it
- The Pack
- Spent
- One of a Hundred
- That Dragon Cancer
- Epistory
- Discovery Tour by Assassin's Creed: Ancient Egypt
- Keep Talking and Nobody Explodes
- Tendar
- Everything
- This War of Mine
- Hair Trigger
- Lakeland

- Attentat 1942

COURSE ASSIGNMENTS

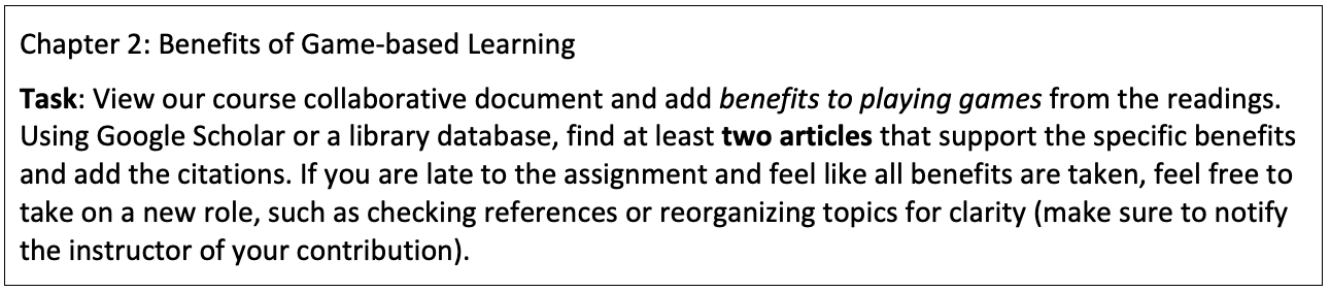
In addition to weekly participation in discussion boards and contributions to a collaborative note taking document, there are three major assignments in the course. The game review and research poster are individual assignments, while the game development is a team assignment.

Attendance & Participation

Attendance in an online course goes beyond course login and is based on documentable participation in class activities. Interacting with the instructor, interacting with enrolled students, attending required online meetings and/or submitting course assignments all constitute attendance. Attendance and participation are graded through a discussion board rubric every two weeks.

Collaborative Document

The students work together to contribute to the course notes document published at the end of the semester as an Open Educational Resource (OER) and licensed under Creative Commons. Every few weeks, students review prior materials to contribute to the document. Initially, specific guidance is given on what each student must add to the document (Figure 1). Over time, students can choose the types of information and notes for their weekly contribution. Each document is peer-edited before posting at the end of the semester. As an OER, the course notes are a frequently accessed document by students and the research community. For example, the fall 2019 (Alam et al.) document has approximately 1,000 views on ResearchGate (view at https://bit.ly/3oFfmti).


Chapter 2: Benefits of Game-based Learning

Task: View our course collaborative document and add *benefits to playing games* from the readings. Using Google Scholar or a library database, find at least **two articles** that support the specific benefits and add the citations. If you are late to the assignment and feel like all benefits are taken, feel free to take on a new role, such as checking references or reorganizing topics for clarity (make sure to notify the instructor of your contribution).

Figure 1. Collaborative document guidance.

Game Review

In this assignment, the learner will produce a short (less than 5 minute) screencast reviewing a game recommended for learning. They combine what they read about the learning that happens in games with a practical review of a specific game. The screencast must include an overview of the game (including video of gameplay), a review of supporting research, and two related scholarly research articles. You can view samples from the previous semester on the YouTube playlist (view at https://bit.ly/2L4x6jZ).

Game Development

Small teams of students create a text-based game using Twine in which they draw from important course ideas and concepts to demonstrate an understanding of how games can facilitate engagement

and learning. Teams can use other digital platforms or non-digital designs with approval. Requirements include 15-20 minutes of gameplay and a document outlining research-based strategies. Figure 2 details the assignment requirements and exemplary rubric rating.

Criteria	Exemplary Rating
Overall Experience	Excellent or exceptional aesthetic qualities. Flawless or near-perfect production values. The approach provides some sensory interest (visual, auditory, etc.) for students. All aspects of the learning experience design are well thought-out to provide aesthetically cohesive, or "whole" learning that is exciting, thoughtful, and stimulating to learners.
Learning Content	An excellent and highly effective approach to teaching the subject matter. Makes the subject matter clear and comprehensible to most learners and presents it in exciting and engaging ways that make the subject come alive.
Research Foundations	Connections to course concepts, readings, and research are abundant. The game exemplifies the chosen game characteristic throughout gameplay.
Teamwork	Attended all or most team meetings. Completed all assigned tasks. Participated in discussions in a timely manner. Engaged in respectful dialog with peers and brought any issues to the attention of the course instructor.

Figure 2. Game development rubric.

Virtual Poster Session

In this assignment, students create and virtually present a digital poster for a research study. At this point in the course, students have reviewed and discussed many potential research topics in the field of game-based learning. The poster must include two interactive components, such as videos, embedded experiences, or polls. This is a proposed study only, although it is common for students to complete the research as an independent study in future semesters. The students may use my provided template (Figure 3) or create their own using Google Slides.

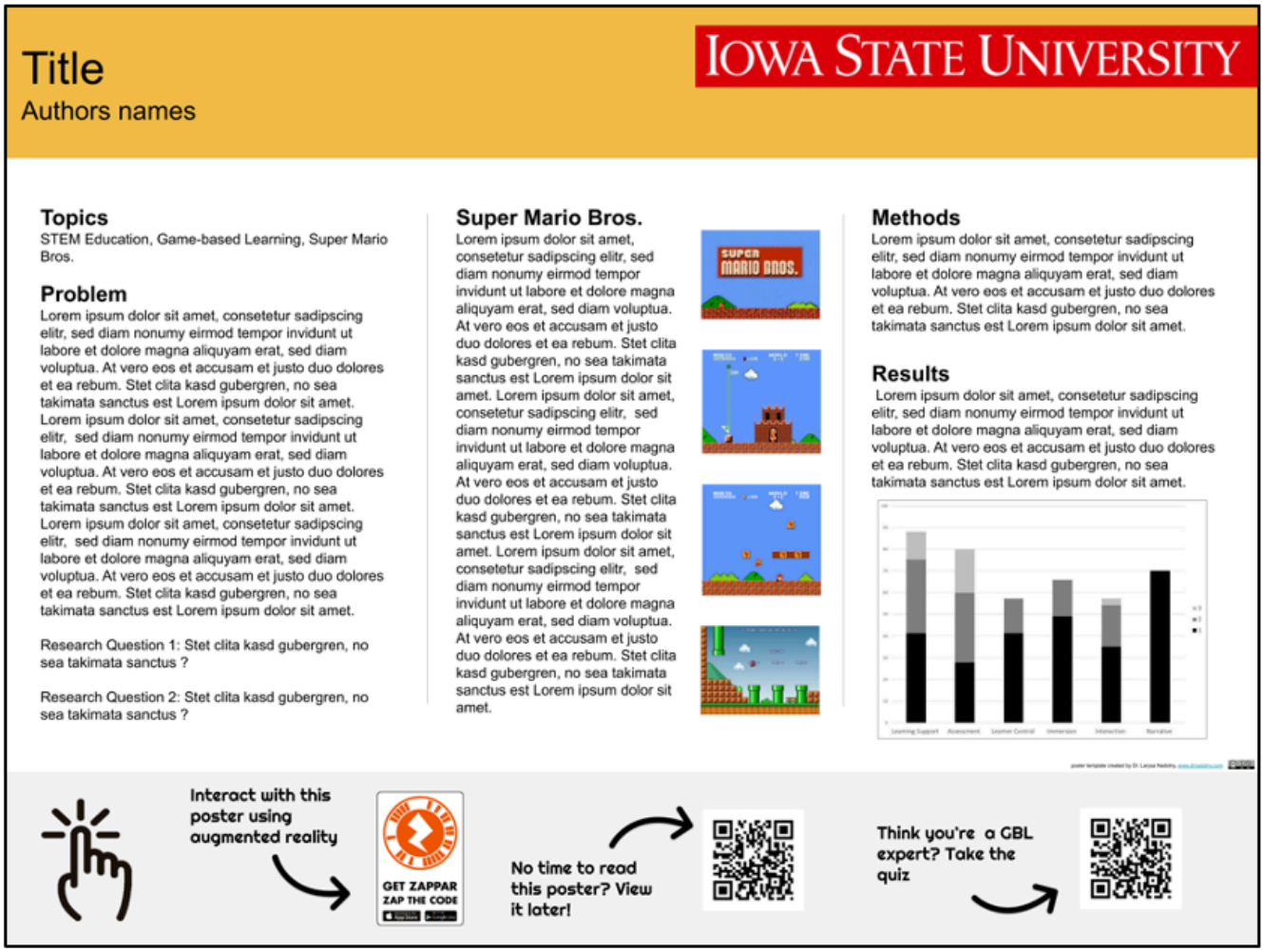


Figure 3. Research poster template.

COURSE ASSESSMENT

Students earn points in both weekly activities and major assignments, with the option to earn additional points through extra credit opportunities (Figure 4).

Learning Outcomes	Assignment	Points
Course Outcome: Course participants will participate in a professional learning community and collaboratively critique research on game-based learning.	Live meeting attendance (average grade)	100
	Participation (graded every 2 modules)	220
Course Outcome: Course participants will synthesize current research on game-based learning.	Game review (40 pts)	210
	Digital poster (40 pts)	
Course Outcome: Course participants will develop and create a game applying research and theory within the game-based learning literature.	Text-based team game & peer review (40 pts)	
	Collaborative document (90 pts)	
Extra Credit	Varies	Varies

Figure 4. Assessment alignment between learning outcomes and assignments.

EXPANDED COURSE OUTLINE

The students follow a consistent schedule each week, including reading academic articles on game-based learning and contributing to a discussion board. Every two to three weeks, the students work on a collaborative document and meet synchronously online for additional activities and reviews of more challenging topics. Below, you can read the key questions, readings, and discussion board topics for each week.

Week 1: What is a game? What is game-based learning?

Discussion Board Topics

1. Non-Digital Games: What role do non-digital games play in teaching & learning from early childhood to adults? Watch this video on a game-based curriculum for inspiration. https://youtu.be/6eA5sidPr8I
2. Defining a Game: How do you define a game? Should we even try? This video by Extra Credits describes one way to look at the issue. https://youtu.be/blj91KLOvZQ
3. Oregon Trail: Oregon Trail was one of the first, and very popular, learning games on the computer. Why was it so popular? Is this a "good" learning game? https://jamesfriend.com.au/pce-js/mecc/oregon-trail.htm

Readings

1. Aarseth (2017)
2. Plass, Homer, & Kinzer (2015)
3. (Optional) Karhulahti (2015)

Week 2: What are the benefits of playing games? What other contexts benefits from game-based learning?

Discussion Board Topics

1. The Transformative Future of Gaming: What is limiting the potential of gaming? It is the technology or our own conceptualization of a game? Watch this TED talk sharing some of the new advances in video games. https://youtu.be/jzrcRcEBrmA
2. Quest2Learn: Is GBL a model for learning in the future? The Quest2Learn school in NYC was a pioneer in GBL, creating an entire middle and high school-based around games. Watch the video below and discuss the role of games in the education system. https://youtu.be/Wk_OfUHpCbM
3. Pokémon Go: If you've never played Pokémon Go, the time is now! This was the first augmented reality mobile game to have a huge following, with over a billion downloads. It may be fun, but would you consider it a learning game? https://www.pokemongo.com/
4. Dragon Box Algebra: The DragonBox apps take an out-of-the-box approach to learning math. What works well in the app and what doesn't? https://dragonbox.com/

Readings

1. Granic, Lobel, & Engels (2014)
2. (Choose one) Thompson, & von Gillern (2020)
3. (Choose one) Tokac, Novak, & Thompson (2019)

Week 3: Collaborative Document Assignment

Week 4: Who are gamers? How can we move beyond stereotypes in games?

Discussion Board Topics

1. Senior Citizens Play Wii: Just as we have stereotypes about younger games, there are also stereotypes about adults NOT being gamers. Hear from these older adults about using the Wii for exercise, and imagine games that are targeted directly to older adults! https://youtu.be/-nN6iV7wxVs
2. Gendered Game Mechanics: Let's move beyond personal anecdotes about gender (e.g., girls like X, boys like Y). As researchers, what is the basis for these assumptions about game design and gender? How have our research methods changed over time informed by gender studies? https://youtu.be/ERR1F-zoTVg
3. Alt-Frequencies: This game is in the category of "audio game". This is a different type of gaming experience that is accessible to a wide audience. What is your experience playing this game?
4. GoldieBlox: GoldieBlox is a company that "challenging gender stereotypes with the world's first girl engineer character". Play one of their games. Are they succeeding at "challenging gender stereotypes"? https://apple.co/2JtbQDB

Readings

1. Entertainment Software Association (2020)
2. Azadvar & Dalqvist (2020)
3. (Choose One) American Psychological Association (2020)
4. (Choose One) Ellis & Kao (2019)
5. (Choose One) Jenson & De Castell (2010)

Week 5: What participatory practices occur during game-based learning? How do the affordances of a game allow for community and cultural practices?

Discussion Board Topics

1. Co-learning in education: Teachers have a very important role in facilitating gameplay, but how much do teachers need to know about a game to elevate student learning? Listen to a few teachers talk about students using Minecraft for inspiration. https://youtu.be/hl9ZQiektJE
2. Meta-Gaming: Twitch is a great way for gamers to share their gaming experience with the greater community (and also make some money). How can spaces like this build a learning community around a game? The video below is a recording of a twitch stream of some GBL researchers and innovators using the Gone Home game for learning. https://www.youtube.com/watch?v=eQNscUSWlb4
3. Fold.it: This game can be challenging to play as a beginner, but it has a rich community around the game. Try it out, and watch the video showcasing some of the players. What do you think of these types of "citizen science" or "crowdsource" games? https://fold.it/portal/

Readings

1. Salen (2008)
2. (Choose One) O'Connor, Longman, White, & Obst (2015)
3. (Choose One) Barany, & Foster (2020)

Week 6: Collaborative Document Assignment

Week 7: How are learning games designed? What is the process for making a learning game?

Discussion Board Topics

1. The Ward Game: Break down this game. How was it designed? Why? Is the dark theme effective for high school seniors? What would you change or add to align with the research? https://youtu.be/AC3-BY2U8bA
2. Designing Games for Kids: How do you design games for young children versus adults? What games have you played that were off-target on the design? Use this video to inspire your conversation. https://youtu.be/NdFw8kvHAY8
3. The Pack: How was this game design according to the research? In what ways it is successful or not successful? https://nysci.org/school/resources/the-pack/

4. Board Games: Get a new board to play with your friends and family! How was the game designed according to the research? In what ways it is successful or not successful? I recommend the following family-friendly games: Carcassonne, Photosynthesis, Horrified, Taco Cat Goat Cheese Pizza, SushiGo

Readings

1. Nadolny, et al. (2020)
2. Institute of Play. (n.d.)

Week 8: How do learning supports in games align to the research in the learning sciences? How do choice and control support learning?

Discussion Board Topics

1. Black Mirror Bandersnatch: Watch Bandersnatch on Netflix (note, this interactive movie contains violence, rating TV-MA, skip if you don't feel comfortable watching it). How did they use scaffolding in the game? How did choice impact your game experience?
2. Teacher – Player: What is the role of the teacher in providing learning supports during gameplay? Is it more effective to have learning supports built into a digital game or provided by external "players"? Use this video for inspiration. https://youtu.be/QUeHyEgvtGA
3. Spent: How did the choice add or detract from your experience in this game? http://playspent.org/
4. One of a Hundred: Take a look at this recent book introducing "100 Games to Use in the Classroom and Beyond " (2019). Choose a new game to play and take a close look at the learning supports in the game. Does the description provided by the author match your experience in gameplay? https://bit.ly/3obkGV6

Readings

1. Nadolny, Alaswad, Culver, & Wang (2017)
2. Sawyer et al. (2017, June)

Week 9: Why are stories important in game-based learning?

Discussion Board Topics

1. That Dragon Cancer: What type of learning happens in games that seem to pull at negative emotions (e.g., pain, hardship, sadness)? Watch the video or play this game, and discuss. http://www.thatdragoncancer.com/
2. Inanimate Alice: The game is considered a transmedia experience, with learners able to play, watch, and contribute to the game through multiple media. Explore the website to see how they wove the story using different mediums for deeper learning. https://inanimatealice.com/
3. Epistory: This beautiful game has a surprisingly simple goal, to practice typing and learning vocabulary. Why didn't they just make a simple typing game (e.g., letters falling down on the screen)? Who is the target audience for this game? https://bit.ly/3ogh2JF

4. Discovery Tour by Assassin's Creed, Ancient Egypt: Through an "education mode", this game has a clear learning focus. Was it successful in meeting learning goals? Are they other games that you wish had an education mode? https://bit.ly/36ttZty

Readings

1. Dubbelman (2016, November)
2. Dickey (2011)

Week 10: Collaborative Document Assignment

Week 11: What are the theoretical foundations that apply to immersive learning? How can the use of XR make more playful and motivating games?

Discussion Board Topics

1. Luna Magic Leap: How does this game break down boundaries for the learner? What other areas would be a good fit for this technology? https://youtu.be/xZtSxqWsRB0
2. Keep Talking And Nobody Explodes: If you have a VR headset, you can play this game, but it is just as fun to watch others play! Check out the video below and consider the following: What is learned in this game? How can it apply to a specific field of study? https://bit.ly/33BFjC4
3. Everything: There are stunning visuals in the game, but it is the open and exploratory gameplay that is cutting edge. Is this considered a learning game? What was your experience playing the game? https://bit.ly/2VtkqVe
4. Tendar: This innovative game makes YOU the main character through augmented reality. Although it was not designed for education, how could games using this technology becoming learning games? https://tenderclaws.com/tendar

Readings

1. Michailidis, Balaguer-Ballester, & He (2018)
2. (Choose One) Graf et al. (2019, October)
3. (Choose One) Li, Van der Spek, Hu, & Feijs (2019, October)

Week 12: In the News

Discussion Board Topics

1. This War of Mine: This game (to the best of my knowledge) is the first game to be recommended "reading" on a state or national curriculum (2020/21 school year). In Poland, students 18 years or older (due to the rating of the game) may be playing the game in humanities courses for free. https://bit.ly/3qiCWOl
2. FDA Approved: In 2020, the first video game was approved by the FDA to treat ADHD for children ages 8-12 years old. The participants included 600 children from multiple studies. What does this landmark decision open up for "prescription" gameplay in the future?

https://bit.ly/3ohJ2wI

3. Sea Hero Quest: Sea Hero Quest is an app that was created in partnership with a telecom company and non-profit organizations. What conflicts of interest might this present? This app is no longer available to play (as of Dec 2019), but you can see the demo below. https://youtu.be/SULJYDv-bIg

Readings

1. No readings this week

Week 13: Game Assignment Peer Reviews

Week 14: How can we rigorously design research studies for game-based learning?

Discussion Board Topics

1. Below you will see a series of recorded conference presentations (linked to SIGCHI PLAY Conference Proceedings). For this week, you are to take on the role of an audience member. What question(s) would you ask the presenters? Which speaking points need clarity? You can also add your informed opinion as well. For example, a question might be, "Why did you use X method to collect your data? Method Y might have been more appropriate given your research participant background."

Readings

1. Duran et al. (2006)
2. (Choose Two) Yanez-Gomez, Cascado-Caballero, & Sevillano, (2017)
3. (Choose Two) Mayer et al (2014)
4. (Choose Two) Kivikangas et al. (2011)
5. (Choose Two) Mayer (2016)

Week 15: How can you assess learning during and after gameplay?

Discussion Board Topics

1. Hair Trigger: What types of assessment were built into the game? What are the assessments measuring besides learning? Could someone complete the game without learning the content? https://hairtriggergame.org/
2. Lakeland: How is assessment built into gameplay? Does it break up the flow of the game? What could be improved? https://fielddaylab.org/play/lakeland/
3. Attentat 1942: This adventure-based game combines comics, real-life interviews, and games on the topic of the Nazi occupation in WW2. How would you assess this game in and outside of gameplay? How would this assessment change if you were a teacher or a researcher? http://attentat1942.com/
4. Assessment as Game: Is gaming the future of testing? Us the videos below to inspire the conversation. https://youtu.be/BHPp73xZ1pw

Readings

1. Shute & Ke (2012)
2. Bellotti, Kapralos, Lee, Moreno-Ger, & Berta (2013)

Exam Week: Collaborative Document Assignment and Poster Presentations

COURSE BEST PRACTICES:

EDUC 510 was first taught in 2015 as an experimental course and it has been offered once or twice a year for the past six years. Over time several best practices have emerged that create an environment of success for the students and me as the instructor, which includes (a) organization, (b) interaction, and (c) collaboration.

Online courses are at a disadvantage as compared to face-to-face classes. Instructors are not able to change course plans at a moment's notice or respond to student confusion in real-time. The best way I have found to prevent student frustration or anxiety is clear organization and consistent communication. Students enter the EDUC 510 course online with assignments, calendars, and due dates accessible and open for viewing. Each week, they receive a message on upcoming assignments, and I respond to questions typically within 24 hours. Student feedback consistently mentioned these points, and one student said, "Dr. Nadolny's organization of the syllabus and course structure made it easy for us to follow and use our time efficiently".

I paid close attention to the organization of the course overall as well as individual assignments. For example, the team game assignment is introduced approximately two months before it is due. Students begin by forming teams, and slowly move to team building, drafting the game for instructor review, peer review, and finally, submission of the final assignment. This structure supports the instructional scaffolding pedagogy and reduces cognitive load.

I have found that a blend of synchronous and asynchronous delivery maximizes course interactions in the online format of the course. The live sessions are a great way to give students the chance to express opinions on the value of games for learning while moving towards a shared understanding over the semester. Fifteen weeks later, students have the background and skills to recognize differences and stay grounded in the research literature. Also contributing to the interaction is a commitment to flexibility and meeting the needs of working adults. Live meetings every two weeks have shown a right balance between managing student work or family responsibilities and supporting interaction between students.

The majority of students appreciate the collaborative learning in the team game assignment, but there are always some challenges each semester. For example, one student mentioned that "I thoroughly enjoyed the text-based game design project. It gave me a chance to work with others outside of my career field and bring my strengths into the game design process, while learning from their strengths and ideas". During the same semester, another student commented that "the team project should be handed out earlier. Most likely at the start, with more details being released in stages. I think it would make the assigning of groups less shocking. Especially if you end up in a group with someone you don't like working with. Concerns can be addressed much earlier". In the past few semesters, I

implemented a small team building experience at the beginning of the assignment. This includes a statement on team expectations and time to get to know team members.

Collaboration is also central to the OER document development process. In the beginning of the semester, students are unsure what to do and who is in charge. Over time, leaders and roles emerge, and students move smoothly without many questions. For example, some students enjoy being editors while others focus on writing. The scaffolding mentioned in the assignment description is imperative to help students feel comfortable with this undefined task.

FUTURE COURSE PLANS

The course content is frequently updated with new games, new research, and new technologies. Recent changes in 2020 include replacing two older modules with (a) mixed reality and (b) current events to address the rapid development in game-based learning. This continual reinvestment in the course energizes me as the instructor and maintains relevance for the learners.

The course was offered in spring 2020, the semester when COVID-19 closures swept the United States. This online course was now faced with complex challenges for both the instructor and the students. For example, some student's family and work requirements changed suddenly, preventing them from accessing materials or complete assignments.

I implemented two significant changes in response to the COVID-19 pandemic. First, the team game was modified as an individual assignment more limited in scope. The team game assignment is a highlight each semester, and the change was a disappointment for students and the instructor. Second, I transformed the synchronous meetings into optional asynchronous lectures and discussions to accommodate students with health issues and new family obligations. One student reflected on the new structure, responding that "the readings were good. The games (which I played) were good, too. I really loved it when we had synchronous meetings. It was really sad when we moved to completely asynchronous instruction, though I can understand that it was necessary. It was a well-designed class with a truly top-notch teacher". Another student mentioned that "the instructor was very helpful, quick to adapt to changing circumstances, family emergencies, Covid-19. Changes were implemented to enhance the experience of the students throughout the course".

Although the course provides an essential foundation for the research on games and learning, some students struggle on what to do next. Ph.D. students interested in joining the game-based learning research community require more advanced skills and continued discussion. Although I frequently volunteer to work one on one with students after the course, one student summarized in her course evaluation that "We NEED a second part for 510". I agree! Foundational courses in game-based learning are essential to support the next generation of game developers, educators, and researchers, and a second course is in development to take that learning to the next level.

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CHAPTER 8.

FOUNDATIONS IN GAME-BASED LEARNING (EDLT541)

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Course Title: Educational Learning Technologies (EDLT) 541: Foundations in Game-Based Learning
Course College/School: Drexel University/School of Education
Course Department/Program: Teaching, Learning and Curriculum/ M.S. Learning Technologies
Course Level: Graduate, Undergraduate, PD, Continuing Education
Course Credits: 3.0
Course Length: 10 Weeks
Course Medium: Online
Course Keywords: Graduate Course, Digital Games, Game Studies, Game-Based Learning, Player Styles, Affinity Space, Foundations Course

CATALOG DESCRIPTION

In this course, students explore the rationale of game-based learning, the history of games and learning, the role of digital media, game types, and games as an affinity space for social learning. Students demonstrate their understanding of why games are powerful environments for learning, identity formation, and motivation. Students explore the relevance of game-based learning from the perspectives of educators, designers, and researchers. Students examine the application of game-based learning in informal and formal learning environments. Students learn about current practices, trends, and gaps in game-based learning research and practice.

COURSE PURPOSE AND OBJECTIVES

As a foundational course on game-based learning, the following essential questions guide the course

1. Dr. Aroutis Foster, Ph.D. (anf37@drexel.edu) is the Associate Dean for Academic Affairs and Graduate Studies and Associate Professor of Learning Technologies in the School of Education. He explores the design of virtual learning environments such as games and virtual realities to advance our understanding of teachers and learners' knowledge, identity, and motivation in different settings.
2. Mamta Shah, Ph.D. (m.shah@elsevier.com) is a Learning Scientist at Elsevier, where she conducts research to support effective learning solutions and outcomes for nursing and health education. For over a decade, Dr. Shah has researched the design and integration of interactive digital environments such as games and virtual realities to advance students' knowledge and motivation. She has worked with PK-20 educators to incorporate the cognitive, pedagogical, and experiential affordances of educational technologies in a variety of formal and informal settings.

activities: (a) What is educational game-based learning? (b) What is the role of digital games in learning? (c) Why game studies now? and (d) How do digital games engage and motivate learners? Additional questions guiding the course purpose and objectives include:

- Why is game-based learning an interdisciplinary field?
- What is the current state of game-based learning for facilitating teaching, learning, and assessment?
- What frameworks are available for educators, designers, and researchers to incorporate game-based learning in their context?
- What is the difference between gamification and game-based learning?
- What is the role of an educator, researcher, or game designer in designing experiences that make learning in games and with games meaningful?
- What purposes can game-based learning serve in formal and informal educational contexts?

Students begin with a course overview – big ideas, goals, schedules, assignments, and expectations. They are also introduced to games and learning in Week 1. They obtain an overview of games as a form of technology and their bidirectional relationship with society. In Week 2, the objective is to introduce students to key concepts including what are game types, genres, and mechanics and how they impact learning; and, how technical features, pedagogical characteristics, and content impact learning in games. In Week 3, students segue into learning about the Playing Research Method for examining the educational merits of games. The objective of week 4 is to facilitate students' understanding of personal, contextual, and competitive analyses, and the benefits that yield for educators and researchers interested in game-based learning, and game designers. In weeks 5 and 6, the focus transitions to the nature of learning games can facilitate. In the case of this course, the spotlight is chosen on situated learning and identity change as forms of learning facilitated by games. In week 7, students are introduced to theoretical, analytical, pedagogical frameworks for designing and implementing game-based learning experiences and environments. The focus of week 8 shifts to the role of educators and the importance of assessment in game-based learning. In week 9, the penultimate week of the course, the objective is to help students focus on games in multiple contexts, particularly their own (e.g. workplace, informal/formal education, game-design, research). In the final week; that is, week 10, students focus on game-based learning implementation.

COURSE CONTEXT

EDLT541 was introduced in Fall 2010. At this time, courses on games and learning, game-based learning, and game design were seldom offered in graduate programs housed in schools of education. The course was designed as part of a Learning in Game-Based Environments certification where EDLT541 was the first of five courses offered in the series. Other courses included, Research in Motivation & Game-Based Learning, Play & Learning in Participatory Culture, Integrating Games & Pedagogical Content Knowledge (see chapter in this book), and Design & Development of Learning Games. Over the decade, the course has been taken by K-12 teachers, administrators, and professionals involved in training and education in multiple fields (e.g. medicine, military, music). These groups of students typically have limited experiences of playing games in their personal and professional lives; however, they are keen to introduce technological and pedagogical innovations

such as games to enhance their instructional practices and engage their learners. Students from other colleges within the university have also enrolled in this course (e.g. game design and development program students). While these students come to the course identifying themselves as gamers and having frequently played commercial entertainment games, students from college of digital media have found this course beneficial to understand games from an educational perspective.

COURSE PEDAGOGY

Two principles inspired the creation of this foundational course and have been at the heart of the course for the last 10 years. First, we wanted students, irrespective of their disciplinary focus, to understand that games are a form of curriculum with affordances and constraints for what can be learned and how they teach in a given context (Foster, 2012). Second, game-based learning is a way of facilitating learning; it is a multifaceted approach which provides opportunities for learners to discover and construct their own knowledge and understanding. We have described these principles in greater detail in Foster and Shah (2020).

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Texts: In order to keep the course nimble, there are no required textbooks for this course as the goal is to engage readers in a wide-variety of materials (readings, games, websites, and additional multimedia) that are seminal and/or current. All the readings are provided and electronic. Students are asked to obtain full texts of assigned readings through the university library.

Core Reading List

- Bakie, R. (2010) Games and society. In S. Rabin, Introduction to Game development. Course Technology Cengage Learning: MA
- Bakie, R. (2010) Brief History of Video Games. In S. Rabin, Introduction to Game development. Course Technology Cengage Learning: MA
- Muriel, D. and Crawford, G. (2018). Video games as culture. Routledge, NY.
- Steinkuehler, C. & Squire, K. (2015). Videogames and learning. In K. Sawyer (Ed.),Cambridge Handbook of the Learning Sciences, Second Edition. NY: Cambridge University Press.
- Slota, S. T., & Young, M. F. (2017). Stories, Games, and Learning through Play: The Affordances of Game Narrative for Education. In Zheng, R. Z., & Gardner, M. K. (Ed.), Handbook of Research on Serious Games for Educational Applications (pp. 294-319). IGI Global. http://doi:10.4018/978-1-5225-0513-6.ch014
- Whitton, N. (2010) Learning with digital games: A practical guide to engaging students in higher education. Routledge: NY
- Gee, E., Siyahhan, S., & Cirell, A. M. (2017). Video gaming as digital media, play, and family routine: Implications for understanding video gaming and learning in family contexts. *Learning, Media, and Technology*, 42(4), 468-482.

Recommended Reading

- DaCosta, B., & Seok, S. (2017). Factors That Explain Adolescent and Young Adult Mobile

Game Play, Part 1: A Quantitative Examination of the Characteristics Describing the Casual Player. In Zheng, R. Z., & Gardner, M. K. (Ed.), Handbook of Research on Serious Games for Educational Applications (pp. 320-339 IGI Global. http://doi:10.4018/978-1-5225-0513-6.ch015

- DaCosta, B., & Seok, S. (2017). Factors That Explain Adolescent and Young Adult Mobile Game Play, Part 2: A Quantitative Examination of the Casual Player in the Context of Age and Gender. In Zheng, R. Z., & Gardner, M. K. (Ed.), Handbook of Research on Serious Games for Educational Applications (pp. 340-365). IGI Global. http://doi:10.4018/978-1-5225-0513-6.ch016
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- Laurel, B. (2016). AR and VR: Cultivating the Garden. Presence Teleoperators & Virtual Environments 25(3): 253
- Shaffer, D.W., Nash, P., & Ruis (2015). Technology and the New Professionalization of Teaching. Teachers College Record 17(12).
- Shah, M., Foster, A., & Barany, A. (2017). Facilitating Learning as Identity Change Through Game- Based Learning. In Y. Baek (Ed). Game-Based Learning: Theory, Strategies and Performance Outcomes (pp 257-278). New York, NY. Nova Publishers

Software:

This course is taught online; hence, all course activities are facilitated via Blackboard LMS. Video conferencing tools such as Zoom and Quicktime are used for synchronous sessions and asynchronous lectures. Flipgrid is used as a way in the initial weeks for students to introduce themselves in a more natural way of speaking to each other.

COURSE ASSIGNMENTS

Below we describe some of the major course assignments. We strike a balance between those which are assignments demonstrating students' emerging understanding, and those which are used to build a shared knowledge about games for learning.

Weekly Discussion Boards: Students are encouraged to incorporate the readings and make personal/professional connections. The aim of discussion boards is for students to reflect on readings while connecting it to their experiences through explanations and synthesizing of readings. The discussion board is not a place to be regurgitating verbatim what students read in the textbooks/articles. It is a place to synthesize, analyze and be innovative in their arguments. Some examples of prompts used for discussion board are as follows:

- Week 1- Using data available online, find out what are the current best-selling games in your area of professional interest/concentration. The game can be designed for education, entertainment or edutainment. For each game you identify, share a screenshot or two from the

game. Write about 5-lines describing the game and

- Week 2- Identify a game based on a genre of your choice and respond to the following prompts based on your player experience: Introduce the game and game objectives; Describe the game play built in the environment; How did the game play enable or obstruct your experience playing the game and learning from it?; If applicable, think about a character in the video game (playing or non-playing); What role did they play to support you?; What can one learn from this game? Would you be able to apply this game to your context? If so, what learning goals can it help you achieve?

Rules for Discussion Board Engagement: Each week you should come to class ready to discuss a game you have played and how it contributes to learning. These discussions more often than not should be based on the course readings and from observations in your life about game play and learning. On each discussion board, you will discuss the following – a) your understanding of the readings for the last two weeks and b) experiences you had in the week from game play and learning. This could be for play and learning in any settings such as schools, museum, work, etc.

Discussion guidelines: Reflect on the discussion board topic. It is related to the course learning and the connections you are making. How will you apply this focus? What stands out for you? What questions do you have? One-word expressions or short phrases that simply agree or disagree with another student are too minimal. Say why you agree or not. Give your own examples. You will have an opportunity to assess your discussion board participation near the end of the course based on the criteria listed below.

General Criteria for Discussion Board

- Post contributions on the Discussion Board as assigned.
- Respond to others' comments, work, or ideas.
- Ask for help or clarification.
- Respond to feedback in a constructive manner.
- Make contributions by sharing your insights with others.

Weekly Game Resource Contribution: Each week one to three students are assigned to find a game about learning and post it to the Interesting Games Wiki/Blog to be discussed**.** Students cannot post a game that is already in the Web Resource. They are encouraged to check the Web Resource before searching and posting a game. Each person posting about a game should post an image of the game; state the genre of the game, its content, how it facilitates learning, and why it is interesting.. The Web Resource serves as a growing repository of games for learning that students may visit even after the course is over. If students find a game that they want to post about, they may do so even if it is not their week to post. The Web Resource is open only to students who are taking or haven taken the course, as such it is not available to the public.

Playing for Research (Due Week 3): The objective of this assignment is for students to apply the playing

research method (PRM) to examine the technological, pedagogical, and content affordances of one game that may align with their professional area of interest/area of concentration. PRM (Aarseth, 2003; Foster, 2011) allows educators, researchers, and designers to gain insights about a game thought direct (i.e. playing the game) and vicarious (e.g. observing someone play the game, reading about the game on game and review websites, watching videos) experiences. Thus, in this assignment, students create an infographic[3] to represent their findings from the game in terms of (a) What the game is about and who it is designed for?, (b) How is the game played and how are players supported to accomplish the game objectives, (c) What are the key technological features of the game and how the game play experience, and (d) What is the potential use of this game in your context?

Students may continue analyzing one of the games identified in weeks 1 and 2 or identify a new game altogether. Students submit the infographic file in a discussion board space that will be made available so that all the course members can view the infographic (this could be considered as an asynchronous poster session). Peers are welcome to provide feedback to one another but it is not required. Students' infographic is graded based on the extent to which they address the four questions stated above and demonstrate their understanding of the relevance of this game for their context.

Game-Based Learning Implementation Plan (Week 10): Students write a 10-12 page paper in which they describe their plan to introduce game-based learning to their job/professional context. Using the essential questions of the course, students begin their paper with a prose explaining their position on game-based learning and how it aligns with their current or future professional goals. Drawing insights gained from the previous assignments, discussions, and readings students are expected to design an action plan that describes their game-based learning implementation plan.

Students may use (but not restrict themselves to) the following guiding questions to help structure their action plan. A grading rubric is also provided:

- What need(s) will the introduction of game-based learning fill?
- Is there an existing program that can benefit from the use of game-based learning?
- What has been the previous experience of the workplace or colleagues been with game-based learning, if any?
- Who will be involved in this new plan?
- How will they be trained?
- What structures exist to support and challenge game-based learning?
- What learning outcomes will the use of game-based learning work towards and how will they be assessed?

GRADING

- Game Resource Contribution: 25 points

3. An infographic is short for information graphic. Wikipedia defines info graphics as, "graphic visual representations of information, data or knowledge intended to present information quickly and clearly. They can improve cognition by utilizing graphics to enhance the human visual system's ability to see patterns and trends. Here are some freely available tools to create info graphics http://www.creativebloq.com/infographic/tools-2131971

- 1 Introductory Blog (not graded) and 5 Discussion Boards (5 points each): 25 points
- Playing Research Method Assignment: 25 points
- Game-Based Learning Implementation Plan: 25 points
- Total: 100 points

EXPANDED COURSE OUTLINE

Week 1: Introduction to games and learning

The role of games in society.

Selected readings/Activities:

- Egenfeldt-Nielsen, S., Smith, J. H., Tosca, S. P. (2020). Ch 3. What Is A Game? Ch4. 8. Serious
- Slota, S. T., & Young, M. F. (2017). Stories, Games, and Learning through Play: The Affordances of Game Narrative for Education. In Zheng, R. Z., & Gardner, M. K. (Ed.), Handbook of Research on Serious Games for Educational Applications (pp. 294-319). IGI Global. http://doi:10.4018/978-1-5225-0513-6.ch014
- Muriel, D. and Crawford, G. (2018). Video games as culture (Chapter 1 and 2).
- Bakie, R. (2010) Games and society. In S. Rabin, Introduction to Game development. Course Technology Cengage Learning: MA
- Bakie, R. (2010) Brief History of Video Games. In S. Rabin, Introduction to Game development. Course Technology Cengage Learning: MA

Assignments:

- FlipGrid use for Introductory Blog/Discussion Board 1

Week 2: Game types, genres, mechanics and Technological Pedagogical and Content characteristics of Games.

- How does game types, genres, mechanics impact learning? How does technological features, pedagogical characteristics, and content impact learning in games?

Selected readings/Activities:

- Whitton, N. (2010) Learning with digital games: A practical guide to engaging students in higher education. Routledge: NY – *Chapters: Understanding the pedagogy of digital Games and Types of Games*

Assignments:

- Discussion board 2
- Learning in game-based resource post

Week 3: Assignment Submission and Course Recap.

- The role of games in society

- How does game types, genres, mechanics impact learning?
- How does technological features, pedagogical characteristics, and content impact learning in games?

Assignments:

- Playing for research method
- Learning in game-based resource post

Week 4: Persona Analysis, Contextual Analysis, and Competitive Analysis

- What insights does persona, contextual, and competitive analysis yield for educators, researchers, and designers?

Selected readings/Activities:

- Foster, A. N. (2011). The process of learning in a simulation strategy game: Disciplinary knowledge construction. Journal of Educational Computing Research, 45(1), 1-27

Assignments:

- Discussion board 3
- Learning in game-based resource post

Week 5: Games and Learning: Ecology of learning

- What kinds of learning can games facilitate? Game-based Learning for situated meaning. Game-based Learning for promoting identity change. Towards an ecology of learning.

Selected readings/Activities:

- Foster, A. N. (2008).Games and motivation to learn science: Personal identity, applicability, relevance and meaningfulness. Journal of Interactive Learning Research, 19(4), 597-614.
- Steinkuehler, C. & Squire, K. (2015). Videogames and learning. In K. Sawyer (Ed.),Cambridge Handbook of the Learning Sciences, Second Edition. NY: Cambridge University Press.
- Egenfeldt-Nielsen, S., Smith, J. H., Tosca, S. P. (2020). Serious Games and Gamification – When entertainment is not enough. Ch.8

Assignments:

- Learning in game-based resource post

Week 6: Assignment Submission and Mid-Course Recap.

- MidCourse live remote recap – zoom meetings with students to reflect on first half of course
- Read course packet: persona, contextual, and competitive analysis readings

Assignments:

- Playing for research method
- Learning in game-based resource post

Week 7: Frameworks for game-based pedagogy and implementation

- Theoretical, analytical, pedagogical frameworks for designing and implementing game-based learning experiences/environments

Selected readings/Activities:

- Foster, A., Shah M., & Duvall, M. (2015). Game Network Analysis: A framework for teaching with games

Assignments:

- Learning in game-based resource post

Week 8: Games and assessment

- The role of educators and the importance of assessment in game-based learning

Selected readings/Activities:

- Silseth, K. The multivoicedness of game play: Exploring the unfolding of a student's learning trajectory in a gaming context at school. Computer Supported Learning 7, 63–84 (2012).
- de Freitas, S., & Oliver, M. (2006). How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? Computers & Education, 46(3), 249–264.

Assignments:

- Learning in game-based resource post
- Discussion Board 4

Week 9: Games in your context

- Games in your context (e.g. workplace, informal/formal education, game-design, research).

Selected readings/Activities:

- Students complete a reading of their choice from the recommended list or one of their own.

Assignments:

- Learning in game-based resource post
- Discussion Board 5

Week 10: Assignment Submission and Course Recap.

Selected readings/Activities:

- Game-based learning implementation plan and presentation
- Students Presentations

Assignments:

- Game-based learning implementation plan and presentation

COURSE BEST PRACTICES

We have found the following practices to work extremely well for a foundations course that welcomes students from different disciplines and varying experiences with game playing:

- The course presents information to many foundational ideas in bite-sized or meaningful chunks so that learners may get foundation and also have an idea of what the game-based learning program covers in more depth in other courses.
- Front loading the course with readings – Many key readings and resources are assigned in the early weeks with a gradual reduction in the number of readings so that students have time to reflect on and synthesize the readings and construct their understanding games for learning for actionable plans.
- Balancing the general and specific by introducing basic ideas on games and learning and always encouraging students to make connections to the use of games in their professional context.
- Encouraging game playing each week and writing about it, and by extension, developing game literacy to help students bridge theory and practice.
- Reducing cognitive load by not assigning any discussion boards or additional activities in the weeks when a paper assignment is due.
- Designing a variety of assignment types to help students construct their models of understanding and express ideas.
- Culminating the course with an action plan that helps students propose the use of game-based learning in their professional settings.
- Having several weeks when assignments are due as well as during the midterms to reflect and recapture what readings, discussions to aid in understanding of course material.

Over the years, some ideas were not as successful. For instance, initially, we tried to engage our students in game design to create games for learning. In 2010, the idea of game-based learning included exploring how teachers could design and develop games. However, we learned over a two-year period through student feedback and frustration, that students in education programs generally do have the design and programing background. There were few successes in the development of games and eventually we pivoted back to focus on design of games and how to design curricular experiences around games with models such as Inquiry Communication Construction and

Expression (ICCE- Foster & Shah, 2015), Technological Pedagogical Content (TPC- Shah, 2019; Foster, 2012), and Play Curricular activity Reflection Discussion (Foster & Shah, 2015; Shah & Foster, 2014).

The course, because of its foundational nature, has all major assignments designed for individual students. Nonetheless, we recognize the social nature of learning. Weekly discussions, game analysis posts on the Learning in Game-Based Web Resource (available only to student who are enrolled or who have taken the course), and class presentation of the final action plan are some ways in which we encourage peers to learn from each other.

In addition, the course includes all types of students from game designers and developers, corporate and learning and development educators to K-12 teachers. As such the technical and content knowledge about games for learning varies and requires an inter and trans-disciplinary team to complete some assignments and to engage a thorough experience about game-based learning or gamification. By extension the deliverables from the course have been varied with games such as Avian, which is about learning about different types of birds, or gamified lesson plans about mathematics or social studies, or work place gamified and game-based learning plans that situate employees on their personalized learning and development pathways in a company.

FUTURE COURSE PLANS

As a foundation course that we will continue to offer, we aim to include seminal and current literature on game-based learning and play. The focus will be to help students appreciate the significance of play for life-wide and life-long learning. Students will be supported in understanding the transition of play and its use in games from a historical perspective to current times. Related to this goal, we aim to expand the breadth of games students are exposed to playing. Digital games are increasingly designed with more immersive, interactive, and interdisciplinary experiences. For instance, the spectrum of extended reality (XR) which includes augmented reality (AR), virtual reality (VR) and mixed reality (MR) presents novel opportunities for enhancing instruction and engaging learners. We hope to introduce students to play and games in all different settings – digital and non-digital. In addition, the course will help students make a clearer distinction between game-based learning, gamification of learning, serious games, game-based pedagogy, and educational games. This is especially important as educators, researchers, and designers often confuse the terms. In the future, we want to pay additional attention to nuanced forms of learning afforded by games such as identity exploration affording players to explore possible future selves in a systematic, intentional and targeted manner (Foster, 2014; Foster & Shah, 2021; Barany & Foster, 2020; Shah, Foster, Talafian, Barany & Petrovich Jr, 2020).

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CHAPTER 9.

INTEGRATING GAMES AND PEDAGOGICAL CONTENT KNOWLEDGE (EDLT544)

MAMTA SHAH[1] AND AROUTIS FOSTER[2]
DREXEL UNIVERSITY

Course Title: Educational Learning Technologies (EDLT) 544: Integrating Games and Pedagogical Content Knowledge
Course College/School: Drexel University, School of Education
Course Department/Program: Teaching, Learning and Curriculum/ M.S. Learning Technologies
Course Level: Graduate, Undergraduate, PD, Continuing Education
Course Credits: 3.0
Course Length: 10 Weeks
Course Medium: Online
Course Keywords: Graduate Course, Digital Games, Game Studies, Games as Curricula, Game Literacy, Game Analysis, Game Integration, Game-Based Learning

CATALOG DESCRIPTION

Students learn about the technological, pedagogical, and content knowledge (TPACK) framework for educational technology and how it was co-opted (TPC) for game studies. Students systematically explore game design by framing game genres as forms of pedagogy as they consider educational content. Students demonstrate their understanding of the interplay of technology, pedagogy, and content in gaming environments. This course is important for educators in a broad sense (e.g., teachers, trainers, designers) who are working in formal and informal learning spaces, interested in understanding how games can facilitate meaningful experiences and learning how to identify games that are suitable for their instructional and training needs.

1. 1. Mamta Shah, Ph.D. (m.shah@elsevier.com) is a Learning Scientist at Elsevier, where she conducts research to support effective learning solutions and outcomes for nursing and health education. For over a decade, Dr. Shah has researched the design and integration of interactive digital environments such as games and virtual realities to advance students' knowledge and motivation. She has worked with PK-20 educators to incorporate the cognitive, pedagogical, and experiential affordances of educational technologies in a variety of formal and informal settings.

2. 2. Aroutis Foster, Ph.D. (anf37@drexel.edu) is the Associate Dean for Academic Affairs and Graduate Studies and Associate Professor of Learning Technologies in the School of Education. He explores the design of virtual learning environments such as games and virtual realities to advance our understanding of teachers and learners' knowledge, identity, and motivation in different settings.

COURSE PURPOSE AND OBJECTIVES

This course focuses on helping students develop an understanding of games as designed curricula and skills to study the pedagogical and content affordances of a variety of games. Specific learning goals include:

- To understand the role of TPACK in education and its role with games for learning,
- To understand how the co-opted TPACK framework (TPC) can enhance learning games for both formal and informal contexts,
- To think critically about game genres and their role in learning games,
- To make informed decisions about what games are good for specific learning goals,
- To consider the underlying pedagogy, design stance, and content based on the particular context.
- To design and develop a game-based instructional strategy based on the TPACK framework.

As such, the following questions guide the course activities:

What is TPACK? Why is it a relevant educational technology framework?

- How are games designed considering the interplay of content and pedagogy?
- How do game genres affect game design and the subsequent learning of educational content?
- What game genres are better for what content learning considering pedagogy?
- How can we support better educational game design through TPACK?

In Week 1, students begin with a course overview – big ideas, goals, schedules, assignments, and expectations. They are introduced to the Technological Pedagogical Content Knowledge (TPACK) framework. In Week 2, students explore a variety of pedagogical approaches including anchored instruction, case-based learning, congruent instruction, problem-based learning and project-based learning. In Week 3, the concept of disciplinary knowledge is introduced. These foundational ideas covered in Weeks 1-3 set students well for an introduction to the concept of disciplinary knowledge in Week 4. In Week 5, students begin to explicitly connect the concepts learned in the previous weeks, starting with games and TPACK; thus, learning about the co-opted TPACK framework (TPC) for studying and designing games. In Week 6, students explore game examples and learn how to make informed decisions about their educational merits. In Week 7, game genres and their impact on game are examined. In Week 8, students engage in a critical analysis of game genres. In Week 9, the penultimate course questions are re-visited, especially prompting students to reflect on what they will take away from this course that will be relevant for their professional contexts. In Week 10, students present their final projects elucidating their application of the co-opted TPACK framework (TPC) for game-based learning in their professional contexts.

COURSE CONTEXT

EDLT544 was introduced in Fall 2010. At this time, courses on games and learning, game-based learning, and game design were seldom offered in graduate programs housed in schools of education.

The course was designed as part of a Learning in Game-Based Environments certification where EDLT544 was the fourth of five courses offered in the series. Other courses included, Foundations in Game-Based Learning (see chapter in this book), Research in Motivation & Game-Based Learning, Play & Learning in Participatory Culture, and Design & Development of Learning Games.

Over the decade, K-12 teachers, administrators, and professionals involved in training and education in multiple fields (e.g. business, medicine, military, music) have enrolled in this course. These groups of students typically have limited experiences of playing games in their personal and professional lives; however, they are keen to introduce technological and pedagogical innovations such as games to enhance their instructional practices and engage their learners. Students from other colleges within the university have also enrolled in this course (e.g. game design and development program students). While these students come to the course identifying themselves as gamers and having frequently played commercial entertainment games, students from college of digital media have found this course beneficial to understand games from an educational perspective.

However, most students typically take the Foundations of Game- Based Learning course (see chapter in this book). This prepares them well enough for diving
deeper into understanding games as a form of educational technology. Students are also prepared to acquire analytical and methodological skills for examining the merits and shortcomings of games based on specific learning goals and ecologies.

COURSE PEDAGOGY

The following principles have been at the core of this course for the last 10 years. First, we want students-irrespective of their professional area of focus-to understand that games are designed experiences (Squire, 2006). In the context of education and the language of educators, each game is a form of a curriculum with affordances and constraints for what can be learned and how a game teaches in a given context (Foster, 2012). Second, empowering educators become game literate is an important pedagogical goal for this course and for the field at large (Hanghøj, 2013; Shah & Foster, 2015). This means, they need direct and vicarious experiences of playing games and learning about them. They also need some analytical lenses to make informed decisions about which games warrant to be integrated as is or need repurposing for use in the curriculum (Foster, Mishra & Koehler, 2011; Foster & Shah, 2015a; 2015b; Shah, 2019). Third, deepening of knowledge and confidence in use of any tool in any domain comes over time with systematic and intentional use. Such is the case with games too (Shah & Foster, 2014). We have described these principles in greater detail in Foster and Shah (2020). All of these principles guide the selection of readings and design of assignments.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

In order to keep the course nimble, there are no required textbooks for this course as the goal is to engage readers in a wide-variety of materials (readings, games, websites, and additional multimedia) that are seminal and/or current. All the readings are provided and electronic. Students are asked to obtain full texts of assigned readings through the university library.

Below, we provide a list of core readings:

- Becker, K. (2006). Pedagogy in Commercial Video Games. In D. Gibson, C. Aldrich & M.

Prensky (Eds.), Games and Simulations in Online Learning: Research and Development Frameworks: dea Group Inc

- Prensky (Eds.), *Games and simulations in online learning: Research and Development Frameworks*. Hershey, PA: Information Science Publishing.
- Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital Games, Design, and Learning: A Systematic Review and Meta-Analysis. Review of Educational Research, 86(1), 79-122.
- Foster, A., Mishra, P., & Koehler, M. (2011). Digital game analysis: Using theTechnological Pedagogical Content Knowledge framework to determine the affordances of a game for learning. In M. Khine (Ed.), *Learning to Play: Exploring the Future of Education with Video Games*. (pp. 189-212). New York: Peter Lang Publications.
- Gee, J. P. (2004). *Situated language and learning: A critique of traditional schooling*. NY: Routledge.
- Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41*(4), 393-416.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.
- Squire, K. (2006). From Content to Context: Videogames as Designed Experience. *Educational Researcher, 35*(8), 19-29.
- Whitton, N. (2010) Learning with digital games: A practical guide to engaging students in higher education. New York: Routledge.

Supplemental readings are always recommended based on students' interests and the manner in which the course unfolds. Select readings are listed below:

- Foster, A. & Shah, M. (2015). The play curricular activity reflection and discussion model for game-based learning. Journal of Research on Technology in Education, 47(2), 71-88.
- Foster, A. & Shah, M. (2015). The ICCE framework: Framing learning experiences afforded by games. Journal of Educational Computing Research, 51(4), 369-395.
- Jayatilleke, A. & Shah, M. (2020) Examining the Technological Pedagogical Content Characteristics of Games for Medical Education. *Medical Science Educator. 30,* 529-536
- Shah, M. (2019a). Pre-Service Teachers Learning to Analyze Games: The Case of *SPENT.* Special Issue on Playing and Pedagogy: The Theory and Practice of Teaching with Video Games. *Films for the Feminist Classroom.*
- Shah, M. (2019b). Supporting Teachers' Examination of Games for Teaching, Learning, and Assessment. In Ifenthaler D., & Kim Y. (Eds.), Game-Based Assessment Revisited (pp 185-210). Springer, Cham.
- Shah M. & Hassinger-Das, B. (2019). Intergenerational and Transmediational Play Partnerships: Perspectives of Two Academic Parents. *Well-Played. Special Issue on Intergenerational Play, 8(3),* 190-214

This course is taught online; hence, all course activities are facilitated via Blackboard LMS. Video conferencing tools such as Zoom and Quicktime are used for synchronous sessions and asynchronous lectures. Students are required to play a variety of games in order to (a) establish a comfort level with playing games and learning to approach them as educational technologies whose strengths and constraints are context-dependent, (b) become fluent with the practices of understanding how a game teaches (pedagogy or game genre) and what a game can teach (content and skills) for a specific context and learning goal(s), and (c) expand the variety of games they are aware of and be ok with the idea that games designed for education and commercial purposes can be repurposed for specific learning goals and contexts. Students refer back to the Learning in Game-Based Environments Web-Resource, a repository of games and game analyses that has been populated by students enrolled in the GBL concentration at Drexel University since 2010. Students are also encouraged to play games on Games for Change (https://www.gamesforchange.org/), Itch.io (https://itch.io/), App Store (https://www.apple.com/app-store/) and Play Store (https://play.google.com/) among others.

COURSE ASSIGNMENTS

Overall, we strike a balance assignments that demonstrate students' emerging understanding, and those which are used to build a shared knowledge about games for learning. All major assignments are designed for individual students. Nonetheless, we recognize the social nature of learning. Weekly discussions, game analysis posts on the Learning in Game-Based Web Resource, and class presentation of the final action plan are some ways in which we encourage peers to learn from each other. Below we describe some of the major course assignments.

Weekly Game Resource Contribution

Each week one to three students are assigned to find a game about learning and post it to the Interesting Games Wiki/Blog for discussion**.** Students cannot post a game that is already in the Web Resource. They are encouraged to check the Web Resource before searching and posting a game. Each person posting about a game should post an image of the game, state the genre of the game, describe embedded content, how it facilitates learning, and why it is interesting. The Web Resource serves as a growing repository of games for learning that students may visit even after the course is over. If students find a game that they want to post about, they may do so even if it is not their week to post.

Discussion Guidelines

Reflect on the discussion board topic. It is related to the course learning and the connections you are making. How will you apply this focus? What stands out for you? What questions do you have? One-word expressions or short phrases that simply agree or disagree with another student are too minimal. Say why you agree or not. Give your own examples. You will have an opportunity to assess your discussion board participation near the end of the course based on the criteria listed below.

Criteria:

- Post contributions on the Discussion Board as assigned.
- Respond to others' comments, work, or ideas.
- Ask for help or clarification.

- Respond to feedback in a constructive manner.
- Make contributions by sharing your insights with others.

Paper 1: From Content to Context – How games embody content

Videogames are more than means for entertainment. They are semiotic-multimodal domains, which are exceptionally rich mediums for facilitating interdisciplinary learning. For this assignment, students write a 4-5 page paper to answer the question, how do video games embody content for school learning? Students use insights from their readings, play experiences, and the following prompts to write the paper:

- Briefly state any previous experience in using games for teaching and learning. What games did you use, how did you use them, and for what purposes?
- Describe and explain each part of TPACK, and the key purpose of TPACK in education,
- Explain how the design experiences within games facilitate the learning of school content,
- Propose how TPACK may be used in games to help design content learning experiences, and
- Explain the implications of games for school and content learning.

Paper 2: Game Genres- Pedagogy and Experiences

There is little agreement on how game genres or types are created or classified. They are usually discussed from either a non-representational perspective (e.g. interactivity) or from a representational perspective (e.g horror). Game genres are a way to tell players the kind of interactivity they will have with games. From this perspective, genres are seen as an implicit pedagogical stance because they determine how players play through interactivity. In this assignment, students write a 5-6 page paper that explores the role of game genres and their pedagogical implications for learning. For this assignment students find and play two games of completely different game genres e.g. simulation strategy game vs. a role-playing vs. a turn-based strategy and so on. They use the following prompts and questions as guides to structure their paper:

- Briefly describe the game objectives and genre
- How does the genre of each game affect game play?
- How is the genre of each game an implicit pedagogical stance? i.e. how did it affect how you learn to play the game and by extension the content in the game?
- If you could design a game, describe experiences you would want learners to have based on an appropriate genre of the game?
- Finally, what are the possible implications of designing a game for learning without considering the appropriate genre?

Paper 3: Critical Game Analysis

In this assignment, students go a step further in developing their understanding of games and pedagogical content knowledge. They will write a paper that is no longer than 6 pages while

performing a critical game analysis using the TPACK framework. Students perform the game analysis along three parameters-

- The game as a form of technology,
- The game genre as an implicit design and pedagogical stance,
- The content or the subject matter can be learnt through the game that is evident in the game's narrative, and the opportunities for inquiry, communication, construction, and expression (ICCE) embedded within the game.

For their guidance ICCE experiences are operationalized as follows: *Inquiry* includes opportunities for exploration and problem solving within the game environment. The objective(s) of the game must be tied to the actions of the player in the game environment. Here, the players must be allowed to be active, engaged and required to reason. The expected learning orientation is mastery development, a process that is guided discovery based and one that expects the player to collect, synthesize and apply multi-modal information. *Construction* of knowledge goes beyond the traditional sense of incremental knowledge gain because of game play; it also includes construction of artifacts, opportunities for applying content knowledge, cultural knowledge, and personal experience. Knowledge construction of such type shall allow players to embody or identify with the ways of thinking, acting, seeing in a given community of practice. *Communication* includes synchronous or asynchronous, purposeful, and multiple means of interaction between player-game and player-peers. It should also provide feedback and guidance that has utility to players' progress towards meeting the game objectives. Finally, *expression* includes opportunities for sharing one's emotions, feelings, values, and ideas. Forms of expression may be text-based, artistic, emoticon based, action based. Expression should result from the experience within the game, have an impact on how the game progresses, and facilitate the intended learning goals. Additionally, two full-length papers on ICCE are also provided to you for reference (Foster & Shah, 2015a; Shah & Foster, 2014a).

Students may choose to refer to additional prompts to guide their game analysis:

- What audience and purpose is this game intended for and how well does it fulfill these goals?
- What are the strengths and weaknesses of this game along pedagogy, content, and technological factors?
- Which standards can you align the game experiences with (NETS, State Standards)?
- What recommendations along content, pedagogy, skills, and ICCE experiences would you offer for teachers seeking to use this game?
- What suggestions would you offer to game designers to modify or improve this game along its pedagogy, content and ICCE experiences?

COURSE ASSESSMENT

- Discussion Board (4 points each amounting to 20 points)
- Content to Context Paper (20 points)
- Games Genres and Pedagogy Paper (20 points)

- Critical Game Analysis Paper (25 points)
- Final presentation TPACK Strategy (15 points)

EXPANDED COURSE OUTLINE

Week 1: What is TPACK?

Class Topics/Activities

- Students read:
    - Mishra and Koehler (2006). Technological pedagogical content knowledge: A framework (TPACK) for teacher knowledge.
    - Koehler, M. J., Mishra, P., & Cain, W. (2013). What is Technological Pedagogical Content Knowledge (TPACK)?
- Students watch: Teaching with technologies: Is TPACK still relevant (shorturl.at/kmyAF, Webinar, 2020)
- Students discuss their background and experiences with games. As a class we explore questions such as: their identification as luddites vs gamers, how they use games in their professional work, how they think games can be used for teaching, learning, and assessment.

Assignments

- Introductory blog

Week 2: TPACK Reframed

Class Topics/Activities

- Students read:
    - Harris, Mishra & Koehler (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed.Students discuss insights about TPACK and their thoughts about pedagogy and content in games.
- Students play games in class and begin dissecting the embedded content and pedagogical characteristics. They gain comfort in playing games and direct experiences of evaluating them. They also learn about the content and pedagogical affordances and constraints of games by observing peers, and engaging in a dialogue during class.
- Student begin work on paper assignment 1: From Content to Context – How games embody content

Assignments

- Discussion board 1
- Learning in game-based resource post

Week 3: Pedagogical Approaches

Class Topics/Activities

- Student learn about pedagogical approaches such as case-based learning, congruent instruction, problem-based learning, and project-based learning
- Student explore pedagogy in commercial games and its impact on learning experiences
- Students read:
    - Gee, J. P. (2004). Situated language and learning: A critique of traditional schooling (Chapters 2, 5, 8)

Assignments

- From Content to Context Paper

Week 4: Disciplinary Knowledge

Class Topics/Activities

- Students read:
    - Whitton, N. (2010) Learning with digital games: A practical guide to engaging students in higher education (Chapters 5, 6, 7)
- Students create a concept map illustrating their understanding of discipline-based inquiry or disciplinary knowledge. They illustrate how pedagogy and content combine in your specialized area of inquiry.
- Students discuss their insights about the interplay of technology, pedagogy and content through game play using examples from games they played during the week.
- Students begin work on paper assignment 2: Game Genres: Pedagogy and Experiences.

Assignments

- Discussion board 2
- Learning in game-based resource post

Week 5: Games and TPACK

Class Topics/Activities

- Students read:
    - Foster, A., Mishra, P., & Koehler, M. (2011). Digital game analysis: Using the Technological Pedagogical Content Knowledge framework to determine the affordances of a game for learning
- Students learn about worked examples of the co-opted TPACK framework (TPC) and how it serves as a lens for analyzing games.
- They explore the concept of repurposing games for educational purposes (e.g., Minecraft for

English Language Arts, Rollercoaster Tycoon 3 for Economics, Animal Crossing New Horizon for Life Science education)

Assignments

- Discussion board 3
- Learning in game-based resource post

Week 6: Game Exploration

Class Topics/Activities

- Students explore a variety of games and consider ways to repurpose them for educational goals.
- Student explore games by way of direct experiences (i.e., game play), and vicarious experiences (i.e., Youtube videos, discussion forums, game reviews).

Assignments

- Games Genres and Pedagogy Paper

Week 7: Game Genres and Games Play

Class Topics/Activities

- Students read:
    - Foster, A. N., & Mishra, P. (2009). Games, claims, genres & learning.
- Students begin work on paper assignment 3: Critical analysis of game genres and games.

Assignments

- Discussion board 4
- Learning in game-based resource post

Week 8: Critical Game Genre Analysis

Class Topics/Activities

- Students learn about the Inquiry Communication Construction and Expression (ICCE) framework as an additional lens to adopt in critical game analysis.
- Student explore descriptions of games developed for commercial entertainment and education (e.g., Spore, Urban Science, Quest Atlantis, Mission Biotech). They identify designed characteristics of TPC and opportunities for ICCE.

Assignments

- Critical Game Analysis Paper

Week 9: Revisiting Essential Questions

Class Topics/Activities

- Students reflect on the essential questions of the course.
- Students begin working on their final presentation.

Assignments

- Reflective blog
- Learning in game-based resource post

Week 10: Summation

Class Topics/Activities

- Students present their final plans using a slide deck, a podcast or a medium of their choice.
- Students synthesize their understanding of TPACK, game genres and pedagogy, content and design.
- The action plan may include a proposal for implementing a specific game or a general plan to introduce games in students' work setting.
- Students consider insights gained from course readings, discussion boards, assignments, game playing experiences, needs, opportunities and barriers in the respective work setting to propose a plan to implement games.

Assignments

- Final presentation TPACK Strategy

COURSE BEST PRACTICES

We have found the following practices to work extremely well for a course that welcomes students from different disciplines and varying experiences with game playing and analysis. The first five are specific to this course, and remaining cut across all game-based learning courses designed for the GBL concentration at Drexel University.

- Encouraging game playing, and by extension, developing game literacy to help students bridge theory and practice.
- Emphasizing that students play a variety of games (individually and with others), and observe others play games, and do so regularly so that intersection of pedagogy and content becomes apparent.
- Inviting renowned senior scholars in educational technology such as Chris Dede, Eric Klopfer, Punya Mishra, and David Williamson Shaffer to deliver lectures on teaching, learning, and assessment in games at the University level, and incorporating those archived videos into the course to introduce students to big ideas in the field.
- Inviting guest speakers who design, study, and incorporate games for training and education

in a variety of contexts. For instance, Kelli Dunlap for game design for mental health, Sagit Betser for game analysis and integration of commercial entertainment games in K-12.

- Facilitating students to connect hands-on game playing experiences with insights from readings while contributing to an ever growing repository of game reviews, and during asynchronous and synchronous discussions.
- Presenting information to many foundational ideas in bite-sized or meaningful chunks.
- Front loading the course with readings – Many key readings and resources are assigned in the early weeks with a gradual reduction in the number of readings so that students have time to reflect on and synthesize the readings and construct their understanding games for learning for actionable plans.
- Balancing the general and specific by introducing basic ideas on games and learning and always encouraging students to make connections to the use of games in their professional context.
- Reducing cognitive load by not assigning any discussion boards or additional activities in the weeks when a paper assignment is due.
- Designing a variety of assignment types to help students construct their models of understanding and express ideas.
- Culminating the course with an action plan that helps students propose the use of game-based learning in their professional settings.

Over the years, some ideas were not as successful. For instance, initially, we tried to engage our students in game design to create games for learning. In 2010, the idea of game-based learning included exploring how teachers could design and develop games. However, we learned over a two-year period through student demographic and feedback, that students in education programs generally do not have the design and programing background. This issue is compounded in a course that is taught during a quarter which is only 10 weeks long. There were few successes in the development of games and eventually we pivoted back to a focus on investigating the design of games and how to design curricular experiences around games with models such as Inquiry Communication Construction and Expression (ICCE- Foster & Shah, 2015), Technological Pedagogical Content (TPC-Foster, 2012; Shah, 2019), and Play Curricular activity Reflection Discussion (Foster & Shah, 2012; 2015b; Shah & Foster, 2014).

FUTURE COURSE PLANS

As a course that is anchored heavily in supporting students' practical understanding of the educational merits of games, we aim to expand the breadth of games students are exposed to. For instance, digital games are increasingly designed with more immersive, interactive, and interdisciplinary experiences.

For instance, the spectrum of extended reality (XR) games which includes augmented reality (AR), virtual reality (VR) and mixed reality (MR) presents novel opportunities for enhancing instruction and engaging learners. We hope to introduce students to these XR environments and become aware of their applications in K-16 education and workforce training. While the course focuses on digital games, we also want to help students gain an understanding that the TPC lens can be used for all

kinds of games, including table top games such as board games and card games. Moving forward, we also want to help students make a clearer distinction between games and gamified environments. Educators and professionals often confuse between the two; therefore, it is important that they learn what makes them different and how that impacts teaching and learning.

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CHAPTER 10.

DESIGNING, PLAYING AND LEARNING (TIP 641)

MATTHEW FARBER [1]
UNIVERSITY OF NORTHERN COLORADO

Course Title: TIP 641: Designing, Playing and Learning
Course College/School: College of Education and Behavioral Sciences/School of Teacher Education
Course Department/Program: Technology, Innovation, and Pedagogy
Course Level: Graduate
Course Credits: 3
Course Length: 8 weeks
Course Medium: Online
Course Keywords: teacher education, play theory, design thinking, game-based learning, gamification

CATALOG DESCRIPTION

Explore opportunities for creating, designing, tinkering and making in learning contexts. Develop an understanding of theory and practice for creating environments for learners to design using available resources and modes. Explore paradigms establishing educational innovations that challenge traditional norms in pedagogical and assessment practices. Investigate theories and practice of creativity and change in the processes of innovating teaching and learning.

Design and develop games for educational contexts. Explore various design tools and examine research and implementation issues related to gaming in various educational settings.

COURSE PURPOSE AND OBJECTIVES

Students will explore opportunities for creating, designing, tinkering and making in learning contexts analyze theories for creating environments for students to design; identify and apply 21st century skills; create environments to foster design, play, and learning; appreciate opportunities for play, tinkering, creating, and designing. Through this course students will: Understand current and future technology trends in gaming; unpack game design and development processes; design an educational

1. Matthew Farber, Ed.D. (Matthew.Farber@unco.edu) is an assistant professor at the University of Northern Colorado, where he founded the Gaming SEL Lab. He has been invited to the White House, authored several books and papers, and is a frequent collaborator with UNESCO and Games for Change. His latest book is *Gaming SEL: Games as Transformational to Social and Emotional Learning*. For more, please visit MatthewFarber.com.

game and produce appropriate design documentation; design and build a digital application (prototype is acceptable); summarize research on educational games; explore integration of gaming in pedagogical practices.

Students will

- Complete all reading assignments and engage in process work and discussions as assigned. This includes discussion boards, collaborate sessions, short assignments, or other projects.
- Create a simple digital gaming application. This can a prototype but must be functional.
- Design an educational game and develop all of the design documents and non-digital prototype for promoting their game.
- Design a gamified educational experience (classroom, online, professional or adult learning, etc.) that integrates elements of game design and play. Present this by engaging the class in a small element of their experience.

COURSE CONTEXT

The goal of the program in Technology, Innovation and Pedagogy is to develop educational professionals and classroom teachers that have foundational theoretical knowledge of technology infused pedagogy for transformative teaching and learning. This is a course in the Technology, Innovation and Pedagogy master's program. It is an elective that can be taken by students interested in applying innovative practices to teaching and learning in unique learning contexts. It builds practical knowledge in a subarea most relevant to educators interested in working in K-12 or associated areas.

COURSE PEDAGOGY

Building with LEGO bricks, remixing sounds in podcasts, assembling sensory words to write haiku, and clicking blocks together in coding applications like Scratch or MakeCode are all examples of constructionism—learning through making, reflecting, and sharing a personally meaningful artifact (Holbert et al., 2020; Papert, 1980/2020). Constructionism is based on Papert's (1980/2020) influential book, *Mindstorms: Children, Computers, and Powerful Ideas,* which describes constructionism: learning through active engagement of making, reflecting upon, and sharing an external artifact (Kafai & Burke, 2015, 2016; Papert, 1980/2020; Resnick, 2017). Rather than using games as teaching machines, students can become bricoleurs, constructing "theories by arranging and rearranging, by negotiating and renegotiating with a set of well-known materials" (Turkle & Papert, 1991, p. 8). Or, as Papert (1993) wrote, "Like other builders, children appropriate to their own materials they find about them, most saliently the models and metaphors suggested by the surrounding culture" (p. 19).

The textbook adopted for this course is Resnick's *Lifelong Kindergarten* (2017), which is based on constructionism. Resnick distills creative learning to the 4 Ps: Projects, Passion, Peers, and Play, referencing Papert throughout the book. Scratch, the visual block-based coding language, is a descendent of Logo, from Papert. These principles are foundational to this course and guide all pedagogy.

The pedagogy of course is guided by *constructionist gaming* principles from Kafai and Burke (2015; 2016), which combine Papert with on Gee's notions of learning and literacy from video games to

include making and sharing. Constructionist gaming describes playing, followed by game making, and then sharing (Kafai & Burke, 2015, 2016). *Minecraft* and *Fortnite* are two examples. Other constructionist games include *LittleBigPlanet 2*, *Dreams*, *Super Mario Maker 2*, and coding apps, like Scratch, MakeCode. Like *Minecraft*, coursework has a "Survival Mode" where students try a game or technology, then assignments are "Creative Mode," project-based game design where students are afforded time to reflect, share, and iterate.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Course Textbook

Resnick, M. (2017). *Lifelong kindergarten: Cultivating creativity through projects, passion, peers, and play*. MIT Press.

Additional Required Readings

Culyba, S. (2018). *The transformational framework*. ETC Press.

Kafai, Y. B., & Burke, Q. (2016). Constructionist gaming: Understanding the benefits of making games for learning. *Educational Psychologist, 50*(4), 313-334.

Schrier, K. (Ed.) (2019). *Learning, education & games vol. 3: 100 games to use in the classroom and beyond.* ETC Press.

Software

- Scratch: https://scratch.mit.edu
- Twine: https://twinery.org/2/
- Adobe Spark Education: https://spark.adobe.com/ex/edu/
- Classcraft: https://www.classcraft.com

Hardware

- Computer (Mac or PC)

COURSE ASSIGNMENTS

Readings, Viewings, Discussions, Process Activities, Reflections

Students are expected to read and respond to the assigned readings. The purpose of these reflecting on your reading is to help you synthesize, activate prior knowledge, and apply your learning to your classroom. Time spent reflecting will serve to increase your understanding and help you gain a better grasp of the content of the course material. Guiding questions for both the professional conversation and the written reflection will be provided. Some reflections will be digital, using Google Jamboard (collaborative whiteboard) or Flipgrid (video reflection). Some reflections are graded assignments.

Lifelong Kindergarten

Learn more about the big ideas of creative learning including the four P's—projects, passion, peers,

and play—and the creative learning spiral. You will read chapters from *Lifelong Kindergarten* (Resnick, 2017), then take part in a mini-activity and reflection. Activities include coding and remixing on Scratch as well as reflections on teaching, more generally. This book frames the coursework on learning by making and sharing.

Shark Tank

You will make an online advertisement using Adobe Spark Education (https://spark.adobe.com/ex/edu/) to create a video or infographic or webpage for your game idea pitch. You will design this game in subsequent weeks of this course. You will also share in Discussions to the "Sharks" (guest speakers from the field). This is a game about a game pitch!

Constructionist Gaming

Sign in to *Minecraft: Education Edition* (free trial) using your school email Office365 account. Download a lesson map from the National Writing Project mentioned in the Edutopia article (https://www.edutopia.org/article/guide-teaching-writing-minecraft), as well at https://education.minecraft.net/blog/teach-writing-with-the-new-english-language-arts-pack.
After completing one of the activities, share screenshots from your experience, and write a reflection on how these activities invite youth to play with the connections between creative writing and creative gaming.

Play in Everyday Things

In this assignment, tinker with a physical material like plastic cups, straws, and string. Reflect on your tinkering process. Share and comment in Flipgrid.

Toy Take Apart

First, read MIT's Mitch Resnick on What 'Toy Story' Gets Wrong About the Future of Play (https://www.edsurge.com/news/2017-09-19-mit-s-mitch-resnick-on-what-toy-story-gets-wrong-about-the-future-of-play). Next, take apart a toy (carefully!) and share a reflection connecting to the reading. Follow the instructions from Exploratorium (https://www.exploratorium.edu/tinkering/projects/toy-take-apart). Share and comment in Flipgrid.

Design a Learning Game

Using the Institute of Play's Q Design Pack: Games and Learning resource (on Connected Learning Alliance: https://bit.ly/2N5QFZQ), design an analog learning game that is a system, not a quiz. See *Socratic Smackdown* and *Absolute Power* print-and-play games on https://clalliance.org/institute-of-play/ as examples, as well as other resources. Use the templates in the Q Design Pack: Games and Learning.

Transformational Twine Game

Often, learning on a computer, either online or face-to-face (i.e., Google Classroom in K12 on Chromebooks) can be transactional, or transmissive. However, innovative learning can be transformational. Here's an example: a reading app or game may "teach" reading, somewhat like a Skinner box, complete with extrinsic rewards. These extrinsic rewards may make kids dislike reading

(do you read in your personal life for pleasure, or do you keep a book log with the hope of getting a Pizza Hut coupon?). More than teaching reading (or math, or cooking, or any content area), to be transformational, education should encourage students to want to read. Similar, a civics game can teach how-to vote, but a transformational civics game would impart a civic disposition on youth to want to be civically engages—to want to vote.

Read *The Transformational Framework* (http://press.etc.cmu.edu/index.php/product/the-transformational-framework/) (Culyba, 2018) ebook (free download), which was written to help designers create games that change players. Centered around eight exploratory questions critical for every team working in this space, the Framework provides tips, best practices, and insights that help teams navigate the challenges of developing transformational games. As you read, think about the Eight Exploratory Questions, because those should guide your innovative, transformational assignment! The Transformational Framework is an approach centered on the player—or, in your case, the student. As you read, The Transformational Framework refers to how games can be designed "to change players in some way" (Culyba, 2018, p. 7). In transformational games, player dispositions are the design goal, not didactic teaching of a specific content or skill. For instance, a game about public health designed using this framework may try to transform how players think about vaccinations, rather transmitting knowledge of how vaccinations work. A civics game can do more than teach when and how to vote: it should impart civic engagement. A reading game should inspire reading. A citizen science game should promote youth too go outside and explore.

Next, watch a video about role-play in classrooms: https://youtu.be/2xT3dBO7Duk. Think about role-play and how that can transform your student/player. Finally, design a Twine interactive fiction experience around a player change. There are Twine tutorials in the course. How will you make the Twine assessable and achievable so that a transformation can be compared to the student/player's initial state. Will there be curricular materials or can the game alone do this? With your twine, write a 300-word reflection sharing your design process, connecting to (Culyba, 2018). The reflection is an in-depth analysis of the learning experience, the value of the derived learning to self or others, and the enhancement of the student's appreciation for the discipline. Connects to The Transformational Framework.

Class Games Book

Read chapters from *Learning, Education, & Games, Vol 3: 100 Games to Use in the Classroom & Beyond* (http://press.etc.cmu.edu/index.php/product/learning-education-games-volume-3/) (Schrier, 2019), which can be downloaded for free. Next, it's your turn! Your goal is to adapt a commercial game to classroom learning standards. You will author a 2-3 page "chapter" on a game that is not in the book. Your "chapter" can be a tabletop or digital game or an app. To make things simple, I created a Google Doc template: http://bit.ly/3nKZTY2. Please "File > Make a Copy" to get your own copy to edit. Citations are not required; however, if you do cite, be sure it is APA 7. I will assemble these together in one PDF to conclude the course, as a class ebook!

Certified Classcraft Educator

Classcraft has launched a Certified Educator Program (https://info.classcraft.com/cce) designed to deepen teachers' understanding of Classcraft and the pedagogy behind it. To complete the program, JOIN as a TEACHER. You can create a free account on game.classcraft.com/signup. You will then be

able to complete the Certified Educator quest and take the quiz. This is a micro-credential you can include on your CV. The goal here is not to so much as knowing a "product" or tool (Classcraft), but to understand intrinsic motivation in context, in a gamified system. *This is an "all-or-none" single-point rubric.* The passing score is **60%** on the Classcraft quiz, which you can take as many times as you want. Be sure to send a screenshot image as you await confirmation from Classcraft.

Gamified Quest and Final Reflection Paper

Use Classcraft to design a gamified quest. When you join as a Teacher, you have some choices… there is a "Demo" class set up by default with fake students. You can use that one for quests. Or, Option 2 is to click to manually enter in students. I usually add one name only (my son's name). Once you do, everything opens up. Use the free version of Classcraft: You can create free accounts on game.classcraft.com/signup and you will have access to quests with a maximum of 6 objectives per quest. Your quest should have: a narrative: *Why are students going on this quest?* Your quest should branch to offer students choice on what to learn (e.g., if you are teaching the American Revolution, students may explore specific battles or events) as well as what to produce (student demonstrate learning with a slideshow, or a podcast, etc.). This can be by branching, which I know is limited in the free version, or with a bulleted list (like a menu) of choice written in the Objectives

You will turn in:

- Link to your Classcraft Quest. I will import ALL of your quests to one island in the Classcraft Class you previously joined. You can then view and share each other's!
- 300-word paper reflecting on how your quest motivates learners (e.g., self-determination theory in gameful pedagogy).

COURSE ASSESSMENT

Assignments are weighted by group (100% total):

- Lifelong Kindergarten Modules (10% of grade)
- Projects and Passion (10% of grade)
- Constructionist Gaming (10% of grade)
- Peers and Play (10% of grade)
- Games as Systems and Game-Like Learning (10% of grade)
- Teachers as Educational Game Designers (10% of grade)
- Game-Based Lesson Writing (15% of grade)
- School as a Game (15% of grade)
- Class Interactions/Practices (10% of grade)

EXPANDED COURSE OUTLINE

Week 1: Course Introduction

Class Topics/Activities

- Students meet each other on Flipgrid (video reflection).
- Playful web annotations: Social Annotation in the Digital Age (https://www.edutopia.org/article/social-annotation-digital-age) blog on Edutopia, leading to activity where students annotate the syllabus using Hypothesis (https://web.hypothes.is).

Assignments

- 30 Circles Creativity Challenge and reflect on how it can jump start ideation: https://www.ideo.com/blog/build-your-creative-confidence-thirty-circles-exercise. Students receive a paper with 30 circles and are asked to turn as many of the blank circles as possible into recognizable objects in 5-minutes. They share a smart phone image and share in Flipgrid.

Week 2: Projects and Passion

Class Topics/Activities

- Read: "Doing a Project" vs. Project Based Learning: https://www.pblworks.org/doing-project-vs-project-based-learning
- Jamboard: leave a note: Crafting Driving Questions That Drive Projects
- Read *Manifesto: The 21st Century Will Be Defined by Games* (online, here: http://bit.ly/3qfVxK2) (Zimmerman, 2015)

Assignments

- Complete Lifelong Kindergarten book readings and activities: Projects and Passion
- Shark Tank

Week 3: Constructionist Gaming

Class Topics/Activities

- Annotate Kafai and Burke (2016) article using Hypothesis.

Assignments

- Constructionist Gaming in Minecraft: Education Edition

Week 4: Peers and Play

Class Topics/Activities

- Learn about peers and play.
- Discussion: What is your play personality?

Assignments

- Complete Lifelong Kindergarten book readings and activities: Peers and Play
- Play in Everyday Things
- Toy Take Apart

Week 5: Games as Systems and Game-Like Learning

Class Topics/Activities

- Watch the Game-Like Learning series of videos that bring the principles to life, offering a view into the way they are implemented at the NYC public school Quest to Learn (https://www.q2l.org). Each video shows how the core design principles of the model become classroom practice, highlighting just some of the ways game-like learning can be effectively used by students and teachers: https://clalliance.org/institute-of-play/. Respond in Discussions about how you can connect Game-Like Learning in your teaching.
- Explore these Slides: Games as Systems (http://bit.ly/2LS5rCV). In it, we will "hack" systems such as tic-tac-toe, making it for three players. Slides connect to James Paul Gee's video on systems, How Wolves Change Rivers video, and a review of the MDA Framework (Hunicke et al., 2004) from designer Bob De Schutter.
- Read the Institute of Play's Q Design Pack resource (on Connected Learning) on Systems Thinking (https://bit.ly/3oXOy8c).

Assignments

- Design a Learning Game

Week 6: Teachers as Educational Game Designers

Class Topics/Activities

- Twine and Interactive Fiction and Twine Tutorials.
- Share and comment on classmate's games in Discussions.

Assignments

- Transformational Twine Game

Week 7: Game-Based Lesson Writing

Class Topics/Activities

- Read chapters from *Learning, Education, & Games, Vol 3: 100 Games to Use in the Classroom & Beyond* (Schrier, 2019)

Assignments

- Class Games Book

- Week 8: School as a Game

Class Topics/Activities

- Get Your Gamer Motivation Profile from Quantic Foundry: https://apps.quanticfoundry.com. Share your results with the class.
- Read: The Difference between Gamification and Game-Based Learning: http://bit.ly/3oPn58P.

Assignments

- Certified Classcraft Educator
- Gamified Quest + Final Reflection Paper

COURSE BEST PRACTICES

In my experience, students in this course should be afforded choice and freedom to design games and projects in their content areas, for their students. I was trained by faculty from Quest to Learn and the Institute of Play as a fellow in HistoryQuest, a TeacherQuest professional development experience over a 2-week intensive period. This course is informed by that experience, as the participants were practicing teachers. In other words, students need to be respected for the teaching expertise they bring this course, regardless of their experiences playing or making games.

I have taught using *Lifelong Kindergarten* (Resnick, 2017) with undergraduate pre-service teachers, and this course is similarly informed by that experience. (I also shared that approach with a colleague formerly at the Lifelong Kindergarten Lab, who is in several of the online videos on Lifelong Creative Learning). The approach is as follows: Early in the course, have students read the course text and participate in online course videos (https://learn.media.mit.edu/lcl/). These modules have students design and share Scratch projects, reflect with images and text on childhood objects, peer learning environments, play with everyday objects, and more. Students then read the book, which centers on constructionism and gaming, connecting with reflection to the projects they experientially make and share. This is followed by the balance of the course, where students apply the 4 P's from the book to the remaining week's modules.

In essence, I am teaching students to be the type of educator that teaches at Quest to Learn or who would be part of the Connected Learning Alliance community, more generally. Coursework is also informed by Karen Brennan's Creative Computing work and her HGSE course, T-550: Designing for Learning by Creating.

Regarding other iterations on how to teach my course, TIP641, I am a proponent of a "Minecraft" approach, having students start in Survival Mode, experiencing a game or technology, and then afforded Creative Mode time to design, share, and reflect.

Some student examples of games for learning from my course:

- Tell-tale Heart Digital Escape Room: http://bit.ly/35HCIb3
- Wizard of Oz Twine: http://bit.ly/3qfWh1M

- Photosynthesis Twine: http://bit.ly/3oRP5ZG
- Great Baking Challenge – Math Twine: http://bit.ly/3bFA5dr
- Class Ebook on SEL and Ed Tech and Games: http://bit.ly/3soQlp7

FUTURE COURSE PLANS

An earlier iteration of this course was maker-focused. Maker education content is covered in other core department coursework. As a result, this class was able to shift towards game-making, while still keeping play and play theory at its core (as per the stated curricular goals and objectives). Play theory is foundational to educational psychology, as well as games. In games, constraints create a possibility space, which is also where learners can be brought to the zone of proximal development.

Some of the foundational work in educational gaming over the past decade was centered on appropriating massive multiplayer online (MMO) guilds and communities from *World of Warcraft* into classrooms. To a small extent, this may have led to gamified learning. Few classrooms teach with World of Warcraft, and it can be argued that the games teachers adopt have changed. In many K12 classrooms, *Scratch*, *Minecart*, and escape room games have taken hold more than the classroom MMO.

While games change, many of the principles remain fairly constant (although, they evolve as well). Constructionism, which undergirds project-based learning, the pedagogical approach where students learn through making and sharing artifacts that address solving real-world problems or answer complex questions (e.g., Resnick, 2017). Marrying constructionism to game design in project-based learning goes further in deeper learning contexts, as students may abstract concepts into metaphors playable in systems.

In the future, I'd like to see more location-based games in this course, and also time for teacher educators to host events like game jams. It would be interesting to see how they could use curricular materials from Global Game Jam NEXT or Games for Change's Student Challenge and adapt for K12 learning or in informal settings.

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CHAPTER 11.

GAMES AND LEARNING (HCOL 41333)

WENDI SIERRA[1]
TEXAS CHRISTIAN UNIVERSITY

Course Title: Honors Colloquium: HCOL 41333 Games and Learning
Course College/School: John V. Roach Honors College
Course Department/Program: N/A
Course Level: Undergraduate (upper division)
Course Credits: 3
Course Length: 15 week
Course Medium: Online (see Covid-19 note)
Course Keywords: Gamification, Game Studies, Education, Learning. *Minecraft*, Online

CATALOG DESCRIPTION

From learning about history in *Oregon Trail* to training for a 5K using *Zombies, Run!*, game-based systems are an increasingly important modern tool for learning. Games have been used for everything from teaching the alphabet to preschoolers through the Osmo, to helping surgeons perfect their surgical technique by playing *Halo* and *Half-Life 2*. Despite the growing popularity of learning games in educational, vocational, and even therapeutic contexts, many questions remain. What do players learn from games and when does this learning transfer? How do players learn while playing? When are games and game-based systems useful in education, marketing, professional development, and beyond? In this course we will examine the promise and challenge of serious games in a variety of fields, exploring concepts that include the work/play divide, gamification, participatory culture, and active learning. Students are actively encouraged to apply these concepts to their own interests and majors throughout the course.

COURSE PURPOSE AND OBJECTIVES

A key focus of this course is interrogating how students define both "games" and "learning". As we do so, we think about defining as a value-laden proposition that includes and excludes. My ultimate goal

1. Wendi Sierra (w.sierra@tcu.edu) is an Assistant Professor of Game Studies at Texas Christian University, where she teaches about a variety of topics related to games studies (including learning, representation, and narrative). Her book, *Todd Howard: Worldbuilding in Tamriel and Beyond*, analyzes the worldbuilding style that has made Howard's games critical and commercial successes from *Morrowind* to *Fallout 4*. Her game, *A Strong Fire*, teaches select vocabulary in the Oneida language through interactive narratives and mini-games.

for the course, given a student group unlikely to go into fields related to either games or education, is to provide the tools for students to be critically engaged life-long learners. At the beginning of the course, we think about learning from traditional perspectives; we look at educational games used in formal learning environments. However, we quickly transition to games used in informal learning environments on traditional subjects and to games that encourage specific actions or behaviors but would not traditionally be considered "educational". We also explore gamified apps that use game design principles but might not traditionally be considered "games".

- Students will identify and define key terms related to games and learning
- Students will apply terms to their own experiences, both within the course and in their courses of study at TCU
- Students will analyze how games are used for learning in a variety of formal and informal learning environments across a number of disciplines
- Students will evaluate approaches to games and learning in five different disciplines using terminology and principles from course readings in games-based learning
- Students will create a plan for using games as a learning tool in a field of their choice

COURSE CONTEXT

The John V. Roach Honors College at Texas Christian University has a two-tiered curriculum, lower-division honors and upper-division honors, each part of which may be completed independently. Upper-division honors students may choose to pursue Departmental Honors and/or University Honors. Departmental Honors is typically a six-hour curriculum, undertaken over two semesters, in which work with a faculty mentor in their major or minor to conduct original research or produce original creative works. University Honors is a nine-hour curriculum, comprised of three Honors Colloquia: small seminars for junior and senior honors students (enrollment typically capped at 12) devoted to immersive exploration of big-picture topics relevant to students from diverse disciplinary backgrounds.

As an honors colloquium, "Games and Learning" attracts students from a wide variety of backgrounds, both in terms of major and in terms of gaming experience. There are a wide variety of honors colloquia, with other popular courses exploring everything from musical theater and politics to philanthropy and giving. Given the breadth of choice (roughly 20 different colloquia are offered each semester), those selecting Games and Learning are generally opting into this subject, regardless of disciplinary or gaming background. Thus, I am able to assume a dedicated and enthusiastic student population but not necessarily a group that is fully "gaming-literate."

This mix of student characteristics had a substantial impact on the structure of the course and the games we played in the course. As can be seen in the Expanded Course Outline below, the initial four-week unit of the course introduced students to foundational vocabulary. In addition to introducing students to the main ideas of the course, this unit was meant to build a sense of community within the class and to help students get on a level playing field, so to speak. Because students came from majors across campus, it was important that we as a class were able to build a sense of shared vocabulary and understanding that would not come from having a similar disciplinary background.

Game texts in particular were chosen to be as accessible to novice gamers as possible. In the five-week foundations unit we focused on *Minecraft Edu*. Unlike the standard retail *Minecraft*, *Minecraft Edu* has pre-built modules that teach players how to move using WASD, how to look around with the mouse, and other basic game literacy skills. The game also includes educational modules for a variety of disciplines, allowing students to explore how their home subjects were represented in the game (albeit, at an elementary or middle school level). Weekly gameplay assignments alternated between working in skill level groups (all novices together, all advanced players together) and working in small teams of mixed level groups. The skill level groups allowed students to tackle challenges appropriate to their comfort level in the game, while the mixed level groups allowed students to work in mentoring partnerships.

COURSE PEDAGOGY

In general, I define my pedagogy as one informed by and infused with play. Eric Zimmerman defines play as "the free space of movement within a more rigid structure. Play exists because of, and also despite, the more rigid structures of a system" (2004, p.159). Classrooms are, generally speaking, rigid structures. There is a power structure and an assessment system with substantial real-world impact on students. Thus, finding a space for play inside a classroom does not always literally mean playing games, but can also include looking for opportunities to create a "free space of movement" within the classroom space by de-centering authoring, creating moments of exploration, and providing students with some level of autonomy in course activities. Moreover, play can also be highly disruptive in productive ways. Mary Flanagan observes that while play is sometimes a socializing/enculturating force, it also has the potential to be an avenue to challenge cultural norms and expectations (2009). Play can encourage us to step outside ourselves and see new perspectives, or to temporarily set aside constrains to look at a system from a new angle. Thus, my goals with a play-based pedagogy include providing students with opportunities to explore systems, saturated with elements of meaningful choice, non-linearity, and scaffolded challenges.

In addition to the pedagogical values I bring to every course, Honors colloquium courses come with a prescribed pedagogy. Fortunately, it is one sits that nicely with my own style. The description of colloquia reads: "Honors colloquia are small seminars for junior and senior honors students (enrollments typically capped at 12) devoted to immersive exploration of big-picture topics relevant to students from diverse disciplinary backgrounds". Indeed, while many departments in a university find their sense of cohesion around disciplinary history, methodology, and/or epistemology, the Honors College finds a similar sense of cohesion through its focus on high impact, student centered pedagogical approaches. While I have refined my personal definition of play-infused teaching over the last decade (the majority of which I spent teaching non-honors students), it does align closely with what Kingma, Heijne-Penninga, and Wolfesnberger have called "autonomy-supportive" (2018). Their model of a supportive framework that scaffolds free exploration includes (p. 2):

- Strategies that create space for students' questions, choices, and initiatives' scaffolding
- Strategies that foster the sense and excitement of experimentation
- Strategies that treat honors students as 'junior colleagues' in research and education

For this particular course, one where few (if any) students have any aspirations toward the gaming

industry, a careful focus on how students learned was equally important to the content they learned. From the description of honors colloquia, I drew three important injunctions.

First, that the courses must be discussion centered. Creating a discussion centered course inherently means creating an environment where students feel comfortable sharing ideas and confident in their ability to do so. Because I anticipated students with little gaming background, it was important to me that as a group we had common gaming experience that could serve as generative material for those discussions. Rather than watch some students get left behind in references to games they had never played or heard of, our discussions continually revolved around a "class game" that everyone had played and our connection of that class game to our various readings. Rebekah Shultz Colby, whose "Game-Based Pedagogy in the Writing Classroom" explores a myriad of ways games can be used in college classrooms, discusses the collaborative potential of a course game: "through collaborative gameplay students can learn the social practices inherent in working within teams, collaborative practices which they will need in their professional lives" (2017, p. 66). The course followed a format of read (some scholarship), play (a game illustrating concepts), discuss (the connection of the reading to the game), write/reflect (students' own perspectives on the reading and how it applied to their major studies/other games).

Second, that the course both assumes no disciplinary background and support a variety of disciplinary backgrounds. This was done in a few ways. First, we explored readings from a variety of disciplines with a variety of methods. There was a constant implicit question of method, as we looked at how different works asked slightly different questions of games, gamers, and designers. We also were visited by a total of five guest speakers, each from a different discipline, to address how the concepts related to learning and games figured into their field.

Finally, that the course should offer some profound insight applicable outside the course itself (by dealing with a "big-picture topic"). In practical terms this often involved reflecting back on their own experiences, majors, and aspirations. Ash and Clayton note that "students in applied learning pedagogies may have a vague sense of the impact their experiences have had on them but not be fully aware of the nature of their own learning, its sources, or its significance" (2009, p. 26). Thoughtfully designed reflection helped to tie our play-infused pedagogy back to big picture ideas, by "help to generate and deepen learning in an applied learning environment" (Ash and Clayton, 2009, p. 36). We set out to broaden our understanding of both games and learning, and to think about how principles and best practices from both domains could be applicable in other, non-formal learning or game environments. As mentioned in the course objectives section, my ultimate goal is to create critically engaged lifelong learners.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

In the later units of this course students worked with variable texts or read articles assigned by guest speakers. In the course assignments section I will describe more fully how these readings and games were chosen and assigned. In this section I will describe the two foundational texts that supported the first third of the course and were essential in the construction of a class community. These texts became common touchstones for our class community, and though we transitioned to other materials around the fifth week of the course, students referred to these throughout the course.

McGonigal, Jane. *Reality is broken: Why games make us better and how they can change the world*. McGonigal's *Reality is Broken* served as our foundational course reading. McGonigal offers an accessible introduction to many important concepts in game studies in a way that is accessible to non-gamers. She also offers opportunities for us to challenge both what we mean by game, looking at apps and gamified environments, and to challenge what we mean by learning, as she explores both traditional educational environments and things students might not normally call learning (*Nike* , for example). McGonigal proved effective and was referenced extensively in nearly every class discussion.

Minecraft Edu. Students played *Minecraft Edu,* both individually for homework and as a group during some class sessions. Licenses were purchased by the Honors College. The *Edu* version of *Minecraft* provides additional flexibility to instructors that make it a fantastic classroom tool. There are new items, including a camera that allows students to take screen shots and a portfolio that allows students to caption their pictures and export them as a pdf (for easy upload to an LMS). There are also additional modules on learning how the game works (including how to walk, move the camera, and craft) and educational modules for a variety of disciplines. Finally, it is easy and quick to host a server for students to join during a class session (though these servers are only accessible while the instructor is actively hosting).

During "*Minecraft* weeks" early in the semester we would meet once a week in Zoom and have our other class meeting via *Minecraft* (with voice chat through *Discord*). Students completed individual homework assignments in *Minecraft* and collaborated on group projects during our class sessions. Some assignments were the same regardless of skill level: create a house that is at least 12×12 with two different materials, explore an educational module of interest to you, etc. However, as a sandbox, *Minecraft* also provided a substantial amount of flexibility that allowed me to create assignments scaled to different difficulty levels for students. In one class session students selected a group to work with, dividing into overground, underground, or nether groups (which represented increasing difficulty). Each group was given a different task; students were able to view tasks before selecting groups. The overground group worked together to establish a base of operations at least 200 blocks away from spawn. The underground group tried to find as much diamond as possible. The nether group explored a nether fortress and brought back proof of their success. All groups were required to support each other and stay together in their journey; if a member died the group had to help that member return before continuing.

COURSE ASSIGNMENTS

Covid-19 Note

This course was taught in the Fall 2020 semester as a fully online class. Texas Christian University mandated that, if instructors choose to teach online, the course had to meet synchronously for at least 80% of the scheduled class time. While not what I would have initially chosen, this focus on synchronous engagement definitely helped to build a sense of class community and also pushed me to think about engagement as I planned our class activities. Overall, the daily structure our Zoom class sessions frequently involved a brief set up, a group task in breakout rooms, and a full class discussion. Some of the assignment types below are not ones that I would likely do in a fully in person class (particularly the discussion board). More on this is discussed in the Future Course Plans section.

Discussion Board Posts and Responses: Students were placed into three groups of four students to respond to discussion board prompts and each other. In the first third of the course (the foundations unit) students were in randomly assigned to a discussion group. Discussion board prompts during this portion of the course focused primarily on reading reflections. In the middle third of the course, discussion board groups were switched to match the reading groups (described more fully below). The prompts in this section of the course focused more on connecting their assigned text to course materials and providing a generative space to work on ideas related to their eventual presentation.

Discussion board posts were required to be between 150-250 words and include citation whenever referencing sources of any type (popular or scholarly). Students were required to read and respond to all of their group members. My hope was that, by placing them in smaller groups, they would be more likely to fully read each other's responses and respond more deeply that they might if looking at a board full of all students. While the discussion boards proved to be a productive space during the middle unit, when students were working on a major group project, my hopes for more vigorous conversation in the first unit did not materialize.

Journals: Students wrote one journal entry a week. Topic varied but were typically focused on application in some way. Most commonly journals asked students to connect one of our weekly readings to a game we played as a class or to their major. The journal was described to students as requiring writing that was both more formal and more detailed than discussion board posts. In other words, while discussion boards were intended to be more of an exploration or conversational space, journals were meant to be a more focused investigation of some specific aspect of a reading. The minimum for journals was 250-350 words, but students frequently hit 500 words or more. Journals were also required to integrate quotes or paraphrases from course readings, while this was not always a requirement for discussion boards.

Daily Work: I used daily work as a catch-all category to include anything that was neither a discussion board post nor a journal. Some of these assignments included activities done during class sessions, while others were homework assignments. Any gameplay assignment typically had a daily grade assigned to it, and these assignments alternated between submitting "proof" of their play or submitting a written description of the play activity. For example, the "build a house" activity described earlier was a daily grade assignment requiring students to submit a picture of their house (using the portfolio function in *Minecraft Edu* to export a pdf). The group activity described previously with overworld, underground, and nether groups required students to write a short reflective paragraph on how their group made decisions. Daily work assignments were, generally speaking, completion grades. I repeatedly emphasized to students that they would never be graded on how good they were at a game, only at how they attempted the game and analyzed the game itself.

Game Text Presentation: In the middle third of the course students worked in groups of four to read and then present an assigned book to the rest of the class (books listed below). This assignment occurred concurrently with the Special Topics weeks. With a foundation in games and learning from McGonigal, and a variety of perspectives presented from our guest speakers, students explored these more focused texts and considered how they could add important elements to our understanding of games and learning. A primary function of their presentation was not just summarizing the book their group read but situating it within the larger class framework and vocabulary we had developed about games and learning.

Students were given short summaries and filled out interest surveys. They were sorted into three groups of four based on those surveys. Presentations were 10 minutes long and used pecha kucka format for presentation and slide design (a highly visual, quick moving presentation style that prioritizes dynamic speaking and presenting). As an online class, all presentations were pre-recorded and then posted on the class discussion board for viewing and responses.

- Costikyan, G. (2013). *Uncertainty in games*. MIT Press.
- Isbister, K. (2016). *How games move us: Emotion by design*. MIT Press.
- Juul, J. (2013). *The art of failure: An essay on the pain of playing video games*. MIT press.

Special Topics Weeks: This isn't precisely an assignment, but as an important feature of the course it merits an extended discussion here. In the middle third of the course, we moved from working on foundational vocabulary and concepts to what I have termed special topics weeks. Each week a guest speaker would select a set of scholarly readings and a game for us to play. The guest speaker then visited our class and shared their perspective on games and learning as it related specifically to their field. These weeks were some of the most rewarding of the course, as students got to hear a wide variety of perspectives and explored everything from *Level EX*, a set of mobile games made to train medical professionals, to *I Love You Colonel Sanders*, a dating simulator made by Kentucky Fried Chicken. The guest speakers were selected from the TCU community, and the disciplines represented included Mental Health Counseling, Medicine/Health Professions Education, Marketing, Rhetoric, and Music. These specific disciplines were selected both to try to provide a variety of different disciplinary perspectives and to match (when possible) to students' interests and backgrounds.

Game Design Pitch: The students' final major assignment was a grant proposal. Students were given an imaginary request for proposals from the fictional National Endowment for Games. This imaginary grant, with the title Transforming the Future Through Games, invited proposals for the creation of a learning game in any field. The proposal required the following sections: Executive Summary, Statement of Need, Project Design, and Plan of Evaluation. Thus, students had to do research both on the problem they identified and on games and learning in that field. The assignment required a minimum of six scholarly, academic sources. At least two sources had to be from class readings and two had to be new sources they had found through their own research. Students were also invited to use popular sources to help create context (many students proposing games about financial literacy found Forbes articles to talk about the impact of the pandemic, for example), but these sources did not count toward the six required.

In this project, students synthesized our course concepts into their own interests. Several students decided to propose games related to their majors—finance students proposed games about financial literacy, an acting student designed a game about learning the international phonetic alphabet and dialects, and a computer science major envisioned a game about combating impostor syndrome in the tech sector. However, a number of students also worked in areas representing hobbies, interests, or personal challenges—a student proposed a game to support managing panic disorders, another imagined a game that would help college freshmen have better relationships with their roommates, and a third created the design for a game that would help encourage American kids to stick with soccer past elementary school (when many apparently switch to other sports).

COURSE ASSESSMENT

Grades for the class were assigned based on a percentage system. Grades were weighted as follows:

- Discussion Board Activity: 20%
- Journal Responses: 20%
- Daily Work: 15%
- Game Text Presentation: 15%
- Game Design Pitch: 20%
- Game Design Reflection: 10%

EXPANDED COURSE OUTLINE

Week 1: Foundations

Class Topics and Activities

- Introduction to course technologies
- First play assignment
- Introduction to games and learning main ideas
- Discussion board groups randomly assigned (students will stay with these groups throughout this unit)

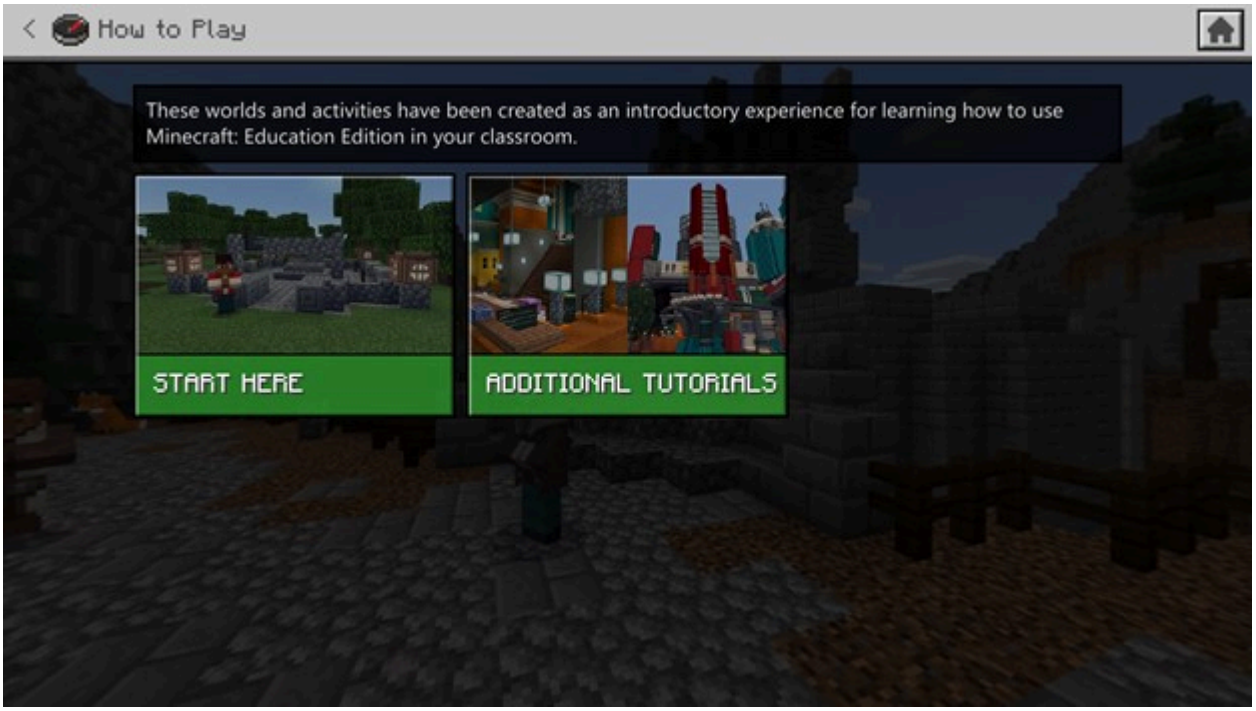
Our first week of class was focused on introducing students to the technologies we would be using in class and defining some key ideas in about games and learning. In the first class session we discussed positive experiences with learning and reflected on what felt like "good learning" to us. We also discussed favorite games and what we enjoyed about them. In the second class session we dug into Gee and McGonigal's definitions of games and learning, comparing them to the observations we had made as a class in our first class session.

Assignments

- **Read:** Gee (2003)
- **Watch:** "Games can Create a Better World": https://youtu.be/dE1DuBesGYM
- **Play:** *Minecraft Edu* for at least an hour https://education.minecraft.net/
- **Write:** Journal about Gee and *Minecraft*
- **Write:** Discussion board post about McGonigal's four motivating aspects of games

Students encountered their first *Minecraft* play assignment this week. This was in part to get any technical issues out of the way early. Thankfully, no students had issues but putting this assignment in the first week meant I would have some time to assist before the game was needed for a full class session if someone had difficulty. For their first assignment, students were simply asked to play for thirty minutes, on their own or with a friend from class. Novice gamers were encouraged (but not required) to complete the "How to Play" lessons (pictured below) included with the *Education Edition*

of *Minecraft*. I also scheduled some office hours specifically for students that might need support in their first play experience. After playing, students reflected on how they learned to interact in this particular game system- what resources or past experiences they drew on to successfully navigate the world of *Minecraft*.



Week 2: Foundations Continued

Class Topics and Activities

- Further support of *Minecraft*
- What is a game? How do we define games?
- How do games motivate us?
- Group Game Text project introduced; preference survey distributed

This week featured our first class session in *Minecraft*, thought we all still played in individual worlds. All students logged on to both *Minecraft* and a discord server created for the class. Students were instructed to go to the "Monthly Build Challenges" section and select the "Build a Better Bedroom" assignment. In this assignment students were given a 20 block by 30 block house to decorate. As we played, we discussed challenges students might be having with the game and reflected on the readings we'd done so far. The images below shows an example of one student's work, and also demonstrates the portfolio option in *Minecraft Education Edition*. This special tool allows students to take pictures in game (using a camera item), write image descriptions, and then export those to a PDF for easy upload into a course management system. Technically much of the same functionality can be done simply by taking screenshots in any game, but the addition of the portfolio and camera greatly simplify the task for both instructors and students.

In the second class session, we reflected on some of McGonigal's key terms, including her definition of "game" and the first several "fixes" she mentions. Students were broken into groups and discussed their experiences both as college students and in *Minecraft*. We then came together as a full group and looked for common themes amongst all groups.

Assignments

- **Read:** *Reality is Broken*: Chapters 1-4
- **Write**: Journal about a learning game of student's choice and connection to Chapters 3-4
- **Write**: Discussion board post- is *Minecraft* a game by McGonigal's definition?
- **Play**: Complete the "Build a Better Bedroom" module in *Minecraft* and post a picture
- **Play**: Build a house of at least 2 materials, at least 12×12 in *Minecraft*

Outside of class students continued to read *Reality is Broken*. Students also selected a "learning game" of their choice. Here I emphasized that the "learning" could be formal (some students picked LSAT study apps) or informal (*Zombies, Run!* was given as an example). This served as an additional text to apply course readings to. Students continued with the learning game they selected for two weeks. Students were also assigned a slightly more complicated *Minecraft* assignment: building a house made of at least 2 materials that was at least 12×12. I invited students to complete this task on any difficulty setting, including creative mode if they chose.

Week 3: Foundations Continued

Class Topics and Activities

- Social elements of learning games
- Alternate/augmented reality games and learning
- Group Game Text Assigned

In week three we completed our first "embodied" class session in *Minecraft*. I created a flat world in creative mode and invited all students to join my server. Students were randomly split into three groups and tasked with building the "tallest safe structure" they could manage. I required that all students participate in the construction, but also stipulated that they could divide the labor however they liked as long as everyone was involved. In this way, I put novice gamers in groups with

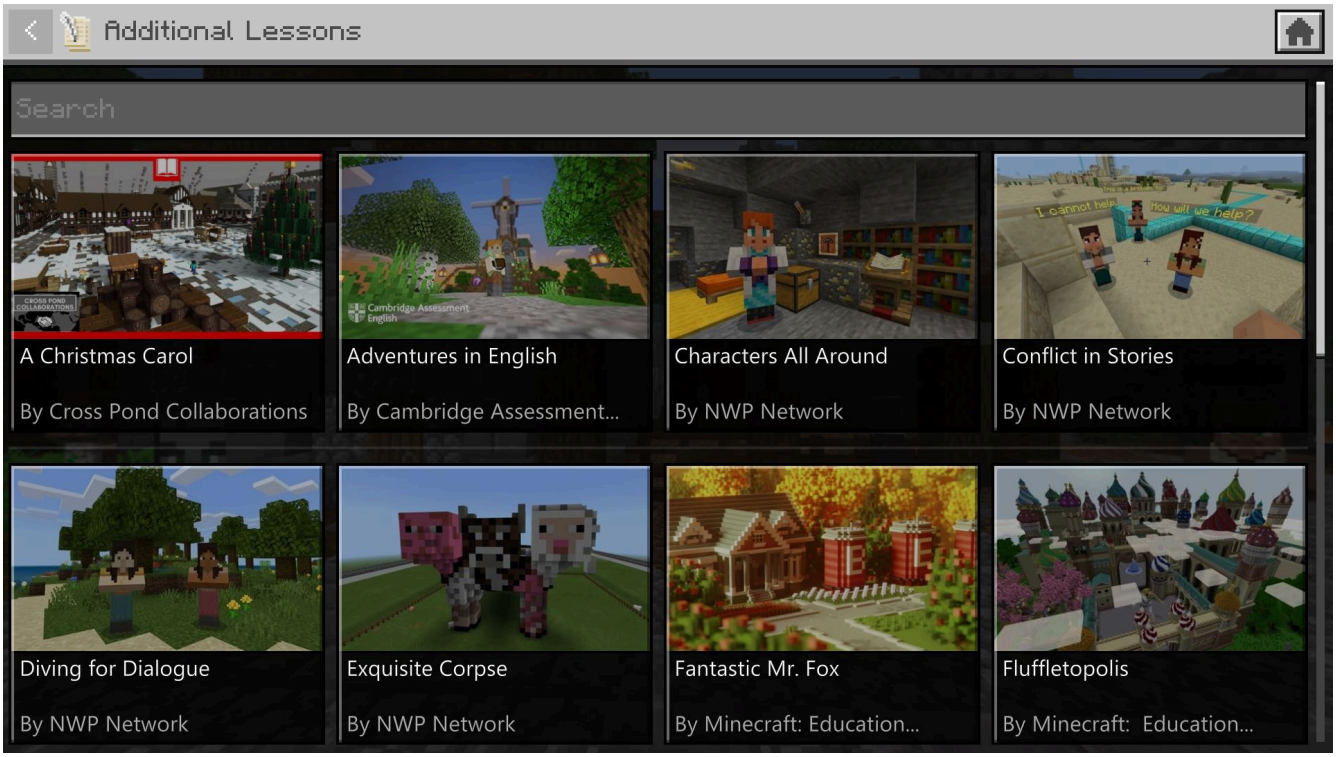
experienced gamers and allowed both groups to articulate their needs and opinions. This ended up being one of the most remarked upon days of class. In one section, students took it upon themselves to first build bridges to each other's structures and then to create a "Unity Platform" between all three groups (pictured below). After the class session, students connected their experience in this class session to McGonigal's arguments about games and social interaction and epic experiences.

In the second meeting of the week, we began a class glossary. Students were divided into groups and assigned sections of the reading. They then created an entry for all key terms in their chapter, including a definition in their own words, a quote with citation, and an example of the term drawn from their experiences in *Minecraft*. This class glossary was used throughout the class as we approached new games and scholarly research.

Assignments

- **Read***: Reality is Broken*, Chapters 5-8
- **Write:** Journal connecting *Minecraft* Module to McGonigal
- **Write**: Discussion board describing a learning game you have played and connecting to McGonigal
- **Play:** Group build activity to create a tall, structurally sound, building
- **Play**: Solo activity to select and play a pre-built module in *Minecraft Edu*'s library

Our second *Minecraft* activity this week, a homework assignment, asked students to find a pre-built module in *Minecraft Edu*'s library, play it, and analyze it using McGonigal. *Minecraft Edu* features a number of teacher-created modules that range from elementary school to early high school and cover just about any subject. Students were invited to pick a subject of their choice and imagine how they might respond to the module if they were the appropriate age. Some students picked modules related to their majors (computer science students gravitated toward the introductory coding lessons) while others simply picked a module that sounded fun (a critical thinking mystery module was popular). The image below illustrates some of the lessons available under the language arts heading.



Week 4: Foundations Conclusion

Class Topics and Activities

- Concluding learning games
- Final *Minecraft* Assignment

While week three's *Minecraft* assignment was one of the most popular class sessions, this week's assignment was unanimously the favorite. In this week we completed the activity described in the "Course Texts" section. Students self-selected a group based on challenge levels and then worked collaboratively with their group to accomplish a task appropriate for their level. Students enjoyed the scaled challenges and the ability support each other. In our class session debrief, several students mentioned learning more about *Minecraft* during this activity than they had in their previous explorations. While last week's session offered a surprising amount of student directed emergent unity, at the end of this class session our "advanced" group of players reveled their more destructive instincts (pictured below).

Group Instructions In Game

In our second class session of the week, we had a "design challenge". Students were put into groups. They were given roughly fifty minutes of class to identify a problem college students face, design a game to address this problem, and connect their design and game mechanics to McGonigal's "fixes". Students chose to tackle a variety of issues, from instructor/student connection to feedback in courses. They wrote brief outlines of their designs and then presented them to the rest of the class.

Assignments

- **Read**: Chapters 9, 10, 14, conclusion in *Reality is Broken*
- **Group Write**: Create a "learning game" for college students. Explain the problem and how your game addresses it
- **Write:** Journal assessing *Minecraft Edu* as a learning game, using McGonigal's principles
- **Play**: Group adventure challenge: overworld, underground, or nether. Share a short group reflection

The journal this week was a summative essay. After four weeks of playing *Minecraft*, students were asked to assess how effective they felt it would be as a learning game for its target audience (primarily elementary and middle school students). They connected their assessment to McGonigal's principles. Interestingly, even though I asked them to focus more on *Minecraft*'s primary audience, several students spoke positively about the game in connection to our own class, particularly with regards to social interaction and community building.

Week 5: Games and Mental Health

Class Topics and Activities

- Guest speakers Joseph LeConte and Eric Gobel from the TCU Mental Health Counseling Center
- Discussion of TCU's "supportive gaming groups" which play *Dungeons and Dragons*, run by the Mental Health Center
- Character sheets for two systems (*Dungeons and Dragons* and *Vampire the* Masquerade) and compared
    - Character Sheet for *Dungeons and Dragons*: https://drive.google.com/file/d/1ULWi61fAdvmPR8rgwWgh6WWVFPmPpUPd/view?usp=sharing
    - Basic Rules for *Dungeons and Dragons*: https://drive.google.com/file/d/1i0A07tO2ulrscgjZ1wATW2Qn7cC30B-_/view?usp=sharing[2]
    - Character Sheet for *Vampire The Masquerade*: https://drive.google.com/file/d/17XdVv0DPNHcnCgYVUuEUKaH0PWbVq3S-/view?usp=sharing
    - Basic Rules for *Vampire The Masquerade:* https://www.dicebreaker.com/series/vampire-the-masquerade/how-to/how-to-play-vampire-the-masquerade-rpg
- Discussion board groups switch to match game text groups

In week five we turned toward our first special topic: Games and learning as it relates to the field of Mental Health Counseling. In our first class session we discussed some of the previous research on games and mental health, and we created character sheets for two different tabletop role-playing systems, *Dungeons and Dragons* and *Vampire the Masquerade*. Ideally, we would have the class play *Dungeons and Dragons* themselves. However, the game is quite mechanically dense, and it would have taken a substantial amount of class time to set up and run even a short session. Thus, with my guest speakers we decided creating a character sheet and watching a video of a gaming session would be the best compromise for our limited time. The Mental Health and Counseling Center ran and recorded a session just for us to watch. We also chose to have students create two characters for different systems so that students could compare how each system highlighted different character and personality traits. In our second class session, the guest speakers discussed their work with the supportive gaming community, answered student questions, and discussed the readings they selected for the day.

2. Wizards of the Coast has made the basic rules free to use and share on their official website: https://dnd.wizards.com/articles/features/basicrules However, in the interest of longevity I have posted the pdf in a google drive.

Assignments

- **Read**: Wright, Weissglass, and Casey (2020)
- **Read:** Kowert and Quandt (2015)
- **Read**: First quarter of your group game text
- **Write**: Journal post: with regards to mental health, what do players learn from games?
- **Write:** Discussion board post: what are the key ideas in the first quarter of your book? How does it connect to anything we have read so far?
- **Play:** Create characters for *Dungeons and Dragons* and *Vampire: The Masquerade*
- **Watch:** TCU-created video of one *DnD* play session (video was made private for confidentiality reasons, many similar videos are easily accessible on YouTube)

During the special topics weeks students both read research about the weekly topic and began reading the game text they were assigned. We did not directly discuss their assigned game texts in class as a large group, but they were frequently given group work time to reflect on their reading and discussion board prompts meant to lay the groundwork for their eventual presentations.

Week 6: Games and Medicine/Health Professionals Education

Class Topics and Activities

- Guest Speaker Kevin Kunkler, Executive Director of Simulation Education, Innovation and Research in the TCU School of Medicine
- Explored different methodologies in articles- case study, meta-analysis, theory-based
- *Level EX* mobile games have cardio, gastro, pulmonary, and airway modules

In our games and medicine week students were asked to pick one of the *Level Ex* mobile games and play it for at least 30 minutes (a trailer for the game with gameplay is available here: https://www.youtube.com/watch?v=dZ4d2RgMAqY&ab_channel=LevelEx). This proved to be a somewhat contentious ask, as many students did not enjoy the graphic realism of these modules, while others found it incredibly interesting and engaging. Our guest speaker spoke about various challenges and innovations in health professionals education, including how games create a lower stakes environment for novice health care professionals to practice skills.

Assignments

- **Read:** Haoran, Bazakidi, and Zary (2019)
- **Read:** Drummond, Hadchouel, and Tesniere (2017)
- **Read**: Gerald et al (2018)
- **Read**: Second quarter of your group text
- **Write**: Journal post: connect one of the readings this week to McGonigal.
- **Write**: Discussion board: connect the main ideas from your text to McGonigal.

- **Play**: Any one of the *Level EX* games for at least an hour: https://www.levelex.com/

Our guest speaker this week assigned three readings using different methodologies, and so we used this as an opportunity to discuss methods in game studies research. Students were also asked to connect both Dr. Kunkler's assigned readings and their own presentation text to McGonigal. In this way, we pulled her framework forward from our foundations unit into the special topic unit.

Week 3: Games and Marketing

Class Topics and Activities

- Guest speaker Eric Yorkston, Associate Professor and Marketing Department Chair
- Introduction to the Mechanics, Dynamics, Aesthetics/Emotions framework (MDA) and Player Types
- Continued work on game text presentation assignment

In the first meeting of this week students were given group work time to discuss their assigned game text. While students had been posting on the discussion board about their text for two weeks, the in-person discussion gave them an opportunity to begin planning out what their presentation might contain. Students were also encouraged to discussed strengths and weaknesses in the skills the project required: summarizing/paraphrasing their text, synthesizing and drawing connections to other course materials, visual/slide design, and presentation skills. Students were admonished to consider doing an equal amount of work, but not necessarily working equally on all parts of the project.

We also played *I Love You, Colonel Sanders!* as our class game this week. The game, created for Kentucky Fried Chicken, went viral in 2019 and is an interesting take on advergaming. With our guest speaker's readings, we also were introduced to two important frameworks, Mechanics, Dynamics, Aesthetics/Emotions, and player types, that we would continue to discuss for several weeks.

Assignments

- **Read**: Robson et al (2015)
- **Read**: Robson et al (2016)
- **Read**: Bogost (2011), available online here: http://bogost.com/writing/blog/gamification_is_bullshit/
- **Read**: Third quarter of your group text
- **Write**: Journal post: pick one of the frameworks discussed (either MDA or player types) and connect it to your group text.
- **Write:** Discussion board post: which of our three subject areas is the best connection to your group text? Why?
- **Play:** *I Love You, Colonel Sanders!*: https://store.steampowered.com/app/1121910/I_Love_You_Colonel_Sanders_A_Finger_Lickin_Good_Dating_Simulator/

Students were a bit overwhelmed with the reading assignments this week, and understandably so.

Unfortunately, this meant we did not have time to discuss "Gamification is Bullshit" in class. A number of students would choose to write on this text in Week 8's journal, both positively and negatively. In retrospect, I regret that we were unable to have what would have been a lively discussion. Regardless, the MDA framework and the concept of player types provided two interesting frameworks to explore the flamboyantly weird *I Love You, Colonel Sanders!*

Week 8: Games and Rhetoric

Class Topics and Activities

- Guest Speaker Jason Helms, Associate Professor of English
- Preparing for the group game text presentation

In our first session for the week, students were again given time to work with their groups on their presentation. Students were required to write a progress report/plan for completion in which they outlined what was already done and what remained to be done (and who, specifically, was responsible for actions). In our second class session, we were visited by Dr. Jason Helms, who spoke about the process of turning a scholarly argument into a game. Students played Helm's twine game "Play Smarter, Not Harder", and many were excited to see a re-emergence of the concept of flow, which we initially discussed in McGonigal's *Reality is Broken*. Helms discussed his design decisions and the constraints that shaped the final game.

Assignments

- **Read/Play:** Helms (2019) https://src-online.ca/index.php/src/article/view/333
- **Read:** Final quarter of your group text
- **Write:** Journal: mid semester reflection. Which readings have you enjoyed and why? Which have you not and why?
- **Write:** Discussion board post: evaluate your book- what does it to well? What are the most important points? What did you disagree with?
- **Write:** Project planning group document

The evaluative journal, assigned this week asking students to reflect on readings students enjoyed and disliked, was enlightening. Many students remarked on not liking a meta-analysis read in Week 6, "Serious games in health professions education: review of trends and learning efficacy". This surprised me, as I was personally quite intrigued by the overview of the field the article provided. Students greatly preferred the case study we read that week, "Validity evidence for a serious game to assess performance on critical pediatric emergency medicine scenarios". Many remarked on liking the specific details about the actual use of a learning game over the more theoretical overview of the field the meta-analysis provided. It was also through this journal that I learned about students' divisive opinions on Bogost's "Gamification is Bullshit".

Week 9: Games and Music

Class Topics and Activities

- Guest Speaker William Gibbons, Associate Dean for Academic Affairs and Associate Professor of Musicology
- This week our discussions included not only what are games/learning in the field of music, but also what is music? What is an instrument? What is dance?
- *Clapping Music* is a "game" that trains you to play an avant-garde piece of music

The first class session included students' last group planning session. Students polished of what remained of their activities and once again were asked to connect their author's theories strongly to other class materials and games. In our second class session, Dr. Gibbons challenged students to question everything they thought they understood about music, instruments, games, and play. Gibbons intentionally selected games at the borders of these intersections and provided a reading from his book that addressed this issues directly. In our class conversation we considered if playing *Just Dance* should be considered dancing and if playing *Rock Band* counted as playing music.

Assignments

- **Read:** Gibbons (2018)
- **Write:** Journal reflecting on your major and learning games. Use specific examples from our topics weeks readings.
- **Write:** Group planning document
- **Play:** Clapping Music (watch if you don't have an iOS device)
    - Play: https://apps.apple.com/us/app/steve-reichs-clapping-music/id946487211
    - Watch: https://www.youtube.com/watch?v=q1Ali_EoV_U&ab_channel=KatieMoritz
- **Play:** One of the Rhythm Cat games (your choice): https://melodycats.com/rhythm-cat/
- **Watch:** "Holy Diver" played in *Rock Band 4*: https://youtu.be/ItzWRMvHDB4?t=1902

The reading and games provided by Dr. Gibbons created a lively week and an incredible discussion during our guest speaker session. *Clapping Music* was only available on iOS. Thus, students without access were asked to follow along with a youtube playthrough of the game. Students were also asked to select a Rhythm Cat game to play and to watch a video of *Rock Band* being played (as no mechanism to play the game in our online format existed). This collection of games provided us with a variety of different perspective on learning games in music, from avant-garde to educational to commercial.

Week 10: Game Text Presentations

Class Topics and Activities

- Groups posted their presentations on the discussion board for viewing and responding
- The final proposal assignment was introduced, and students began brainstorming

Week 10 marked a turn toward the end of the course. Game text presentations were posted on the

discussion board. Students had to watch both presentations for groups they were not in and leave a substantive comment relating to either their own text or any of the materials we had covered thus far in class. Group members were required to respond to all comments, and split the work amongst themselves (so, with a twelve person class each presentation got eight comments, and each student had to respond to two of the comments on their presentation).

Assignments

- **Watch:** Presentations for the other groups
- **Write:** Comments on other group presentations
- **Write:** Responses to comments on your presentation
- **Write:** Personal and Group Evaluation

In addition to submitting a group presentation, each student was asked to write a reflection that included three evaluations: An evaluation of the text they read, of the work they did on the presentation, and on their group's functionality as a unit. In the past, I have used such an assignment as part of an assurance that all group members are contributing roughly equally to the project. This semester, students had only positive remarks for their groupmates, and comment on the in-class groupwork time as essential to their planning process.

Week 11: Designing Learning Games

Class Topics and Activities

- Coming back together after five weeks of special topics
- Required brainstorming conferences
- All course material from here until the end of the semester supports the final project

An important topic of our first session this week was bringing our conversation back to ideas about games and learning. After several weeks of special topics and a week of presentations on game texts, it seemed important to bring us back as a group to our foundational ideas before setting off on a final project. "Moving Learning Games Forward" addresses several issues we encountered during our foundations unit, and also introduces a number of specific ways learning games might be used in classroom environments.

We used our second class meeting session as a virtual library day. We briefly discussed acceptable scholarly sources and some of the challenges in researching games. After offering some suggestions on databases and search terms, students were given open searching time, with the opportunity to request help from me at any point during the session

Assignments

- Read Klopfer, Osterweil, and Salen (2009), pt 1

One of students' first assignments related to the final project was a summary/synthesis journal that connected a scholarly source of their own finding to one of our class readings. This assignment was both meant to set them on a solid path for their project (including letting me identify any problems

early in the process) and to generate writing that could potentially be incorporated into the final assignments.

Week 12: Developing Your Design

Class Topics and Activities

- Required Brainstorming Conferences (continued)
- Defining Use Cases
- Identifying Sources

The first class session of this week was canceled to accommodate required conferences for students unavailable at other times. In the second class session, we discussed creating ideal use cases as a way to help develop their game design. Students thought about how they would imagine players interacting with their game. Students considered duration (how long in one sitting would players play/how long should it take to beat the game), platform (what would most players prefer to play the game on), and possible social elements (should the game be multiplayer or single player). Students wrote an imaginary profile of their typical user and used this profile to refine their design decisions. Students also considered how the conversation of ways to use games in "Moving Learning Games Forward" might influence their design choices.

Assignments

- **Read**: Klopfer, Osterweil, and Salen (2009), part 2
- **Read**: Second scholarly source for your proposal
- **Write**: Journal summarizing/connecting your second source
- **Write**: Work on your draft!
- **Write**: Final assignments plan

One of the important assignments this week was a "final assignments plan". As we were quickly approaching the end of the semester, I asked students to identify the tasks they would need to do to complete our coursework, focusing on both specificity and scope (in other words, making each task a manageable one and breaking large tasks into smaller sub-tasks). Students were then asked to put these tasks into a calendar to layout their own personal milestones for finishing the course. I encouraged, but did not require, that students put all of their final assignments into this plan. Roughly half of my students took me up on this suggestion and mapped out final assignments for all of their courses, not just mine.

Week 13

Class Topics and Activities

- Peer reviewing of proposal sections
- Review of presentation criteria
- Optional second conferences

This week students acted as peer reviewers on each other's drafts and were given the option to attend a second conference with me. I required that any student wanting a conference send me a draft with specific questions at least 24 hours in advance of their conference.

We also reviewed presentation criteria. As the presentations followed a similar format to the game text presentations, I briefly discussed challenges I had seen in those earlier presentations and offered suggestions for how to resolve them. In general, these involved creating logical transitions from one slide to the next, using effective visual design principles, and balancing comprehension and concision in descriptions.

Assignments

- **Write:** Finish your proposal!
- **Meet:** Optional second conferences
- **Present:** Short project summary video/recorded PowerPoint

It was emphasized to students that their main goal at this point should be on completing and polishing their final assignment. The presentation, which was again posted on our class discussion board, was meant as an activity that would help them clarify their own ideas and share the work that they had done with the rest of the group.

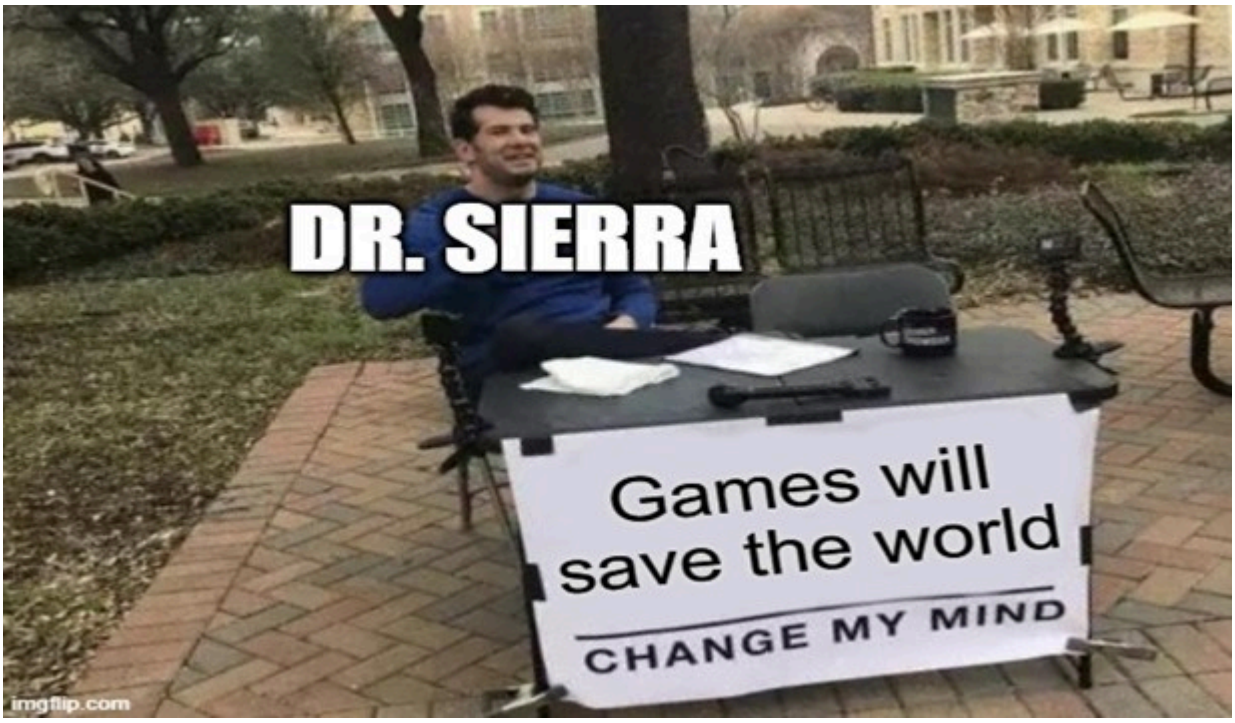
Week 14

Class Topics and Activities

- Class wrap-up

In our last class meeting we completed several wrap-up activities. First, I reiterated for students the structure of the course, which began with Foundations, continued through Special Topics meant to illustrate those foundations in different fields, and ended with a game design project of their own creation. I also asked for some general feedback on the course. In specific, I was interested in which texts they enjoyed/disliked, which special topics weeks were the most engaging, and which games they wanted more of/disliked (these topics are discussed further in the Future Course Plan section). We also completed two activities. First, students were put into groups and asked to write a short paragraph describing the course as if they were talking to a peer or parent explaining what they had learned and what the course was about. I took all of the paragraphs and put them into a word cloud generator (https://www.jasondavies.com/wordcloud/). The cloud from one section of the course is below.

I also asked students to create memes describing something about the class that stood out to them (meme generator: https://imgflip.com/memegenerator). As demonstrated below, some of the memes commented on specific readings, while others commented on the class as a whole. I intentionally gave fairly little direction to this assignment, as I was eager to see where students would take it. I was not disappointed.



Many students used the "Change my mind" meme format, which comes from a picture actually taken at TCU.

Isbister's *How Games Move Us* received a mixed reception from students, which is discussed below in the Future Changes section.

Students shared their memes back to the class and discussed why they made their memes, summarizing course readings, key class concepts, and general perceptions of the course work and themes.

Assignments

- **Write:** Comment on peer's proposal presentations
- **Submit**: Final proposal

In the final week of the course students submitted their final proposal and watched and commented on at least three presentations. The instructions for this response assignment were specifically directed toward encouraging positive reinforcement. Since their comments would come too late to change anything about the final proposal, I wanted students to focus supporting each other with comments about what they did well rather than feel the need to be critical of each other's presentations. The prompt read: "Comment on three peers and provide some positive feedback: What do you like about their design? Does their problem statement bring new light to an issue you were unaware of? Is their visual rhetoric just amazing?" During the week I became concerned that some students might be left without comments, and in retrospect I wish I had assigned at least one commenter to each project. Fortunately, everyone ended up with at least one positive comment on their presentation without my forcing it.

COURSE BEST PRACTICES

Balancing Interaction: An important component of this course was balancing how students interacted with each other and me. This was a particular challenge given our online modality, but something I believe is important regardless of delivery mode. In each week I aimed to ensure that there was balance between when I, as the instructor, led, when students worked collaboratively in small groups,

when we discussed openly as a large group, and when students worked individually on reflections and response. Game play assignments were similarly balanced between individual work and group efforts.

Support Gaming Literacy: In every gaming course I have taught I have worked with a wide range of student gaming literacies. Reassuring students frequently that grades are not based on being "good" at games is important, as is giving students the space to develop the physical literacies required of whatever game you intend to use. Even students that identify as gamers may be unfamiliar with WASD and mouse look if they come from a console background. Game play assignments absolutely must be scaffolded, and in general games should be chosen with an eye toward thinking about the amount of support they will need. *Minecraft Edu*; a game that required students to become comfortable with movement using the WASD keys, using the mouse to move the camera independent of character movement, and game mechanics including crafting and fighting; required substantial support for previously non-computer gaming students. However, the game was used extensively for a month of the course and so the scaffolding required had substantial payoff. The special topic week games were selected in part on the basis of whether or not they would require additional gaming literacy/support for students to play comfortably. *I Love You Colonel Sanders*, a dating simulator that only required students to click on dialog choices, was only used for a single class session, but required no support for students to play. Ultimately, it is imperative that instructors creating a supportive gaming community and drawing a clear line between game ability and ability to analyze/interpret. I frequently emphasize to my students that non-gamers play an essential role in all my classes, as they often find it easier to react with critical distance than gamers.

Being Wary of Technology Overload: Because I intended hold class sessions in *Minecraft EDU*, I created a class Discord server for my course. I had hoped that it would become an informal conversation space and backchannel for our course, in addition to being used for voice chat during our gaming class sessions. Ultimately, however, this did not pan out. During whole group class sessions, students where substantially quieter in Discord than they had been in Zoom. Moving to more small groups activities somewhat solved this problem, as they seemed more conversational as I checked in on them in separate rooms. However, it was consistently difficult to encourage full group conversation when on Discord. Students also rarely posted in the Discord, and never posted once we finished the *Minecraft* section of the course. I suspect that for many students the technology did not seem to offer additional benefits — when they are already interacting in the course LMS, on Zoom, and occasionally via email, what additional benefit does Discord serve? Further, while I had hoped it could be a support space for students needing gaming assistance as we played *Minecraft,* I heard anecdotally that many students had their own supportive networks that they drew on for help gaming (other classmates, friends, or family members). I did have some students (particularly those who already had Discord accounts and were on it frequently for non-class reasons) message me throughout the course with quick questions, but in general most students seemed to prefer email.

Future Course Plans

Structural Changes: The plan of the course was focused on growing student competence and understanding through three major units asking for increasingly sophisticated responses. The first unit built a foundation. The second unit extended the foundation and asked students to apply their growing knowledge to a specific text in a group presentation project. The final unit asked students to synthesize the material they had learned and integrated it with research of their own on a topic

of their choice. While pedagogically sound, the major drawback of this approach is that students received no "major" grades until the final third of the course (since the second unit's major assignment was turned in at the end of that unit). In the future I anticipate introducing a major assignment to be completed at the end of the first unit. This change will also make the overall course structure and the goals of each unit more evident to students. A class dictionary of terms, requiring the use of both course readings and outside research, would support the goal of the foundations unit and also provide a useful resource for later units. While we dabbled with a class glossary as a daily assignment, I believe that this idea could be fully fleshed out into a major assignment incorporating additional scholarly research on the selected terms.

Reading Changes: While the response to readings was generally positive, there were two specific issues that I plan to address with minor tweaks. In the special topics weeks we found often ourselves unable to cover in depth all of the articles assigned by guest lecturers. We also skipped several chapters of *Reality is Broken* in order to finish before the special topics weeks. In the future I anticipate asking guest lectures to pick just one article to assign and pairing that article with one chapter from McGonigal, in order to pull the book further through the course and read all chapters. I also found that students responded very positively to case studies in these weeks. While I don't anticipate requiring that my guest lecturers find case studies, I intend to suggest they lean toward those if possible.

The second issue came during the game text presentation assignment. Across two different sections, students generally hated *Uncertainty in Games*. One common reason cited was the extensive number of examples Costikyan gives in the middle chapters. Students felt they clearly understood his ideas after the early outline and found the rest of the book redundant to read and present about. Indeed, they strongly suggested assigning just the first chapter in a future course, as they did enjoy the initial framework.

How Games Move Us received a mixed reception; the non-gamers in the class seemed to enjoy and appreciate the book substantially more than the students who self-identified as games. While many of the non-gamers across both sections found that Isbister introduced a perspective they had not considered before, the gamers felt that many of these observations were "obvious". I chose books from the MIT Press Playful Thinking series because they provide fairly short, focused perspectives on specific issues in game studies. I am planning to substitute the Costikyan in the next offering with another book from the series. I am still considering whether or not to continue with Isbister. Several students truly enjoyed the perspective, and I am not persuaded that her observations on games and emotion are obvious regardless of one's gaming experience. *Art of Failure* was very positively received, and so that one will remain.

Game Changes: *Minecraft EDU* was incredibly well-received. Students, both self-identified gamers and non-gamers, enjoyed the game, connected it readily to our readings, and generally wanted more. The games we played during our special topics weeks were more uneven. Students were interested in *Dungeons and Dragons* and regretted that we didn't have time to play an actual game (though we did make characters). *I Love You Colonel Sanders* was a hit with some students and hated by some students. *Level Ex* had a similarly uneven reception (as students were frustrated with not being able to excel at the game due to their lack of medical knowledge). Indeed, one student had a particularly visceral negative response to realistic graphics (which, admittedly, look very much like surgery videos).

Were I to teach this course in an online version again, I would absolutely pull *Minecraft* through the entire semester. The game provided a welcome break from Zoom/the course LMS and was incredibly useful in building a class community (which had great payoff for class discussions throughout the semester). As I don't expect to teach online again, I anticipate a mix of bringing *Minecraft* more through the special topics weeks when relevant, and offering more guidance to guest lecturers on game selection if *Minecraft* is not a fit. While we obviously want games that will highlight the disciplinary perspective taken in those weeks, students seemed to enjoy (and consequently do better analysis on) games that contributed to our course community-building.

Modality Changes: My next offering of this course will be an in-person section. With the change to modality I am planning only minor changes to the course assignments. We will likely drop the discussion board, as in class discussion will be able to cover much of the peer sharing I used them for. Otherwise, the structure of the course will stay essentially the same. Because I structured my synchronous online class in much the same way I would conduct an in person class, I anticipate making very few changes to other weekly activities.

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CHAPTER 12.

VIDEO GAMES AND VIRTUAL WORLDS AS SITES FOR LEARNING AND ENGAGEMENT (EDUC552)

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Course Title: EDUC552: Video Games and Virtual Worlds as Sites for Learning and Engagement
Course College/School: University of Pennsylvania, Graduate School of Education
Course Department/Program: Teaching, Learning and Leadership/Masters in Learning Sciences and Technologies
Course Level: Graduate and Undergraduate
Course Credits: 1.0
Course Length: 15 weeks
Course Medium: Face-to-face, Online, Blended/Hybrid
Course Keywords: Connected learning, game design, gaming cultures

CATALOG DESCRIPTION

Drawing on work from education, psychology, communication, and the growing field of games studies, students will examine the history of video games, research on game play and players, review how researchers from different disciplines have conceptualized and investigated learning in playing and designing games, and what is known about possible outcomes for K-12 education. Students will also address issues of gender, race, sexuality and violence that have been prominent in discussions about the impact of games.

COURSE PURPOSE AND OBJECTIVES

If someone were to write the intellectual history of childhood—the ideas, practices, and activities that

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2. 2. Mamta Shah, Ph.D. (m.shah@elsevier.com) is a Learning Scientist at Elsevier, where she conducts research to support effective learning solutions and outcomes for nursing and health education. For over a decade, Dr. Shah has researched the design and integration of interactive digital environments such as games and virtual realities to advance students' knowledge and motivation. She has worked with PK-20 educators to incorporate the cognitive, pedagogical, and experiential affordances of educational technologies in a variety of formal and informal settings.

engage the minds of children—it is evident that the chapter on the 21st century would need to give a prominent place to video games and virtual worlds. The number of hours spent in front of these screens surely reaches the billions. And what is remarkable about this time spent is much more than just quantity. Psychologists, researchers, designers, educators, and parents are struck by a quality of engagement that stands in stark contrast to the half-bored watching of many television programs and the disengaged performance exhibited with school homework. Like it or not, video games and virtual worlds are clearly a highly significant component of contemporary children's culture. A generation of kids has grown up first playing and now also making digital games and continues to do so well into their adulthood. The game industry, now surpassing the movie industry in revenue, has joined mainstream media. We also have witnessed a dramatic shift in the public and academic discussions around these mediated activities and spaces. Researchers from various disciplines are investigating and designing games for learning and teaching. What is behind all of this interest in games?

This course presents current discussions in newspaper articles, policy reports, and research reviews that are debating the educational promise of digital games and virtual worlds. A central premise of the course is the idea of connected gaming, meaning that playing and making games are integral parts of the learning enterprise. While much attention has been given to the impact of playing games for learning, this course will devote equal attention to the benefits of making games for learning. More importantly, the course also involves looking at activities that combine playing and making games, connecting them with social media platforms that nowadays is part of gaming ecologies. The readings and discussions in this course aim to address the following questions and more: (1) What are video games and virtual worlds? How have researchers studied gaming, players, and learning? (2) What are different ways to describe and analyze learning practices and cultures in playing and making digital games? (3) What do we know about engagement and learning of academic topics such as mathematics, science, and social studies with games inside and outside of schools? and (4) Who plays games, and who does not? How do players and designers deal with issues of gender, race, violence, and ethics in games?

Drawing on work from education, psychology, communication, and the growing field of games studies, students will examine the history of video games, research on game play and players, review how researchers from different disciplines have conceptualized and investigated learning in playing and designing games, and what is known about possible outcomes for K-12 education. Students will also address issues of gender, race, sexuality and violence that have been prominent in discussions about the impact of games.

COURSE CONTEXT

The course is a requirement for all students enrolled in the Learning Sciences and Technology Master program. In addition, many graduate students from the Teaching English as a Second Language program and undergraduates from the Computer Science department take this course as one of their electives. While no prior knowledge or experience in games or technology is a prerequisite for taking this course, students come with vastly different prior experiences in gaming and technical expertise. The course is designed to provide a general introduction into games and play from a historical perspective, so students learn about different theories of learning and of play development and a session is dedicated to the design of educational board games. Students bring their personal experiences with all kinds of games (board games, card games, digital games) from their early

childhood into the present day by creating a history wall that combines all the games they have played. This provides a sense of the collective gaming wisdom in the class community, that each class member has a distinct gaming history but many games are also shared experiences. Because we have a large number of international students enrolled in the master program, this activity also reveals cultural differences in gaming histories.

COURSE PEDAGOGY

The core pedagogical belief is that all examinations of games for learning are grounded in students' personal experiences. Thus, whether the discussion is about playing or making games for learning from the research perspective, all sessions focusing on these perspectives are accompanied by experiential activities. For instance, students learn how to play vintage digital games (using web-based emulators) and write about the game mechanics and connections to possible contemporary educational games when the class discusses the history of board games. Likewise, for making games for learning, students collaborate in teams for designing an educational board game when the class discusses the use of board games for learning, and also remixing a Pong version in Scratch to get first hand experience in modding a game. Finally, students enroll in Minecraft to experience play in one of the most popular gaming platforms and examine Youtube fan cultures before the class reviews research applications of Minecraft. Each of these play and design experiences is anchored in readings of papers and subsequent discussions in class. As such, students engage in a meaningful loop of playing, making or modding games for learning while they read about it, reflect on their own experiences and learn from the experiences of their peers. More information on the course pedagogy can be found in the extended outline. For each week, we highlight key activities and assignments that can be adopted and adapted based on the mode of instruction (F2F, Online, Blended).

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

The course is usually taught in person where students and instructors meet on campus once a week for a 2-hour class. Canvas Learning Management System (LMS) is used for accessing course materials and schedules, submitting assignments, and engaging in asynchronous communication during the week (e.g., discussion board, announcements). Video conferencing tools such as BlueJeans and Zoom are frequently used to facilitate synchronous virtual classes.

Course readings are chosen with a goal to expose students to both historical perspectives and current advancements in a wide array of fields where games are studied (e.g., education, communication, psychology, design, history). Readings encompass book chapters, articles in research journals, blog posts, and news articles. Instructors meet at the end of each semester to review the reading list and discuss updates. For some sections the readings have mostly stayed consistent since the assigned ones are seminal readings. For instance, Linaza's (1984) writing on Piaget's Marbles (in the section on Theories of Play and Games) informs students' viewing of videos of marble games in different cultures; Zagal and colleagues (2006) analysis of board game mechanics that foster collaboration situate the board game design assignment (in the section on Board Games), and chapters from Gee's (2003) seminal book "What videogames have to teach us about learning and literacy" introduce the world of games as learning environments (in the section on Digital Games: Today).

Some sections naturally lend themselves to constant evolution. For instance, in the Spring semester

of 2020, a special weekly section on Playing Games for Learning: COVID-19 was introduced mid-semester. As a response to the rapid changes to our world and our lives, it was an opportune moment to use existing games to foster social connection and to examine newly developed games that were inspired by COVID-19. Since the pandemic extended into the Fall semester of 2020, we decided to retain this class and include readings about virtual worlds for learning about epidemics by Lofgren and Fefferman (2007) and various case studies about using historical simulations (Kennedy-Clark & Thompson, 2011).

Quite often, students are assigned to watch Youtube videos and webinar recordings. For instance, in the history of digital games session, videos viewed and discussed on the history of digital gaming include: First Pong home console, 10 worst consoles, 10 best consoles, and classic game advertisements. Students also receive a list of additional resources to explore at their choice. These include links to blogs, podcasts, and game libraries such as:

- Board Game Geek for analog games: https://boardgamegeek.com
- DIGRA digital library of conference papers about educational games:
- http://www.digra.org/
- Gameanlytics for industry analytics: https://gameanalytics.com
- Grand Text Auto for blog posts on machine narrative, games, poetry, and art: https://bit.ly/2M9ZS2J
- Not your Mama's Gamer for podcasts on games from a feminist perspective: https://apple.co/2KHbnOQ

A significant amount of time is spent in playing games. Examples of go-to resources for game playing and game making include:

- Scratch: https://scratch.mit.edu
- Games for Change: http://www.gamesforchange.org
- ZoomJam.Org: https://zoomjam.org/
- Jamming the Curve: https://bit.ly/3p8Xc49
- Itch.Io: https://itch.io/
- CodeMao: https://codemao.cn/

Lastly, students have access to a library of classic board games (e.g., Monopoly, Clue, Carcassonne) and Kickstarter games (e.g., Monarch) to take home for play.

COURSE ASSIGNMENTS

The course includes individual and collaborative assignments. Broadly, they vary from writing assignments (e.g., play reports, game design document, final term paper) to participation in discussion forums (e.g., contribution and facilitation), in class reports and showcases (e.g., video games around the world and board game design prototypes) and design challenges (e.g., board game remix, remix of Scratch games, and game prototype demo). We describe a few of these assignments below.

PLAY REPORTS

In Play reports, students write a journal that covers their play experience from first impressions to final thoughts using the following prompts as guidelines:

- Think about when you entered the game for the first time: What did the title screen invoke? How did you feel about the game during the first few minutes of playing it?
- Think about the game interface. How does the type of interface influence your experience of the game? (For some games, please be sure to note you are playing them on a different interface than originally intended. In these cases, do research on the original interfaces and how the games were intended to be played, and discuss the differences between the two).
- Think about the game mechanics. How do they affect your experience with the game? Do they contribute to the kind of feelings the game tries to invoke?
- What educational affordances do you see with this game (for example, game mechanics, genre capability, content, role playing, etc.)?
- What other thoughts did this game provoke?
- Find a contemporary game that could be used for "serious" purposes or formal/informal learning. You don't necessarily have to find a serious or learning game but can provide a game that has the potential to be used for learning (either through a mechanic it employs or as a whole). Provide a link either to the game itself, or to a video of its gameplay and briefly discuss its educational potential.
- Students use these questions as guidelines for writing the play reports to document and reflect on their play experiences. Each play report can be either in form of a verbal presentation or written reports that range from 1,000-1,200 words.

For a play report on classic video games, students can choose three games to play, one from each category:

Category 1: Pong, Asteroids, Space Invaders, Centipede, Breakout, Galaxian, Frogger, Q-Bert;

Category 2: Donkey Kong, Super Mario Bros, Sonic the Hedgehog

Category 3: King's Quest, Legend of Zelda

and write a detailed play journal entry for each (which includes finding contemporary educational or serious games from a similar genre or with a similar mechanic). There are several online archives of classic games (e.g., https://archive.org/details/historicalsoftware).

For a report on engaging with connected gaming, students play in Minecraft. They can sign up for the free for a trial period which gives them enough time to gain some experiences and provide answers to questions listed above.

Alternatively, students can review YouTube videos from one these popular Let's Players (LPs):

Category 1: Stampylonghead: https://www.youtube.com/user/stampylonghead

Category 2: KarinaOMG: https://www.youtube.com/channel/UCije75lmV_7fVP7m4dJ7ZoQ or

Category 3: StacyPlays https://www.youtube.com/user/stacyplays

Play reports that focus on watching two to three hours of YouTube videos (1,000-2,000 words) address the following questions: What did you learn about Minecraft play? What did you learn about the game mechanics?What did you think about the comments? What did you think about the YouTuber? Any other thoughts did these videos generate?

GAME DESIGN CHALLENGES

Students design a variation of a classic board game that has educational applications and remix an existing Scratch Game. For the first design assignment, students think about the readings they examined for the week and the variations on Monopoly they explored. For example, students could explore questions such as: How would making this board game more collaborative have an effect on learning? How would structuring play differently have an effect on mathematical thinking? How would giving this game a real historical setting change how students learned?

Some further points are offered for students to to consider:

- Think of your audience of learners. Who is this game being tailored to? Does it require a specific age range? What are the learning goals? Where will the game be played (i.e., is this a classroom specific game or a game played with family members)? Be specific.
- Choose a game to modify (for examples, look on BoardGameGeek). Make sure to pick something that can be easily understood, explained and played in the amount of time allocated for the learners (what might some developmental or attention limitations/affordances be with different audiences?) and location (i.e., if played in a classroom, what are the time constraints?).
- Choose a topic, feature or theme that your iteration will center on.
- Research this topic. Have others successfully created games with this topic, feature or theme, and what considerations did they have to make?
- Make a list of all of the game bits (i.e., characters, settings, dice or cards, etc.) and how they might be integrated with the major game elements.
- Make a physical, playable prototype, complete with rules.
- Play your prototype with friends and iterate on it based on what you learned works/doesn't work as intended.

Students use these questions as guidelines for writing the play reports to document and reflect on their play experiences. Each play report can be either in form of a verbal report or written reports that range from 1,000-1,200 words.

DISCUSSION FORUM FACILITATION AND PARTICIPATION

In order to build a collaborative learning community, this on-going assignment involves posting and

responding to comments, thoughts, insights, or reflections online with respect to the weekly readings and students personal/educational experiences. Students use the discussion forum to connect with other classmates to help each other think through the concepts around games and learning they encounter in the course. This is important because virtual environments like these often become self-organized and take off without minimum participation criteria enforced, much like participatory communities grounded in many games.

However, as everyone's continuous participation is essential in creating this virtual community, a minimum of 2 posts per week is required. For the 2-post minimum, students are expected to include the following selected information or data from the literature, interpretation of the literature, relationships you draw from the literature between your understanding and another student's post, literature from the class, or literature from outside sources, or experiences you have had based on practice or points you would like to contribute based on your own understanding. The second post can be a response to a classmate's post and does not need to include the four criteria listed above. Beyond the 2-post minimum, students can respond or comment as many times as they would like without adhering to the above criteria.

Students also sign up to be a discussion facilitator with another person for two week's readings on the first day of class. There are two parts to this assignment. The first part entails monitoring the group's online discussion and evaluating the contributions of their peers. Students read each post and assign a point score of 1 to 4 depending on completion using the above criteria. As a class, exemplary posts are reviewed on the first day of class. After students have evaluated the group's collective posts, they email them to the instructor on a specified date. For the second part, students summarize the main ideas that have emerged from the group's discussion and select an issue or interesting point that may have been unresolved in the online discussion or could extend the discussion in the face-to-face mode. Together they prepare a short presentation and lead a 20-minute whole-class discussion on the summary and issue or interesting point at the beginning of class. Choosing alternative formats for the discussion is strongly encouraged. This presentation is emailed to the instructor on the specified date.

FINAL PAPER *or* PROJECT

Students can choose to write a research paper on a topic of their own choosing and in consultation with the course instructor, or create a learning game design, which requires a detailed design document and playable physical prototype that is demonstrated in class. The only requirement is that the topic draws from the course. These assignments can be done in collaboration with other class members.

If students are writing a research paper, they are asked to give a presentation of their findings on MM/DD in class to receive feedback. Students then have a few days to finish and submit the final paper by MM/DD, to the Canvas course site. The final paper is between 3000-3500 words excluding references and graphics.

If students are creating a learning game design, they are required to work in a group of 2-3 individuals, and write a design document of 2500-3,000 words, complete with concept designs. They are also required to create a physical prototype (i.e., card or board game design) of at least one part (mechanic/dynamic) of their digital or non-digital learning game. Finally, students are asked to

present their game design and playable prototype (demo) on MM/DD (details provided above) in class to receive feedback. The final collaborative paper is due on a specified date on the Canvas course site.

COURSE ASSESSMENT

There are several different types of assessments: (1) play activities like assignments #1 and #5, (2) design challenges like assignments #2 and #4, and (3) reports from play experiences or discussions like assignments #6 and #9. The final paper can either be a review or design project, completed individually or in a small group

- Assignment #1: Play Report: Classic Digital Games with report (500 words) on game play experiences, interface (5%)
- Assignment #2: Design Challenge: Remix of Educational Board Game, prototype and short report on design process (can be done collaboratively) (10%)
- Assignment #3: Final Paper or project proposals. 250-word summary. [Note that game design projects can be done in groups of 2-4 individuals] N (Pass/Fail)
- Assignment #4: Design Challenge: Remix Pong Game in Scratch (Can be done Collaboratively) (5%)
- Assignment #5 Play Report: Minecraft with report (500 words) on game play experiences, interface (5%)
- Assignment #6 Choice Activity: Video Games around the World book or game play report (500 words) (5%)
- Assignment #7 Final Paper Presentation & Demos: in class (10%)
- Assignment #8 Final Paper or Game Design Report with report (3,500 words) on a pre-approved topic or final game design document (35%)
- Assignment 9: Class Participation, Discussion, and Facilitation (25%)

EXPANDED COURSE OUTLINE

Class 1: Introduction and Overview

Class Topics/Activities

- Students introduce themselves with their favorite game played (digital or analogue); we also poll them about whether or not they consider themselves as gamer.
- Students are asked to list on a collaborative online doc, "which questions do you have about games and learning?" We revisit these questions and answers in the last class meeting to take stock of what the course addressed and what not.
- Students discuss in small groups what they know about big issues—sexism, racism, and violence—in gaming.

Assignments

- Students start on Assignment #1 of playing selected historical video games on emulators

Class 2: Theories of Play and Games

Class Topics/Activities

- Students then work in small groups to list as many games as they can identify on Pieter Brueghel's (1560) painting *Children Games.* It helps to divide up the canvas of the painting into four quadrants and assign each group a quadrant. A full list of all 80 games can be found in Wikipedia.
- Students review in small groups videos of children playing marbles from around the world (these short videos from kids playing marbles can be found on internet). They note what they can find out about game setup, rules, collaborations and participants. We discuss the marble game playing in terms of different theoretical perspectives on development and learning: rules (Piaget) and interactions (Vygotzky).
- We present Froebel's kindergarten as an introduction to structured and guided play and the 20 gifts as examples of instructional toys and activities.

Assignments

- Read Caillois (1958/2006). *The Definition of Play and The Classification of Games*.

Class 3: Analog Games: Board Games

Class Topics/Activities

- In each class discussion facilitators sum up key themes and issues raised in online discussion forum and prepare a short activity (for about 20 minutes)
- In class, we review a history timeline of board games from wikipedia; we also present the history of Monopoly board game.
- Students break into small groups of 5-6 players and play a board game (e.g., Monopoly, Clue, Cocarssone); one student is designated an observer and takes note on how students negotiate rules and play. Students can also take board games home to continue playing with others and use as inspiration for assignment #2

Assignments

- Read Zagal, Rick & Hsi (2006). *Collaborative games: Lessons learned from board games*.
- Students are introduced to Assignment #2 working individually or in teams of modding an existing board game with an educational purpose.

Class 4: Digital Games: History

Class Topics/Activities

- Students create a timeline of all the games they have played in their life to represent the collective in clas gaming experience. This can be done on whiteboard or using a free digital applications such as

- We review historical timeline of video game development in consoles and popular games. Examples of such timelines can be found here
- In class, students see short video examples of popular historical games such as *Pong*, *PacMan*, *Habitat* we well as their educational counterparts such as *Oregon Trail*, *Where in the World is Carmen SanDiego*, *MathBlaster*, *SimCity*, and *Civilization*.
- Students share in small groups experiences of from Assignment #1 Classic Game Play

Assignments

- Read Ito (2008). Education vs. Entertainment: A Cultural History of Children's Software.

Class 5: Digital Games: Today

Class Topics/Activities

- Students are invited to present and share their experiences about a game they play today on computer, mobile or console
- In class, we watch excerpts from Southpark series "Make Love not War" to examine playing in popular World of Warcraft game. Students compare video gaming in past with that of today.
- Students review play arrangements at home http://www.youtube.com/watch?v=1mIOEgF3Myg or http://www.youtube.com/watch?v=R9lHyIDtx1E

Assignments

- Read Gee, Siyahhan & Cirell (2017). Video gaming as digital media, play, and family routine.

Class 6: Playing Games for Learning

Class Topics/Activities

- Students read one of the meta-synthesis evaluating playing games for learning. In addition, a number of specific games for learning mathematics, science, history, and so on are assigned by choice, distributed across students
- Students groups are preparing a poster presentation (on paper or online) for an interactive poster session in class
- Students present and play in class their board games remixes from Assignment #e DESIGN CHALLENGE #1 Board Game Remix
- Class discussion focus on game mechanics and principles of good educational design across analogue and digital games.

Assignments

- Read Squire (2006). From content to context: Videogames as designed experience.

Class 7: Playing Games for Learning: COVID Special

Class Topics/Activities

- Students are assigned readings on board games like *Pandemic: Hot Zone,* historical games like *Virtual Singapore*, *Pox in the City*, *Outbreak*, modeling simulations in *NetLogo* and participatory simulations like *Thinking Tags and the Outbreak@The Institute*, and virtual worlds like *RiverCity*.
- Students explore Whyville.net and virtual epidemics like *Whypox* and *Dragon Swooping Cough*
- Students review games from wikipedia on games about viral games https://en.wikipedia.org/wiki/Category:Video_games_about_viral_outbreaks

Assignments

- Read Corredor & Gaydos (2014). Seeing Change in Time: Video Games to Teach about Temporal Change in Scientific Phenomena.

Class 8: Issues I: Gender & Sexuality

Class Topics/Activities

- Students revisit the idea of what it means to be a gamer, reflect on their experiences with gender and gaming, examine empirical reports of game players' experiences.
- Students work in groups to design a game, and gain perspective on how notions of gender and sexuality impact game design.
- Students discuss broader issues in the gaming industry related to gender representation and diversity (e.g., Gamergate).

Assignments

- Read Shaw (2012). Do you identify as a gamer? Gender, race, sexuality, and gamer identity.
- Student begin brainstorming ideas for A3: Final Project Proposal (research paper or game design)

Class 9: Making Games for Learning

Class Topics/Activities

- Students are assigned readings about constructionist gaming and the educational significance of making games for individuals, tools that afford learners to make or mod games, and the communities that facilitate this culture.
- Students present their A4: DESIGN CHALLENGE #2 Scratch Remix and discuss insights from this experience.
- Students evaluate game making tools in small groups (e.g. Scratch, Gamestar Mechanic, Alice, Kodu, Roblox).

Assignments

- Kafai & Burke (2015). Constructionist Gaming: Understanding the Benefits of Making Games for Learning.

Class 10: Connected Gaming

Class Topics/Activities

- Students learn about connected gaming as an inclusive perspective to serious gaming, especially in the context of sandbox games such as Minecraft and emerging favorites such as Among Us.
- *Students discuss* A5: PLAY REPORT #2 Minecraft Game Play or YouTube cultures.
- The class plays Among Us during class and discusses experience as it integrates with insights from readings.

Assignments

- Read Nebel, S., Schneider, S., & Rey, G. D. (2016). Mining learning and crafting scientific experiments: A literature review on the use of Minecraft in education and research.

Class 11: Gamification & Game Schools

Class Topics/Activities

- Students examine gamification of learning and its roots in motivation.
- Students work in groups to propose ways to gamify the EDUC552 course.
- Students learn about innovations in formal education as it integrates with games; i.e., game schools (e.g., QuestToLearn) and esports.

Assignments

- Malone, T.W., & Lepper, M.R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning.

Class 12: Issues II: Race & Intersectionality

Class Topics/Activities

- Students revisit the idea of what it means to be a gamer, reflect on their experiences with race and ethnicity in gaming, examine empirical reports of game players' experiences.
- Students design a game or study, or propose a game modification that accounts for ideas discussed in class and insights gleaned from assigned readings on race, ethnicity and sexuality in games.

Assignments

- Monson (2012). Race-Based Fantasy Realm: Essentialism in the World of Warcraft.

Class 13: Independent Games for Good

Class Topics/Activities

- Students explore games for social and civic good, the purposes they can serve and for whom.
- Student share insights from readings and game play experiences, engage in discussions with guest speakers and review some games for good (e.g. Oregon Trail, iCivics, SPENT).
- Student learn about initiatives such as Raising Good Gamers.

Assignments

- Student begin work on A6: Choice Activity.
- LaPensee & Emmons (2019). Indigenizing Education with the Game When Rivers Were Trails.

Class 14: Issues III: Violence

Class Topics/Activities

- Students revisit the idea of what it means to be a gamer, reflect on their experiences with violence in gaming, and examine empirical reports.
- Students engage in a moderated debate about whether games promote violence (Group 1: In favor of legislating violence in video games; Group 2: Against legislating violence in video games).
- Students introspect on implications of immersive gaming experiences (e.g. virtual reality) and its influence on the perception of violence in video games.

Assignments

- Students continue work on and submit A6: Choice Activity
- Gentile & Gentile (2005). Violent video games as exemplary teachers: a conceptual analysis.

Class 15: Final Presentations & Demos

Class Topics/Activities

- Students revisit their responses to questions explored in class 1 (what questions do you have about games and learning, what is for you a big issue for games in education)
- Students contemplate on questions that remain unanswered or underexplored for them and in the field at large.

Assignments

- Students submit and present their A7 & A8: Final Presentation Demos and Reports

COURSE BEST PRACTICES

Over the years, we have changed the course resources and activities to facilitate collaboration in assignments, to include international perspectives, visits to local board game cafes, invite speakers from academia and industry, and to incorporate reports on games played by students in their pastime. Some of these activities have become part of the regular course curriculum, while others depend on

student interest and availability. At other times, we modify requirements such as changing written reports to verbal experience reports.

In the beginning, most of the assignments were individual assignments but over the years we have shifted to more collaborative projects. While initially only two assignments (i.e., the educational board game redesign, and the game design prospectus for the final project) were collaborative projects by default, we have opened up research synthesis and the Scratch game design activities also to be collaborative so that class members with more and less experience in technical and design skills can collaborate and learn from each other.

With the growing worldwide prominence of gaming, we have consciously included more international perspectives. We know that many games developed for the Asian market are not published and promoted in North America and Europe. The last decade has also seen the emergence of the Scandinavian gaming market. We draw on the book edition "Video games around the world" (Wolf, 2015) which highlights national gaming industries and cultures from over 40 countries. Thus, in the course, students can select a country or region and then prepare short overview presentations featuring video clips of popular games.

In recent years, reports about local board game cafes got included in the course. In the past few years board game cafes have become increasingly popular across the US and Europe. These cafes or bars provide access to libraries with hundreds of board games which patrons can loan to play with friends on premises. We had students visit these cafes and report back with short videos. Of course, this year the visits did not happen. However, we may reach out to owners of cafes known to us, and request a virtual tour and Q&A.

In the Fall of 2020, we added a special COVID session to highlight how playing and making games have been used to help students learn essential concepts about infectious disease epidemiology, and underscore the role game play in fostering social connection and emotional regulation. Discussions around games created as part of game jams announced during the pandemic were a highlight. There are also numerous examples of board games (e.g., Pandemic) that situate players in epidemic outbreaks of smallpox in historical locations of the 18th and 19th century, in addition to participatory simulations and virtual epidemics that have players engage in massive community-wide outbreaks. In future years, we might consider either keeping this topic or changing it to address another relevant pressing issue.

We routinely invite guest speakers from formal and informal educational settings, and across academia and industry. Speakers are invited from within the country and overseas via Zoom to reports on their current research, discuss game designs, share emerging trends and applications, and so forth. The roster of speakers included the following: Sinem Snayhen about family gaming, Earl Aguilera about research on Sims, Karen (Kat) Schrier about game design for civic and social issues, Danielle Chen about play and independent games, Steve Isaacs about esports in K-12 schools, Lindsay Portnoy about table top games for K-12 content, and Lindsey Tropf about online games and virtual worlds for K-12.

FUTURE COURSE PLANS

In the future, one of the sections we will expand upon is that of e-gaming and its connection to school learning. The emergence of esports in the US has changed the sports landscape and the role esports has come to play on the highschool and college levels. The first high school curriculum in connection to eesports has been developed. We also foresee that the emergence of esports will influence changes in the nature of gaming and fan communities, especially in light that financial incentives have become more prevalent, moving gaming from a leisure activity into a financial enterprise.

Another area we will pay attention to is the emergence of afterschool gaming activities such Minecraft camps that provide mentoring and support to young players. We will examine the learning opportunities in these spaces, and what other models exist for expanding the afterschool gaming landscape.

Finally, we will pay closer attention to the emergence of YouTube peer pedagogies in gaming cultures. One of our sessions has already integrated observations of Lets Play channels that often attract millions of views for their videos of playing Minecraft and other popular games. What role do these influencers play in the larger gaming ecology? How does learning take place in these spaces?

Games and the cultures around them are intriguing. We will continue to seek the work of research scholars, people in industry and entrepreneurs, and innovators in K-12 and afterschool spaces who are catalyzing new practices through game playing and making.

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CHAPTER 13.

DIGITAL GAME BASED LEARNING FOR K-12 EDUCATORS (MSET 570)

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Course Title: MSET 570 Digital Game Based Learning
College: College of Education and Human Sciences
Course Department/Program: Teacher Education, Educational Leadership & Policy
Course Level: Graduate Level
Course Credits: 3.0
Course Length: 16 weeks
Course Medium: Hybrid
Course Keywords: digital game based learning; teacher preparation; instructional technology; multimedia; digital learning; interdisciplinary teaching; gamification; 21st century learning; problem-based learning; video games

CATALOG DESCRIPTION

Digital Game Based Learning (DGBL) is a graduate level technology elective within the Mathematics, Science, Engineering, and Technology (MSET) strand of a teacher preparation department at a minority-serving, research-intensive university. The course, MSET 571 Digital Game Based Learning, is described in the catalog as helping students "develop professional knowledge, skills, and dispositions for using technology, digital games, and interactive learning environments to promote learning and independent inquiry aligned with K-12 curricula; [and to] make learning accessible to students while strengthening digital citizenship through multimodal instructional approaches".

COURSE PURPOSE AND OBJECTIVES

Theories of multiliteracies (New London Group, 1996) and critical media literacy (Kellner & Share, 2007) form the overarching structure for the course. Multiliteracies and new literacies studies (Lankshear & Knobel, 2014) are the organizing concepts around which assignments and projects are created. Because most students enrolled in the class are licensed K-12 teachers, video games

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are considered through the lens of *critical multiliteracies*, where traditional forms of literacy such as reading, writing, speaking, and listening are expanded to include the processes of analyzing and interpreting multiple forms of text, and of producing and distributing media, while simultaneously examining how social and political constructs such as race, class, and gender are used to construct narratives about people and marginalized groups (Mirra, Morrell, & Filipack, 2018).

Well-designed video games immerse students in meaningful activities that connect their academic learning with the social and cultural practices they engage in outside of school (Vasquez, 2004). With this in mind, readings and online discussions include critiques of the sociocultural and sociopolitical dimensions of multimedia and digital games, and an examination of how learning, language, and literacy are socially constructed. Students are encouraged to consider how video games offer opportunities for contextualized, experiential learning (Dewey, 1938) across and within content areas, while also taking into account what kinds of knowledge are and are not valued at school. In addition to harnessing video games for academic instruction, students in the class investigate how games can offer support for social and emotional learning and encourage prosocial behavior (Kingsley & Olefumi, 2015).

The course includes the following learning objectives:

- Describe the properties and educational significance of educational, epistemic, and serious games
- Understand and describe the importance of digital games as a cultural artifact, including how societal ethics, norms, and social codes and mores are reflected in game design, game play, and representations in games
- Describe the importance of games as a driver of technology-mediated, innovative, student-centered, life-long learning
- Identify, explain, and enact the core principles of digital citizenship and digital literacy
- Gain practical experience with multiple forms of digital social interaction and online communications (including Web 2.0 tools)
- Gain practical experience working collaboratively in virtual environments as part of a team to solve problems
- Participate in face-to-face (F2F) and online discussion to reflect on and analyze the process of situated learning through game play
- Develop and enact situated literacies, including multimodal literacies, media literacy, visual literacies, game literacy, technological literacy, and civic literacy
- Describe issues of identity and representation within games and game-playing communities
- Identify design elements of educational games that embody well-established principles and models of learning, and juxtapose them with more traditional approaches to teaching and learning
- Identify genres and educational potentialities of a wide array of games and game-supported activities that focus on contextualized, culturally relevant/sustaining learning while simultaneously addressing issues of caring, advocacy, social consciousness, and civic efficacy

- Critically evaluate games for their educational potential, including developmental appropriateness, cultural responsiveness, connections to core content, learner-centered approaches, potential to facilitate reflective practice, facilitation of life-long learning
- Develop the capability to locate online professional ratings of various games and virtual environments

COURSE CONTEXT

This graduate level course is for students enrolled in an MA program for elementary or secondary education, or in a doctoral program in teacher education. The class aims to increase the efficacy of current and future educators through game based learning and through the gamification of instructional activities. Students enrolled in the class tend to be licensed, practicing teachers; however, being a classroom teacher is not a requirement for taking the course. Because students range from teaching kindergarten through high school and post secondary education, they usually work in small groups with peers who are teaching in similar grade bands. The tenets of game based learning and gamification are taught within the structure of project based learning, utilizing a *connected learning* framework (Ito et al., 2013), where meaning making is intertwined with creative problem solving, innovative thinking, metacognition, and collaboration. Students are scaffolded through the process of integrating educational games into lessons, units, and learning activities that they plan to teach or are already teaching.

The course focuses on educational video games and game play for active, critical, interdisciplinary learning, something which can happen in school or out of school. We examine a variety of perspectives on what it means to learn, how learning is assessed, and the ways digital games can effectively accommodate the needs of diverse students, including English learners and emergent bilingual students, culturally and linguistically diverse learners, and children and teens with disabilities or special needs. Course participants integrate the concepts of digital literacy and digital citizenship into their repertoire of instructional strategies and resources; they also contemplate strategic uses of digital games to support rigorous, inquiry-based learning, while drawing on digital games to promote social and leadership skills. Particular emphasis is on critical examination of identity and representation in games and online environments related to issues of social consciousness, identity formation, social advocacy, and global awareness. Students in the class develop professional knowledge, skills, and dispositions in several areas:

- Use technology, digital games, and interactive learning environments to promote active learning and independent inquiry
- Articulate beliefs about technology-enhanced teaching and learning and how digital resources can improve the conditions of learning for all students
- Integrate technology and digital games into subject matter to make it accessible to students and to promote the values and practices of responsible citizenship
- Use flexible, appropriate technology to support learners from various backgrounds
- Build connections between students' academic and out of school experiences in order to contextualize subject matter learning and to reach intended assessment outcomes

- Reflect on their own pedagogical perspectives in order to stimulate, inform, reinforce, challenge, and question existing practices, with the goal of developing the intuitive knowledge and professional judgment needed for effective teaching with games and simulations

COURSE PEDAGOGY

The course is rooted in 21st century pedagogies, where teaching is "continually reshaped and renewed in the changing sociopolitical context" (Seglem & Garcia, 2018). Because the class is primarily designed for K-12 teachers, we consider how electronic games enrich, enhance, and/or extend content area instruction, and how they can be used to facilitate interdisciplinary learning. For example, we explore how digital games can be used to scaffold language and literacy learning, as well as disciplinary literacy and content knowledge. The narrative structure of electronic games provides avenues for students to immerse themselves in texts that they may find less intimidating than the traditional lengthy passages of printed text. The images and illustrations, the sounds and narration, and the decisions involved in game play are forms of literacy that align with English Language Arts (ELA) standards at all grade levels (Steinkuehler, 2020). Video games are in fact a type of literacy with observable outcomes. During game play, learners develop the cognitive skills needed to navigate and interact with game elements in order to make progress and achieve goals. In the process, they activate the thinking processes needed to understand how images and text work together to tell a story. Gee (2007, p. 135) points out that in games

> real-world consequences do not exist, allowing learners to take greater risks. For example, in gaming worlds learners are able to "try-out" different identities relating to gender, ethnicity, and even species. Similarly, gaming environments allows learners to make multiple attempts towards a given reward (i.e. new level, boss) without any real-world consequences. This creates a safe space for the learner to fully engage with the environment.
>
> While players are immersed in virtual environments, they are free to interact with other players and non-player characters, and to modify their surroundings. Players are encouraged to engage in social activities in games that draw upon 21st century skills such as collaboration, strategic reasoning, critical thinking, and communication. In the process of navigating the game, players interpret representations within the game, including icons, images, text, signs and symbols, maps, animation, gauges, and audiovisual cues. We incorporate Kress's (2009) framework of multimodality, which explicates how "written-linguistic modes of meaning interact with oral, visual, audio, gestural, tactile, and spatial patterns of meaning" (cited in Cope and Kalantzis, 2015, p. 3). Because players assign meaning to the semiotic elements in a game through interactions with them, students utilizing the same game may have very different experiences with it.

Video games are a form of text that can be scrutinized in ways similar to how we analyze texts such novels, narratives, history, fiction and non-fiction. Players encounter moral decisions, interpret metaphoric text and images, and discover hidden messages the same way they would while reading a passage of text, viewing a work of art, or listening to a song. Video games often include all of these elements at the same time, and countless others. Games require players to make value judgments and to learn from the consequences of their decisions. As players interact with these digital texts, they learn to interrogate the meanings of signs and symbols, and to identify viewpoints such as implicit bias that may be embedded or represented in games (Lankshear & Knobel, 2016).

Students enrolled in the DGBL class employ digital age best practices for teaching with an emphasis on designing curricula and instructional materials that accommodate the myriad needs of learners with diverse backgrounds, interests, abilities, and needs. The national education technology standards

(NETS) for teachers, students, and coaches provided by the International Society for Technology in Education (ISTE) guide students through the development of constructivist-oriented curricular materials; those who are K-12 teachers also align their lessons with state standards and benchmarks across or within content areas. The lessons should be flexible enough to encompass the needs of English learners, students with disabilities, and learners with intersectional identities and backgrounds who may not benefit from traditional forms of classroom instruction. Using a combination of text, video, and other multimedia texts, we use video games for differentiated instruction (Tomlinson, 2017) that attends to sociocultural aspects of students' lives, experiences, and identities (Paris & Alim, 2017). We discuss frameworks for effective technology integration, including technological, pedagogical, and content knowledge [TPACK] (Mishra & Koehler, 2016), the SAMR model of technology integration that includes Substitution, Augmentation, Modification, and Redefinition levels, and Levels of Teaching Innovation (LoTI). Throughout the course, students engage with interactive applications such as FlipGrid, Jamboard, Google Suite, and EdPuzzle that are helpful teaching in blended or virtual environments.

Course Texts, Games, Software, and Hardware

The required technologies for the course include high-speed access to the internet, a computer or gaming device equipped with a graphics card designed for multimedia operations (e.g., high resolution and a high refresh rate), an email account, and cloud space, which is provided by the university. Game consoles such as PlayStation 4, Nintendo Switch, and Xbox One are not required; however, students who have access to gaming consoles are encouraged to use them as part of their play experiences. Mobile devices such as smart phones and tablet computers are also encouraged but not mandatory. A social media presence is recommended, particularly for students who are working on projects or playing games together. A headset designed to work with a sound card and game engine for communication between players might be useful in the class. A flash drive for storing media and files is required (two are recommended).

Readings for the course are provided electronically by the instructor. Two books are highly recommended for the class: *Understanding video games: The essential introduction* by Simon Egenfeldt-Nielsen, Jonas Heide Smith, and Susana Pajares Tosca (4th ed.) (2020), and *The gamification of learning and instruction: Game-based methods and strategies for training and education* (2012) by Karl Kapp. Students are encouraged to seek out used editions of the books or check the library for additional recommended readings, including *Good Video Games Good Learning* by James P. Gee (2007); *Digital Games and Learning: Research and Theory* by Nicola Whitton (2014); *Power Play: How Video Games Can Save the World* by Asi Burak & Laura Parker (2017); *SuperBetter* by Jane McGonigal (2016); and *Flow* by Mihaly Csikszentmihalyi (2008).

COURSE ASSIGNMENTS

Digital games are a fundamentally different approach to learning that contrasts sharply with the traditional models of instruction that are usually homogenous, content-specific, and assessed through standardized testing. Students in the DGBL class, who are often teachers themselves, need guidance, hands- on practice, and specific modeling as they learn to enact instructional practices that likely deviate from what they have experienced at school. Assignments and coursework are designed to facilitate a shift away from typical measures of student achievement and toward inquiry-oriented

instruction, interdisciplinary learning, and authentic assessments that incorporate an array of techniques for students to access content and participate in meaningful learning. The activities are meant to stimulate interest and motivation for learning in ways that allow students experience learning and express what they know and understand through multiple modalities. The assignments, some of which intentionally overlap and bleed into one another, are outlined below.

- Readings and online discussions –Students use annotation tools (e.g., xodo.com, hypothes.is, Adobe Acrobat Pro DC) to notate articles and readings, ask questions, and share how the readings connect with what they are learning. When more than one reading is assigned in a week, small groups select a reading and pose questions for the class. Their peers respond to the questions by annotating one or more papers or chapters, and all students can respond to the postings of their classmates. Required readings include:
    - Bowden, H., & Aarsand, P. (2020). Designing and assessing digital games in a classroom: An emerging culture of critique.
    - Canning, S., & Betrus, A. (2017). The culture of deep learning in esports: An insider's perspective.
    - Denham, A., & Guyotte, K. (2018). Cultivating critical game makers in digital game based learning: Learning from the arts.
    - Dezuanni, M. (2018) Minecraft and children's digital making: implications for media literacy education.
    - Ferguson, C. (2015). Do angry birds make for angry children? A meta-analysis of video game influences on children's and adolescents' aggression, mental health, prosocial behavior, and academic performance.
    - Halbrook YJ, O'Donnell AT, Msetfi RM. (2019). When and how video games can be good: A review of the positive effects of video games on well-being.
    - Kingsley, K., & Olufemi, D. (2015). Video games for engaged learning and prosocial behavior.
    - Larson, S. (2020, April 30). Positive effects of video games on educational achievements.
    - Learning Games Network (2015). *Better learning in games*.
    - Portnay, L., & Schrier, K. (2019). Using games to support STEM curiosity, identity, and self-efficacy.
    - Romero, M., Usart, M., & Ott, M. (2015). Can serious games contribute to developing and sustaining 21st century skills?
    - Shliakhovchuk, E. (2018). Using video games in intercultural, diversity and inclusive education.
- Game play and Play diary – Students may use online or commercial off-the-shelf (COTS) games to connect best practices in teaching with the thinking and meaning making processes they observe in digital games. Each week students reflect on one or more games they played, as well as their experiences in other virtual environments, such as games they played with friends. Gaming activities can include recreational play; they do not all have to be education-

related experiences. Students are welcome to use any games they own, borrow, buy or share with classmates, as long as the games have educative value and are age-appropriate. In their play diaries, students make notes on which games they played and describe actual and/or potential learning experiences in the game. They reflect on the motivational or engaging aspects of the game, including the user interface, the types of thinking and reasoning needed to advance in the game, and their own progress throughout the game. Over the course of the semester, students get better at identifying the structures within games that support learning, motivation, and engagement, and at recognizing how the elements of games, such as learning goals, game mechanics, and measures of player performance are aligned with content area standards and benchmarks (Learning Games Network, 2015).

- Learning Log – At the end of each class session students complete an exit ticket, where they reflect on what they learned, questions and wonderings, and what they hope to explore in the future. They connect what they learned through gameplay with instructional practices they might integrate into their own teaching, with particular attention to students' out-of-school knowledge and experiences. Learning logs can be in various formats, including a typed paragraph, a blog posting, listicle, voice recording, a tweet, or other form of microwriting.
- Midterm Project – This is a major project students complete in the class. Students propose a video game that includes an **Alternative History** or an **Imagined Future**. An Alternative History involves conjuring a different ending to a true historical event such as: the southern states won the civil war; nuclear weapons are banned in all countries; women rule the world; the Nazis prevailed in WWII, etc., or an Imagined Future (e.g., the world has run out of oil water, and/or clean air, so humans must colonize another planet and establish a civilization and government; people and animals can teleport to different multiverses; humans can get brain implants for knowledge rather than enduring years of public schooling; we live in a surveillance society such as Orwell's *1984*). The proposed games can include real and imaginary events, storylines, and characters; students often use picture books or literature as a starting point for their projects. Students make an interactive timeline to illustrate how the proposed game would unfold for players, and create faux primary artifacts (personal letters, newspaper headlines, tweets, official documents, social media postings, etc.) to develop the plot and the characters. They create a setting and context for the game, determine the characters (including non-playable characters [NPCs]), outline the goals and objectives of the game, determine the game mechanics and the rules of play, determine possible paths toward winning or progressing in the game, and design a rewards structure. Students are not required to actually create the game; rather, the goal is for them to think about the components of games and how they interact with each other within a meaningful context.
- Ten Minute Teach – students learn to play an educational or epistemic game and create a presentation to demonstrate the game to the class, modeling how it can be used to support teaching, learning, and/or assessment, and how it might encourage prosocial behaviors. They reflect on what they learned during gameplay for this project in their play diary.
- Game prototype – students create a simple electronic game using free, open-source software. Basic coding skills are taught in class. Their classmates play a beta version of the game and offer feedback. Tweaks and revisions are made to improve the game.
- Literature review – students write a brief paper (6 to 10 pages) connecting theories of game

based learning with their aspirations for teaching, parenting, or civic engagement. APA formatting is required for the paper, with a minimum of six peer-reviewed sources cited. An outline for the paper is provided to guide students through the process of planning and composing their paper. Students offer peer review to each other, and they are allowed to make revisions to the paper if they do not earn a satisfactory grade on the assignment. Students are encouraged to write for possible publication or for professional conference presentation, although that is not a requirement.

COURSE ASSESSMENT

In this class, formative assessment is the primary mechanism for evaluating learning. The class emphasizes epistemic frames, where players learn to work and think as a professional in a particular field would do. When engaged in epistemic gaming, players apply a repertoire of knowledge and skills to solve problems in innovative ways (Nodoushan, 2009). Epistemic game play allows players to "apprentice" in a supervised environment, and reflect on their learning with their friends, peers, and other players. Thus, learning and assessment of learning are not separate activities; instead, they are part of the same process that unfolds during game play. When students are immersed in an activity that requires them to think in innovative ways to solve complex problems, or to strategize as part of a team working toward a goal, they are learning to think as professionals in a particular field do. During and after game play, students reflect on what they found difficult, frustrating, enjoyable, motivating, and gratifying. They also make note of instances when they used metacognitive strategies to deal with setbacks, unravel mysteries, solve puzzles, or change their perception of what they are able to accomplish in the game.

As the semester progresses, students identify key design principles that high-quality games have in common in order to support learning. Students are allowed to edit, revise, and resubmit assignments if they did not receive all the points. If they submit their work (literature review or presentation) to a peer-reviewed journal or professional conference they receive bonus points.

Students complete the following assignments during the one semester class:

- Play diary:10 entries per semester – 20 points
- Learning logs, attendance, and participation – 10 points
- Reading responses and online discussions – 10 points
- Ten Minute Teach presentation of educational game – 10 points
- Midterm Project focused on an alternative past or imagined future – 25 points
- Development of a simple game prototype – 10 points
- Literature review (six to ten pages in length, APA style) – 25 points

EXPANDED COURSE OUTLINE

Week 1: Introduction to Digital Game Based Learning

Class topics/Activities

- Introduction to class: syllabus and course requirements (online discussion – whole group)
- Blackboard interface (demonstration)
- Using games to build community in distance learning (online reading in small groups)
- Play Diaries (instructor shares examples)

Assignments

- Student introductions in class and/or on Blackboard. Share your interest in video games, experiences with games, grade level and subject area you teach or plan to teach
- In small groups, brainstorm and sketch a game (on paper or in Google Draw) to explore goals, rules, conflict, reward structures, and feedback structures of digital games; post on BB
- Read Ch. 1 in Egenfeldt-Nielsen book *Studying Video Games* (reading response)
- Read pp. 3-22 in *Whitton* (2014) Evaluating digital games for learning

Week 2: Video games for learning and problem solving

Class topics/Activities

- Frameworks for constructivist games (lecture & slideshow)
- Holistic and diagnostic evaluations of learning – higher order thinking skills (HOTS) (lecture and slideshow)
- Player types and game patterns (small group discussion)

Assignments

- Read *Farber* (2019) on constructionist games – respond on BB
- Read/watch *Gee's Learning Principles* https://www.edutopia.org/video/james-paul-gee-learning-video-games
- Try out Loopy animation tool for concept mapping of higher order thinking skill (HOTS)
- Learning principles and game play (online discussion)
- Week 3: Gamification, Serious games

Class topics/Activities

- Games for collaborative problem solving (lecture and slideshow)
- Digital games across disciplines and content areas (small group discussion)
- Gamification of education https://www.youtube.com/watch?v=1CZtIIy7tRU (video)

- Gamification v. game based learning https://www.youtube.com/watch?v=kHn0Maj8ygs (video)
- Examples of play diary entries (slideshow)

Assignments

- Read *Kapp* (2012) Ch. 1 What is gamification and Ch 2 Game Elements – respond on BB
- Play a game at www.playful-pedagogy.org or www.gamesforchange.org and reflect on your experience in your play diary, post on BB
- Ethics, morals, and virtual rights (online discussion)

Week 4: Social aspects of video games; VG and pro-social behavior

Class topics/Activities

- Technology integration frameworks LOTI, SAMR, TPCK, NETS Standards (lecture & slideshow)
- ESRB and PEGI ratings https://www.esrb.org and https://pegi.info (websites)
- Flow Theory https://thinkgamedesign.com/flow-theory-game-design/?web=1&wdLOR=c81502186-EE61-A34B-AFF3-A04FBDAF6054 (video)
- Common Sense Media game reviews www.commonsensemedia.org (discussion, Q&A)
- Joan Ganz Cooney Center report on how parents and teachers are bridging students' interests (small group discussion)

Assignments

- Read *Kapp* Ch 3 Theories of gamification for learning and instruction (pp. 1-74); Respond on BB
- Read *Vaala* (2019)
- Read Takeuchi et al., (2019) Learning across boundaries https://joanganzcooneycenter.org/publication/learning-across-boundaries/
- Review a video game: see examples at https://www.wikihow.com/Write-a-Video-Game-Review
- Check out Anita Sarkeesian and Feminist Frequency website https://feministfrequency.com
- Play diary – post on BB

Week 5: Games and social issues

Class topics/Activities

- Social impact games (online tour, walkthroughs, video trailers)
- *Half the sky*
- *Re-mission*

- *Fold-It*
- *This little war of mine*

Assignments

- Read *Burak & Parker* Ch 6 (A lab of hope) and Ch 7 (Armchair scientists) – respond on BB
- Play *Animal Crossing* or *Among Us* (individual or small group)
- Choose a game for your ten-minute teach presentation – post on BB
- Play diary – post on BB

Week 6: Games as storytelling; Esports

Class topics/Activities

- E-sports https://edtechmagazine.com/k12/article/2019/01/esports-programs-start-pop-k-12-schools
- Augmented reality; ARIS platform (lecture & slideshow)
- Why we love MOBAs & MMORPGs http://www.sagernotebook.com/blog/2016/09/20/people-love-mobas-mmorpgs/ (online discussion)
- Game Accessibility Guidelines http://gameaccessibilityguidelines.com (online tour)
- Avatar creation (in-class activity)

Assignments

- Play *Dota 2, League of Legends*, and/or *Fortnite* (individual or small group)
- Play *Mentira* http://www.mentira.org/the-game (individual or small group)
- Draft of prototype game due – post on BB (individual or small group)
- Read Leagues of Learning https://www.k12blueprint.com/sites/default/files/Intel-Esports-in-Education.pdf
- Play diary – post on BB

Week 7: Research on video games and violence; Diversity, Equity, Inclusion & Accessibility (DEIA) in games

Class topics/Activities

- Active User v. Active Media perspective (*Egenfeldt-Nielsen et al.)* (lecture & slideshow)
- Video games for prosocial behavior (small group discussion)
- DEIA in games https://guides.lib.umich.edu/c.php?g=282989&p=5955092 (website tour)
- Goldilocks Effect (Turkle) (discussion & video) https://www.socialmediatoday.com/content/technology-connections-and-goldilocks-effect

Assignments

- **Alternative history / Imagined Future Midterm** project (small group brainstorming)
- Read *Ferguson* (2015) Do angry birds make angry children? – respond on BB
- Read *Kingsley & Olefumi* (2015)
- Play diary – post on BB

Week 8: Video games for learning and thinking

Class topics/Activities

- Explore Alice, Scratch, Quest, Stencyl & Tynker programs to design prototype games (online tour and demonstration)
- Constructivist learning (online discussion)
- Transfer of Learning – Ferlazzo (2019) video https://larryferlazzo.edublogs.org/2019/04/29/one-way-im-promoting-transfer-of-learning-with-my-students-handout-videos-included/ (online reading and video, small group discussion)

Assignments

- Hexagonal thinking activity (lecture and demonstration)
- Create mini-lesson in Jamboard or Flipgrid (small group)
- Explore Hour of Code activities https://hourofcode.com/us/learn – respond on BB
- Watch VGs and violent crime https://www.cnbc.com/video/2018/03/08/violent-video-games-do-not-contribute-to-violent-crime-says-expert.html (video) – respond on BB
- Read *Davis* (2014) on gamification
- Play diary – post on BB

Week 9: Game taxonomies; Decision making in games

Class topics/Activities

- Standards aligned curricula (small group discussion)
- Game prototype testing (small group feedback)
- Rewards (lecture and slideshow)
- Debugging and revision process (lecture & slideshow; small group)

Assignments

- *Sphero* programming (small group meetings w/ instructor)
- Work on game prototypes (small group)
- Test prototype w/ peer feedback (small group)
- Read *Gee* (2007) Ch 7 Why study games now? – respond on BB

- Read *Larson* (2020) Positive effects of VG on educational achievement
- Play diary – post on BB

Week 10: Games for teaching diversity, inclusion, and social justice

Class topics/Activities

- Situated play and affinity spaces (lecture and slideshow)
- *ReMission* game (in-class game play)
- Small group game play
- *Never Alone* http://neveralonegame.com
- *Papers Please*
- *Paintball Hero*
- *Cat in the Hijab*

Assignments

- Read*Zhu* (2020) VG and COVID-19 pandemic – respond on BB
- Play *Animal Crossing, New Horizons,* or *Skylanders* (individual or small group)
- Read *Shliakhovchuk* (2018) Video games and diversity/inclusion
- Play diary – post on BB

Week 11: Games as cultural artifacts; game culture

Class topics/Activities

- GamerGate – What we still haven't learned from Gamergate https://www.vox.com/culture/2020/1/20/20808875/gamergate-lessons-cultural-impact-changes-harassment-laws (online reading)
- Sexism and gender bias in games and in social media (small group discussion)
- Racism, bigotry, misogyny, and hate in VG (small group discussion)
- Stereotypes in games (small group discussion)

Assignments

- Peer review of literature review paper
- Read *Portnoy & Schrier* (2019) Using games to promote STEM
- Play diary – post on BB

Week 12: Video games and new literacies; Assessing learning

Class topics/Activities

- Video games and literacy – *Apperley & Walsh*, 2012 (online discussion)

- Formative and summative assessment (online reading and small group discussion)
- Virtual / hybrid teaching and learning with video games (slideshow and discussion)

Assignments

- Peer feedback on game prototypes (small group)
- Read *Halbrook et al*. (2019) When and how VG can be good – respond on BB
- Ten Minute Teach presentations (post presentations on BB)
- Play diary – post on BB

Week 13: STEM/STEAM games

Class topics/Activities

- Teaching science, technology, engineering, mathematics with interactive video games (lecture and slideshow; websites; discussion)
- Explore *Phet* and *Manga High*
- *Minecraft* in K-12 classrooms (online discussion)

Assignments

- Read *Dezuanni* (2020): *Minecraft* and children's digital making – post response on BB
- Work on literature review paper
- Play diary – post on BB

Week 14: Augmented reality

Class topics/Activities

- Benefits of augmented reality
- Try out *Merge* cubes

Assignments

- Create **mini-lesson** using *3D Bear*
- Play one of these games: *Pokemon Go, Ingress, Zombies Run, Monster Park AR*
- Read *Barab & Gershenfeld* (2019) The Serious Business of Play (pp. 3-8)
- Play diary – post on BB

Week 15: Health & wellness; games as therapy; games for people with disabilities

Class topics/Activities

- VG to alleviate trauma (online discussion)
- Games for blind or deaf players (websites)

- Games and PTSD; treating trauma, preventing pain, healing w/ VG (slideshow)
- Haptic feedback in games (online tour)
- Cultivating empathy w/ VG (lecture and slideshow)

Assignments

- Watch Heal your brain w/ VG (McGonigal TED talk)
- Try out one of the following games (individual or in small groups)
- *Superbetter*
- *Snow World* to treat burn victims
- *Tree Project*
- *Mitsu Desu* (social distancing game)
- *EndeavorRx* (ADHD)

Week 16: Presentations and literature review

Class topics/Activities

- Share/demo the game(s) you created (small group)
- Final draft of literature review (slideshow in small groups)
- Analysis of Play Diaries (slideshow or other presentation)

Assignments

- Game presentations (video walk through)
- literature review presentations (slideshow or other presentation)

Course reflections

COURSE BEST PRACTICES

To understand how well-designed video games enhance thinking, learning, and engagement, students play a variety of games, including fantasy games, strategy games, and *epistemic games*, where a player steps into a role that requires them to think, act, and plan the way a professional in a particular field would. This might include, for example, taking on the role of an urban planner, or that of a zookeeper, a pilot or captain of a spaceship, a surgeon or a paramedic, an environmental activist or a scientist, a civic leader or a dictator. Throughout the course "wicked problems" (Kolb, 2012) are emphasized: problems that are difficult or impossible to solve because they are interconnected with other problems. Health and wellness, poverty, and economic inequality are examples of wicked problems that can be explored through games. Game play strengthens players' ability to think through predicaments, to consider a variety of viewpoints and perspectives, to contemplate taking action to effect social change, and to reflect on the struggles associated with tackling intractable social problems.

We also focus on the concept of *eustress*, or positive stress (McGonigal, 2016), where a person feels capable of solving a problem without panicking, fleeing, or becoming distressed. When players experience eustress, they feel challenged but not defeated because they are receiving feedback from the game that can help them discover or invent new ways of completing a task or accomplishing a goal. Knowing that they can negotiate game play decisions and consequences, that their actions matter, and that they can call on their friends for assistance during a game contributes to learners' sense of *self-determination* (Deci & Ryan, 1985). As such, learners are motivated to persevere as they work through challenging problems knowing they have the power to determine the outcomes of their actions. In self-determination theory (SDT) there are two types of motivation: *intrinsic* motivation, comes from within and is based on our values and interests, and *extrinsic* motivation, which is based on external rewards such as grades, recognition, awards, evaluations, or fear of punishment. DGBL can facilitate intrinsic motivation by highlighting students' assets and abilities, as opposed to their deficits, a mindset that benefits both the teacher and the learner.

Metacognition, the knowledge and understanding of one's own thought processes, is one of the explicit learning goals for game play in the class. When students are encouraged to become critically aware of the meaning making processes inherent in game play, such as planning, monitoring progress, and self-assessment, they are empowered as thinkers and problem solvers (Drummond & Saur, 2015). Well-designed video games help bridge learning across the content areas, while also fostering dispositions such as a willingness to take risks, resilience in the face of setbacks, and tenacity, skills that are associated with college and career readiness. Students are encouraged to make connections between electronic games and the 4 C's of college and career readiness: collaboration, communication, creativity, and critical thinking, and to consider how these skills can support remote and blended learning in synchronous and asynchronous environments.

FUTURE COURSE PLANS

Moving forward, games embedded in social media, and that utilize augmented reality and virtual reality will play a more prominent role in classes like this one. Mobile computing is taking hold, and students are using their phones and handheld devices for all aspects of their lives, so a course on game based learning should move in that direction. An exploration of mobile game creation and the design of apps for smart phones and tablets would address this need. In particular, dialogue and games that attend socially constructed issues such as gender, ability, class, and sexual orientation, and that critique systems of oppression are needed. Although these topics are largely absent from public school curricula, they are essential dimensions of education that must be addressed in order to mitigate social and educational inequalities. Video games can provide a framework for making visible the institutional formations that privilege some members of society but limit access to opportunity for historically marginalized individuals and groups. In this way, video games can be useful for both learning and "unlearning" some of the misdirected lessons that kids observe in school and in life.

With the increase of online teaching and learning, educators are in need of activities that students can complete individually or in groups, cooperatively or competitively (Aldrich, 2009). In an era of remote education, video games offer potential pathways for formal and informal learning that resemble the types of participatory activities students engage in when they aren't at school. Digital games and interactive virtual worlds hold students' attention and spur their motivation to learn. In this way, games can help to alleviate the sense of tedium and frustration that many students, teachers, and

parents are experiencing during the shift to remote education (Kingsley, 2020). Rather than learning in narrow, disciplinary silos, students can use games to develop critical intelligence, the skills and habits of mind that allow learners to succeed across disciplines. An example of this would be the rise of esports, where diverse social groups students work together in teams to compete in electronic competitions using massively multiplayer online role-playing games (MMORPG) like *Fortnite*, *League of Legends, Minecraft,* and *Valorant*. Esports are a viable way to foster the kinds of broad, layered, collaborative thinking that are applicable to both academic and non-academic settings (Canning & Betrus, 2017).

Research on digital game based learning is evolving, too. Nascent scholarship on games and education was predominantly focused on measuring discrete facts and rote processes learned through game play. The implication was that the primary purpose of games was to help students perform better on high-stakes tests. Student achievement and teacher quality were often gauged by student scores on standardized tests, and games were considered from the perspective of whether or not they boosted test scores (Aldrich, 2009; Egenfeldt et al., 2020; Squire, 2011). Games, entertainment, and play were viewed as antithetical to rigorous academic learning. Now, though, studies increasingly explore how electronic games and schoolwork are actually closely intertwined, mutually beneficial processes that serve a larger purpose for both students and for teachers. More research is needed to examine the use of digital games for raising awareness and catalyzing social change, for designing collaborative approaches to knotty problems, and for medicinal and therapeutic purposes. Scholars should also consider how games can inspire creativity and innovative thinking, ameliorate educational inequities, and help people of all ages and backgrounds to become lifelong learners.

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CHAPTER 14.

GAMING AND SIMULATIONS FOR LEARNING (ED893.628)

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JOHNS HOPKINS SCHOOL OF EDUCATION

Course Title: ED893.628: Gaming and Simulations for Learning
Course College/School: Johns Hopkins University School of Education
Course Department/Program: Digital Age Learning and Educational Technology
Course Level: Graduate
Course Credits: 3
Course Length: 16 weeks (fall, spring), 12 weeks (summer)
Course Medium: Online (Primarily asynchronous via Blackboard)
Course Keywords: games; simulations; game-based learning; performance-based-assessment; K–12

CATALOG DESCRIPTION

This course provides an overview of game-based learning theories and practices for incorporating educational games and simulations into a range of learning environments. Students learn to apply analytic frameworks to commercial and educational games so as to evaluate a game's potential as a learning tool or environment for K–18, business, and government settings. Students also integrate games with lessons and other learning activities, as well as produce paper prototypes for their own educational games and plan to use gameplay data for assessment.

COURSE PURPOSE AND OBJECTIVES

The purpose of *Gaming and Simulations for Learning* is to introduce working educators (primarily K–12 teachers) to instrumental theories, frameworks, and methods to assist them with analyzing, evaluating, and using games as tools for learning. The course prepares students to think about game design and gameplay critically and systematically, as a means to evaluate the utility of existing games as tools to support a variety of learning objectives for different learners, and to help them conceptualize their own educational games, primarily as an exercise to deepen their understanding of the relationship between an educational game's learning mechanics and competencies associated

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with learning objectives. Students also learn to apply teaching practices to connect their own learners' gameplay experiences with other learning activities. The course's main learning objectives are:

- Describe and explain the basic features of several theories of game-based learning.
- Analyze digital and physical game rule systems and mechanics using a range of criteria and make judgments about their value as educational tools to support specific learning objectives.
- Describe whether and how gameplay operationalizes learning objectives and explain how gameplay data can be used to make inferences about student learning.
- Create a design document for an educational game.
- Conceptualize and prototype an educational game designed to support the practice of a subset of skills in a domain of students' choosing.
- Design lessons and activities that integrate gameplay into a broader educational setting.
- Create a plan to use gameplay data for formative assessment.

In addition to supporting these seven objectives, the activities, readings, and presentations in *Gaming and Simulations for Learning* are intended to reinforce three ideas about using well-designed games as tools for teaching and learning: (1) games are logical systems that can support model-based reasoning (Gee, 2003, 2008; Lehrer & Schauble, 2006; Salen and Zimmerman, 2003); (2) games can serve as tools for formative assessment and performance-based assessment (Bauer et al., 2017; Shute, Ke, & Wang, 2017); and (3) games and gamification can promote playful learning experiences, which are associated with intrinsic motivation (Homer, Raffaele, & Henderson, 2019; Ryan, Rigby, & Przybylski, 2006). The course also emphasizes instructional techniques in which games are treated not as standalone tools, but rather as "small and condensed micro-universes that provide rich and compelling experiences that can be explored further with a variety of teaching methods" (Egenfeldt-Nielsen, 2007, p. 276). In other words, the course does not focus exclusively on "how students learn in games," but rather it also addresses how gameplay can be connected to other learning activities to improve student learning outcomes.

COURSE CONTEXT

Gaming and Simulations for Learning is an elective and primarily asynchronous course in the online graduate program in Digital Age Learning and Educational Technology (DALET). Like all online courses in the JHU School of Education, the course is housed in the Blackboard learning management system. Approximately 60–70% of students in the program are typically in-service K–12 teachers (most in elementary and middle school education) pursuing their first master's degree, with the remainder working in different areas in adult education. From year to year a small number of students in the program are (or plan to be) instructional designers, curriculum developers, or media producers, but they generally do not intend to work in the area of game design or development. The course also usually draws a small number of preservice teachers from the school's teacher preparation programs. DALET students are typically clustered in the U.S. New England, Mid-Atlantic, South, and West regions, as well as in other countries, including China, South Korea, Japan, and Brazil.

I administer a survey at the beginning of the semester to learn about students' interest in playing games, how frequently they play them, and whether and how they use games as part of instruction.

Most students typically report that they play card or board games a few times a year, and between 30–40% usually indicate that they play video games weekly. Nearly all of the in-service teachers note that they use games regularly in their classrooms; examples of the games they use often include apps like Kahoot! and Quizziz and trivia games like Jeopardy!, and only rarely do they provide examples of commercial games. Most students who are educators usually enter the course with some experience using gamification techniques in their instruction. Additionally, they generally use "exogenous games," in which the learning content is external to gameplay, rather than "endogenous games," where the learning content is integrated with the gameplay (Rieber, 1996; Squire, 2006).

Following are typical survey questions:

- Have you ever taken a higher ed course on educational games and simulations?
- If you have taken such a course previously, please describe it briefly:
- How often do you play organized sports?
- How often do you play card or board games?
- How often do you play video games?
- What are some card or board games that you're currently playing or have played in the past?
- What are some video games that you're currently playing or have played in the past?
- Have you ever used games or simulations as part of your work?
- If you have, please describe how, briefly:
- Do you ever read or watch video game reviews or participate in discussions about games?
- If you do consume or produce game reviews, please describe how, briefly:
- In your opinion, how can games and simulations be used as tools for learning?
- What questions do you have about the role of games and simulations as learning environments?

COURSE PEDAGOGY

The course is designed to facilitate student experiences in an authentic learning environment, "a pedagogical approach that situates learning tasks in the context of real-world situations, and in so doing provides opportunities for learning by allowing students to experience the same problem-solving challenges in the curriculum as they do in their daily endeavors" (Herrington, Reeves, & Oliver, 2014, pp. 401–402). As most students are usually K–12 educators, the activities are generally intended to enable students to build and apply problem-solving skills that they will need in formal learning environments. That is, applying their understanding of theory and practice to make judgments about whether and how to use games as tools to support learning.

My pedagogical beliefs are strongly influenced by social constructivist perspectives on teaching and learning, which posit that knowledge and meaning emerge through ongoing interactions between individual learners and a local community (or, classroom) (Cobb & Yackel, 1996; Palincsar, 1998). Accordingly, I use project-based learning methods—"an integrative perspective on motivation and learning…by engaging students in investigation" (Blumenfeld et al., 1991)—and asynchronous

discussions to support the social construction of knowledge and skills in class. I believe that graduate students in a professional school should have frequent opportunities to design educational interventions by applying what they have just learned and to give each other guided, constructive feedback on their designs. As an instructor, I am also frequently active in the discussion boards by commenting on individual student posts and providing summaries of major themes I have noticed when reading through discussion threads.

The course is run in two-week sessions. Each session begins with a pre-recorded presentation or "mini-lecture" as a form of direct instruction and advance organizer. The presentations briefly revisit content from previous sessions, introduce new content, and summarize the student activities for the session. Approximately 60% of the major assignments are collaborative—students work on projects in teams of three or four and then provide written feedback to other teams. The remaining activities are completed individually.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

The course has four required texts: (1) *A Theory of Fun for Game Design* (Koster, 2013); (2) *What Video Games Have to Teach Us About Learning and Literacy* (Gee, 2003); (3) *Rules of Play: Game Design Fundamentals* (Salen & Zimmerman, 2004); and (4) *Understanding Video Games: The Essential Introduction* (Egenfeldt-Nielsen, Smith, & Tosca, 2019). Students read the Koster and Gee books in full and select chapters from the Salen and Zimmerman and Egenfeldt-Nielsen, Smith, and Tosca textbooks. Gee's seminal text provides the major conceptual grounding for the course (along with other individual articles), while the other three books are intended to provide students with an overview of concepts related to games and play, as well as with conceptual lenses for analyzing games and gameplay. There is also one recommended text: *Games, Design and Play* (Macklin & Sharp, 2016). This text is recommended to give students insight into iterative game design processes when they conceptualize and design their own games.

There is no required software or hardware, as students are able to choose the card, board, and video games they will analyze, in consultation with the instructor. Students must create free accounts on Board Game Arena (https://boardgamearena.com) and Tabletopia (https://tabletopia.com) because they use these two sites to play card and board games together (the DALET program is online and students are typically not close enough to one another to meet in person). Students are also encouraged to create Twitch (https://www.twitch.tv), Reddit (https://www.reddit.com) and YouTube (https://www.youtube.com) accounts if they want to curate Let's Play recordings (recorded video game walkthrough and analyses) and streaming gameplay to share with other students. These accounts are optional, however.

COURSE ASSIGNMENTS

1. Game Design Projects (Collaborative, 2 in total)

Students design two educational games (and develop one). In Game Design Project #1, teams design and develop a small card or board game that targets two or three learning objectives of their choosing. The game must be playable for another team and the instructor, as teams give and receive peer feedback. In Game Design Project #2, teams mock-up a digital game that addresses two or three learning objectives. Teams are not required to develop (i.e., program) the digital game. In both

assignments, teams are asked to think both as game designers and as educators, trainers, or administrators. The work must show evidence that the team can conceptualize a game with mechanics that enable players to practice skills or apply knowledge that is connected to specific learning objectives. The design document must also demonstrate that the team is able to help an educator make use of the gameplay data to make inferences about student learning.

2. Lesson Plans (Individual, 2 in total)

Students create two lesson plans that integrate at least one digital game into teaching and learning activities in your professional context. They are not required to teach these lessons to their students during the course, though that is encouraged. The main goal of this assignment is to use an educational game or simulation as part of instruction such that the learning experience from gameplay is meaningful for teaching and learning. The gameplay must enable learners to use knowledge or skills associated with the learning objectives to play the game and achieve game-related goals. The lessons should also enable teachers or facilitators to connect gameplay to other non-game activities such that the learner activities are linked. Lesson Plan #2 must link to Lesson Plan #1. In Lesson Plan #2, students include a plan for data analysis and utilize data from Lesson Plan #1 in the development process.

3. Discussion and Participation (Individual)

Students participate in a discussion at least every other session. The goal of these discussions is typically for students to engage in substantive conversation with their classmates and the instructor, incorporating what they have learned through the readings and their own personal and professional experiences to support their assertions. Students revisit the prompts and questions throughout the course.

4. Game Analyses (Collaborative, 3 in total)

Teams analyze four games using models or frameworks from the readings and post 10-minute presentations using VoiceThread for each analysis.

5. Response Paper OR Game-Based Learning Reflection Paper (Individual)

If students choose to write a response paper, they select a book to read during the semester from an approved list (they may choose their own with the instructor's approval). Students are required to connect at least four of the major themes from the book to four other readings from the semester. In their discussions, they must compare and contrast the readings for each theme, evaluate how effectively the author discusses main points, and discuss how or if the book changed their opinions or understanding of the major themes contained in the book.

If students choose to write a learning reflection paper, they will write a summation of their experiences learning in a digital game over the semester. The focus of the paper is on what students learned during gameplay and how they learned to do it. Students must include major concepts they have learned during the term.

COURSE ASSESSMENT

- Game Design Projects = 25 pts. (score is average of two projects)

- Lesson Plans = 25 pts. (score is average of two lessons)
- Discussion and Participation = 20 pts. (score is average of all posts)
- Game Analyses = 15 pts. (score is average of three analyses)
- Response Paper OR Game-Based Learning Reflection Paper = 15 pts.

EXPANDED COURSE OUTLINE

Session 1 (Weeks 1 and 2): Jumping In: What Makes for a "Good" and "Fun" Game? And…What is a Game, for That Matter?

Topics

- Course goals
- Analytic frames for games
- Basic concepts and definitions
- Games as systems

Session Guiding Questions

- What are some personal and formal criteria you can use to analyze games?
- In what ways can knowledge of a game's features help educators make informed decisions about whether and how to use a game in a given context?
- What are your personal learning objectives for this course?
- What are the distinctions between "play" and "games," and why are those distinctions meaningful in the context of instructional design?

Reading and Media

- Egenfeldt-Nielsen, Smith, & Tosca: Introduction and Chapters 1, 3, 5, and 6
- Koster: Entire book
- Salen & Zimmerman: Chapters 3–10 and 22

Reading Guiding Questions

- What makes a game a game? That is, by what criteria do we determine whether something is a game and what type of game it is?
- In what ways are games designed systems? What is the role of player interactivity within a game system?
- In what ways are concepts such as rules, mechanics, genre, and others that are addressed in the readings meaningful for educators who use and create games?
- How do games differ from other forms of media, such as television, film, or literature, and what implications do those differences have for educators and learners?

Assignments

- Personal Objectives Discussion
- Game Analysis 1 (1 game)
- Gaming Experience Poll

Session 2 (Weeks 3 and 4): Analyzing Educational Game Designs: Games as Systems and Systems Thinking

Topics

- Analytic frames for games
- Games as systems
- Procedural rhetoric
- Game-based learning theory

Session Guiding Questions

- What are the elements of a game?
- In what ways are games systems?
- How can games be used to build systems thinking skills and model-based reasoning?

Reading and Media

- Arnab, Lim, Carvalho, Bellotti, deFreitas, Louchart,…De Gloria: Entire article
- Bogost: Chapter 1
- Gee, Learning and games: Entire chapter
- Hunicke, LeBlanc, & Zubek: Entire article
- Farber (Optional video)

Reading Guiding Questions

- What are "game mechanics" and "learning mechanics," and what is the relationship between the two?
- How can game mechanics be constructed to support learning objectives?
- In what ways do well-designed video games support systems thinking and model-based reasoning? (And what does "well-designed" mean in this case?)
- How can games embody arguments? (And what does it mean to "embody an argument"?)

Assignments

- How Do People Learn in Games? Discussion
- Game Analysis 2 (2 games)

Session 3 (Weeks 5 and 6): Theories of Game-Based Learning, Part 1

Topics

- Game-based learning theory
- Game mechanics and learning mechanics

Session Guiding Questions

- What are some big theoretical ideas for why well-designed games are effective tools for learning?
- How can elements of game design help to create opportunities for learning?

Reading and Media

- Gee, *What video games have to teach us about learning and literacy:* Entire book
- Homer, Raffaele, & Henderson: Entire chapter
- Plass, Homer, & Kinzer: Entire article
- Plass, Homer, Kinzer, Frye, & Perlin: Entire article

Reading Guiding Questions

- What are some differences between behaviorist, constructivist, and sociocultural approaches to the educational use of computer games?
- Gee groups his learning principles under several broad headings, including situativity, literacy, and connectionism. How does he describe each of these, and how does he relate them to video games? Why does he believe they are important?
- In what ways can games promote cognitive, behavioral, affective, and sociocultural engagement with learning materials?
- What is the relationship between game mechanics and learning mechanics?

Assignments

- How Do People Learn in Games? Discussion

Session 4 (Weeks 7 and 8): Theories of Game-Based Learning, Part 2

Topics

- Game-based learning theory
- Consequential engagement
- Epistemic games
- Endogenous vs. Exogenous games

Session Guiding Questions

- In what ways can games facilitate authentic learning experiences? (And what's meant by "an authentic learning experience"?)
- How do "video games as designed experiences" promote learning?
- How do the game-based learning principles from James Paul Gee relate to consequential engagement and epistemic thinking?

Reading and Media

- Egenfeldt-Nielsen, Smith, & Tosca: Chapter 8
- Gresalfi, Barab, Siyahhan, & Christensen: Entire article
- Nodoushan: Entire article
- Squire: Entire article

Reading Guiding Questions

- What are some distinctions between "edutainment" and games for educational use?
- In what ways can games support learners' meaningful and consequential engagement with learning content?
- What are "epistemic games" and how might they promote "epistemic thinking"?

Assignments

- How Do People Learn in Games? Discussion
- Game Design Project #1

Session 5 (Weeks 9 and 10): Theories of Game-Based Learning, Part 3

Topics

- Motivation
- Self-determination theory
- Flow
- Gamification

Session Guiding Questions

- What is the relationship between motivation and gaming?
- What is the relationship between motivation and learning?
- What are self-determination theory and flow theory and how do they relate to educational games and simulations?
- How do "gamification" and "game-based learning" compare to one another, and what are the implications for teaching and learning experiences?

Reading and Media

- Baron: Entire article
- Kiili, de Freitas, Arnab, & Lainema: Entire article
- Rigby & Ryan: Introduction, Chapters 1–5
- van Roy & Zaman: Entire chapter
- Csikszentmihalyi (Optional video)
- Mathews (Optional video)
- McGonigal (Optional video)

Reading Guiding Questions

- What is a flow state, and how can it be achieved?
- How might flow states facilitate learning?
- In what ways might educational games help learners to experience self-determination?
- How does gamification differ from game-based learning, and what are the possible implications for instructional design?

Assignments

- Lesson Plan #1
- Motivation and Engagement Discussion

Session 6 (Weeks 11 and 12): Integrating Games and Simulations Into Educational Settings

Topics

- Transfer of learning
- Serious games
- PCaRD framework

Session Guiding Questions

- Under what conditions might game-based learning transfer to real-world situations, and why?
- How can educators support the transfer of learning from games to real-world situations?
- In what ways is the use of educational games in academic settings different from the use of games in business settings? In what ways is it similar?

Reading and Media

- Barnett: Entire chapter
- Black, Khan, & Huang: Entire chapter
- Foster & Shah: Entire article

- Lieberman, Biely, Thai, Peinado, & Blumberg: Entire chapter

Reading Guiding Questions

- What are some methods that educators can use to integrate gameplay into a larger program of instruction?
- What techniques can educators use to help learners meaningfully transfer learning from a game to other situations?

Assignments

- Game Analysis 3 (1 game)

Session 7 (Weeks 13 and 14): Assessment In and With Games and Simulations

Topics

- Formative assessment
- Performance-based assessment
- Stealth assessment

Session Guiding Questions

- What is meant by "stealth assessment" and how does it relate to educational games?
- In what ways can games support formative assessment?
- How do games differ from other forms of assessment with which you are familiar?

Reading and Media

- Bauer, Wylie, Jackson, Mislevy, Hoffman-John, John, & Corrigan: Entire article
- Kato & de Klerk: Pp. 1–3, stop at Section 2
- Shute: Entire article

Reading Guiding Questions

- What is formative assessment?
- In what ways does formative assessment with games resemble other forms of formative assessment with which you are familiar? How are they different?
- How can gameplay data become actionable for educators, trainers/coaches, and administrators?

Assignments

- Lesson Plan #2
- Engagement and Transfer Discussion

Session 8 (Weeks 15 and 16): The End of the Beginning: Designing an Educational Game

Topics

- Formative evaluation
- Iterative game design

Reading and Media

- Macklin & Sharp: Chaps. 9–13

Assignments

- Game Design Document #2
- Reading Response Paper OR Game-Based Learning Reflection Paper (I): By 5/15 end of day
- What Have You Learned, What Do You Still Want to Learn? Discussion

COURSE BEST PRACTICES

Time

It is essential that students give themselves time to play games and to analyze them together, particularly with more complex board games. Analyzing and critiquing games is often a new experience for students and many often begin the course unprepared for how long these activities can take. Students who self-identify as "gamers" in the beginning-of-course survey, and especially those who indicate they play board games frequently, can be very instrumental in helping other students to manage their expectations about time. I encourage students to play all games at least twice—once to learn the rules and again to have a more playful experience. In addition to the analytic frames that are included in the sessions, I recommend that students read and use Raph Koster's *How I Analyze a Game* (https://www.gamasutra.com/blogs/RaphKoster/20140113/208527/How_I_Analyze_a_Game.php) before their first game analysis assignment, though it is not required. Having Koster's suggestions at hand as they play their first games together can save them time because they have an initial framework with which to analyze the games.

Gameplay and Operationalization of Learning Objectives

My students do not always intuitively grasp the concept of operationalization as it is understood in the context of gameplay. All students have experience with taking assessments and administering assessments as educators, but I have noticed that they sometimes struggle to think about gameplay as a performance indicator and how to use it for the purposes of formative assessment. Most K–12 educators who take the course did not use games or simulations in any systematic way during their preservice methods courses (this information is from the beginning-of-course survey). This course is partly intended to give educators opportunities to think about games as forms of assessment (thereby extending their assessment literacy), but students can always use more time to think deeply about whether and how gameplay can aid in performance-based assessment. The readings on learning mechanics tend to be especially helpful in this area, but it is also useful to ask students to reflect on their gameplay through the lenses of specific learning objectives. Some students have opted to

keep gameplay journals and share them with me as part of the reflection, though it is not required. I encourage students to explain how their performance in a game demonstrates their level of competence and to consider how they might ask the same of their own students, which some have found helpful.

Gamification vs. Game-Based Learning

Most K–12 educators who take the course usually begin with a clearer understanding of how gamification techniques (i.e., the use of elements of gameplay in non-game contexts) can be used in the classroom than how to implement game-based learning activities. Students in adult education-oriented professions tend to have more experience using simulations for learning, though that does not always mean that they have a stronger understanding of game-based learning. In addition to the multiple readings on games and systems thinking, I revisit the concept of "well-designed games as responsive, logical systems" in several mini-lectures, which students find helpful for thinking about how gameplay can help build knowledge and skills.

FUTURE COURSE PLANS

I plan to address four topics more fully in the course in the near future: motivation, play, gameful learning (Aguilar, Holman, & Fishman, 2018), and games as tools to support critical thinking. Students will benefit from more thinking about the relationship between motivation to engage in activities and games and gamification. Readings on play and gameful learning—framed by thinking about pedagogy and instructional design—will also help students to consider the benefits of more playful learning experiences in formal settings, along with the barriers that might exist to supporting those experiences. Finally, I plan to use chapters from *Woke Gaming* (Gray & Leonard, 2018) and Frasca's (2001) work on "video games as means of consciousness raising" to expand students' understanding (beyond the current reading from Bogost) that game systems can reflect social systems that exist in the world and provide gamers/learners with opportunities to examine those systems critically.

In the near future I also plan to add a session (most likely the final session of the course) on "The Technologies of Gaming." We will review modalities such as augmented reality and virtual reality and what affordances those technologies might add to game-based learning scenarios, and what challenges they might present in the context of formal learning environments. Students will read research on embodied learning and analyze VR and AR games through the lenses of biology and neuroscience.

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CHAPTER 15.

GAMES AND SIMULATIONS FOR TEACHING AND LEARNING (EME 6156)

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UNIVERSITY OF FLORIDA

Course Title: Educational Technology (EME) 6156: Games and Simulations for Teaching and Learning
Course College/School: College of Education
Course Department/Program: Educational Technology
Course Level: Graduate
Course Credits: 3
Course Length: 8-weeks
Course Medium: Online, fully asynchronous
Course Keywords: educational game design, serious games, gamification, common-off-the-shelf games, social constructivism, project-based learning, cognitive apprenticeship, educational game development

CATALOG DESCRIPTION

Topics include the characteristics and terminology of games and simulations; development life cycles; design principles; evaluation; virtual worlds; and an emphasis on connecting principles of learning and teaching to the design of games and simulations. Students practice these concepts in several assignments relating to educational contexts.

COURSE PURPOSE AND OBJECTIVES

This 8-week, fully online, asynchronous course provides a highly scaffolded learning sequence in which learners develop knowledge and skills in the four areas of digital games-based learning (DGBL), namely:

1. Integrating common, off-the-shelf (COTS) games into educational contexts,
2. Playing educational games and simulations designed for learning

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3. Gamification, and
4. Teaching students to create their own games.

The overarching purpose of the course is to prepare instructional designers for digital games-based learning, as detailed in Hirumi and colleagues' three-part *TechTrends* article series (2010a; 2010b; 2010c). To this end, learners encounter foundational principles of DGBL through gameplay, readings, reflection, discussion, and debate, as well as by developing their own prototype educational game.

Importantly, the course intentionally guides learners to encounter the design tensions that exist at the intersection of game objectives and learning objectives. Having learners struggle to achieve the elusive balance between the playful aspects of game design (e.g. game mechanics) and the serious aspects of learning design (e.g., pedagogical objectives) leads to deep engagement in, as Lloyd Rieber puts it, "one of the most sophisticated design problems one can attempt" (Hirumi et al., 2010b, p. 24).

Learners also develop core skills related to DGBL by designing and developing their own educational game, serious game, or simulation. Not only does this provide a design space in which the tensions of balancing gameplay and learning outcomes are encountered, it also allows learners to develop useful expertise. Ultimately, "having students build digital games remains a challenging means of DGBL for most public education environments. Although the tools have become more powerful and easier to use, and many remain free, they all present the same hurdle for teachers: they require the teacher to develop additional expertise before designing lessons" (Van Eck, 2015, p. 18). The game development aspect of this course speaks specifically to this need.

The specific course objectives/goals are as follows:

- Construct our own understandings of concepts such as play and fun and their role in learning.
- Explore and share divergent perspectives on games and simulations for learning.
- Integrate our understanding of gaming with our understanding of learning.
- Explore the underlying mechanics of games (e.g., telling stories, exploring, making).

COURSE CONTEXT

This course is an elective designed for students enrolled in the UF Educational Technology Online M.Ed. program. Within the Educational Technology Online M.Ed. program, students are able to select four electives, of which this course is one of many available. Most students who take this course are masters and doctoral students from the College of Education; however, the course attracts students from a variety of departments across the University, for example, Construction Management, Environmental Health & Safety, and Family and Consumer Sciences. About half of the learners state they are regular video game players, but the vast majority have no experience with educational video games. The course therefore adopts a "tabula rasa" approach, assuming no prior knowledge. This also means that the game development tools used in the class must have a low threshold for entry, have high usability, be available at no cost, be intuitive, and have a manageable learning curve. Identifying such tools is no small feat! This course exists within the broader university ecology of game design courses and curricula at the University of Florida. For example, the Digital Worlds Institute (https://digitalworlds.ufl.edu/) offers a BA in digital arts and science with courses available

related to creating mobile games, game content development, and game systems development. EME 6156 differentiates itself in that it is a graduate-level course, is focused on learning (as opposed to entertainment), and surveys all recognized aspects of DGBL within just 8 weeks.

COURSE PEDAGOGY

This course is grounded in problem-based (Jonassen, 2010), social constructivist learning principles (Huang, 2002; Woo & Reeves, 2007). Learners are presented with the overarching problem of designing an educational game. This problem highlights two key principles of Woo and Reeves' (2007) interpretation of how to apply social constructivist principles in online learning in that the task is authentic and the social interaction required to solve the problem is meaningful. As to the authenticity of the problem, designing and developing a game represents an incredibly sophisticated design problem (Hirumi et al., 2010b). As to meaningful social interaction, the course requires students to openly share, discuss, and critique one another's' work (discussed in detail in Pro Tip 3 in the Course Best Practices section below). These interactions can lead to tensions, which require negotiation to overcome. This, in turn, is conducive to reflection and collaborative construction of knowledge (Jonassen, 1994). Importantly, these interactions must be intentionally fostered by the instructor, so as to promote a "safe environment for learners to express themselves freely in appropriate ways, to share their ideas and to ask questions" (Huang, 2002, p. 33). In principle, this can lead to learners being more open to failure (discussed in detail in Pro Tip 4 in the Course Best Practices section below), which is a critically important aspect of game design and development.

In addition, the course utilizes a project-based learning approach that is realized using a cognitive apprenticeship model (CAM; Brown, Collins, & Duguid, 1989; Collins, Brown, & Newman, 1989). In this mode, learners engage in an intentionally sequenced and scaffolded learning trajectory in which they draw from their own prior knowledge, consult artifacts such as media and textbooks, and engage collaboratively with peers to solve the ill-structured design problem of designing and developing a prototype educational game. Many constructs related to CAM have been discussed already, such as consideration of the sociological context of the online course, sequencing and scaffolding of activities, and providing opportunities for learners to engage in authentic tasks (Collins & Kapur, 2014). Now, the focus shifts to instructional methods and specifically to two key principles drive this approach: (1) assigning importance to learners' development of critical thinking (process-oriented) related to games as opposed to the quality of the final submitted game project (product-oriented) and (2) a commitment on the part of the educator to provide the coaching and modeling of expert performance required within CAM. Development of critical thinking related to games requires a range of different kinds of knowledge, including domain knowledge, heuristic knowledge, control strategies, and learning strategies. Domain knowledge of DGBL in general and as applied in the area of instructional design is prerequisite to approaching the heuristic knowledge, or expert knowledge, of game design and development. Control strategies are required in order for learners to be able to apply their knowledge and skills of educational game design. The learning strategies embedded in the online course materials allow learners to acquire different knowledge types in a strategic, scaffolded, and structured manner. These online course materials are made available to readers below, in the Expanded Course Outline section.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Textbooks

Required: Mayer, R. E. (2014). *Computer games for learning: An evidence-based approach*. MIT Press.
Optional: Prensky, M. (2006). *"Don't bother me mom – I'm learning".* Paragon House, St. Paul, MN.

Games

Learners are able to choose from a variety of educational and commercial games to fulfill the requirements of assignments. The criteria for selecting these games are as follows:

1. Game must be available at no cost
2. Game must incorporate aspects of "good" games (Gee, 1997)
3. Game must be playable across platforms (Windows & Mac for desktop, iOS & Android for mobile)
4. Game must not install malware, spyware, etc.

Additional criteria for commercial games are:

1. Game must be popular
2. Game should be relatively recent

Additional criteria for educational games are:

1. Game must be a strong example of an educational video game (e.g., no edutainment titles, no low-quality games)
2. Game must showcase good balance between learning objectives and gameplay
3. Games with published research support are preferred, but this is not a strict requirement

Games list

Commercial Games

- Minecraft: Education Edition: https://education.minecraft.net/
- Fortnite: https://www.epicgames.com/fortnite/en-US/home
- League of Legends: https://na.leagueoflegends.com/en-us/
- Player Unknown Battlegrounds (Lite): https://lite.pubg.com/download/
- Roblox: https://www.roblox.com/
- The Sims Freeplay: https://www.ea.com/games/the-sims/the-sims-freeplay
- Kerbal Space Program Demo: https://www.kerbalspaceprogram.com/demo.php
- Mini Game Madness! (student must play all four)
    - Angry Birds https://www.angrybirds.com/

- Bad Piggies https://www.angrybirds.com/games/bad-piggies/
- Plants vs Zombies http://www.miniclip.com/games/plants-vs-zombies/en/
- Candy Crush http://candycrushsaga.com/en/

Educational Games

- Fold It: https://fold.it/portal/
- PeaceMaker: Israeli Palestinian Conflict: http://www.peacemakergame.com/
- People Power: http://peoplepowergame.com/
- Apollo: https://www.apollogame.site/ (requires 2 computers)
- Stop Disasters!: https://www.stopdisastersgame.org/
- Immune Attack: https://melanieanns.itch.io/immune-attack
- Rabbids Coding!: https://register.ubisoft.com/rabbids-coding/en-US
- The McDonalds Video Game: https://molleindustria.org/mcdonalds/
- Wolf Quest: http://www.wolfquest.org/downloads25a1.php
- Mini Game Madness (choose at least 4 from the PBS Kids website: https://pbskids.org/games/

Hardware

Learners must have a recent computer (within the last 5 years) running MacOS or Windows (no ChromeOS) and access to high-speed, broadband Internet.

COURSE ASSIGNMENTS

Course assignments include (1) readings, (2) discussions, (3) topical assignments, and (4) a semester project.

Readings are aligned with the topic of each learning module (e.g., integrating COTS games, designing educational games, gamification). In line with the project-based pedagogical approach of the course, readings are directly applied to course assignments and discussions.

Discussions are designed to promote meaningful discourse, that is, scaffolded discussion that promotes critical thinking. These discussions are designed following structured online protocols (Zydney & Dichter, 2012) and using pre-structured argumentation techniques (Brooks, & Jeong, 2006).

The semester project requires learners to design and develop a prototype educational video game. The project takes place across the entire course. It is scaffolded using weekly progress journals. Learners begin the project by developing a game idea, building that idea out into a game design document, rapid prototyping their game using lo-fi tools (i.e., wireframes, storyboards, etc.), and then iteratively developing their game using free-of-cost, simple video game development tools.

COURSE ASSESSMENT

The foundation for learner assessment in this course is CAM theory (as discussed in the Course Pedagogy section above), with emphasis placed on learners' progress and development of the critical thinking skills needed to solve problems associated with DGBL. This stands counter to project-based courses that assess the quality of the products that learners produce. Given that many of the learners taking this course do not play games often or consider themselves gamers, and nearly none have had any exposure to game development tools, to assess learners' final products would be counter-productive to the course objectives and, moreover, would be dissonant with the CAM theory that guides the course. All assignments are assessed using a rubric, with rubric scores accompanied by video-based feedback from the instructor. Assessment is designed to gauge learners' progress across two course phases. The first four weeks (or "levels") of the course comprise Phase 1 and the second four weeks comprise Phase 2.

From week 1 until the end of week 4, learners engage in Phase 1. Phase 1 is focused on providing foundational domain knowledge related to DGBL across the four dimensions outlined in the Course Purpose and Objectives section above. For assignments, learners engage with commercial games, educational games, gamification, etc. and critically reflect on their experiences. They also engage in discussions with their peers around key topics related to the assignments. These assignments and discussions are fairly straightforward, highly scaffolded, and unambiguous. This provides opportunity for learners to gain early success, which serves to build confidence and establishes a buffer for those students who are particularly concerned about their grade. In addition to this, over the course of Phase 1, learners are beginning to develop their game idea and slowly shape it into a formalized game design document. This is organized into weekly progress journal entries which are scaffolded from low-stakes and simple to higher-stakes and more difficult. The points structure for Phase 1 progress journals reflects the low-stakes nature of the assignment and is intended to allow students to take risks and make mistakes with some confidence that their grades will not suffer.

Beginning in week 5, Phase 2 begins. Phase 2 centers around on applying what is learned in Phase 1 while also developing knowledge and skills (i.e., control strategies) related to educational game design and development, and with a specific focus on balancing game mechanics with learning objectives. Over the course of this 4-week arc, learners iteratively design and develop their game, solicit feedback, and engage in topical discussions. This phase requires significant time investment on the part of the instructor to provide individual, meaningful feedback to students. Although learners are required to submit iterations of their in-progress games each week as part of their progress journal, the points associated with the submissions are minimal. The purpose of the submissions is to provide opportunities for the instructor and the learners' peers to review and provide constructive feedback. The final submission of learners' semester-long project is worth 55 points, but only 20 points are associated specifically with the final product. The remaining points allocation focus on learners' engagement with others in discussions and their performance related to developing a constantly maturing product.

Learners are assessed using the points structure detailed in the list below.

Level 1

Online Discussions: 10 points
Assignments: 15 points
Progress Journal: 2 points
Total: 27 points

Level 2

Online Discussions: 10 points
Assignments: 20 points
Progress Journal: 2 points
Total: 32 points

Level 3

Online Discussions: 10 points
Assignments: 20 points
Progress Journal: 2 points
Total: 32 points

Level 4

Online Discussions: 10 points
Assignments: N/A
Progress Journal: 20 points
Total: 30 points

Level 5

Online Discussions: N/A
Assignments: 15 points
Progress Journal: 15 points
Total: 30 points

Level 6

Online Discussions: N/A
Assignments: N/A
Progress Journal: 2 points
Total: 2 points

Level 7

Online Discussions: 10 points
Assignments: N/A
Progress Journal: 2 points
Total: 12 points

Level 8

Online Discussions: 45 points
Assignments: N/A
Progress Journal: 10 points
Total: 55 points

Course Total

Online Discussions: 95 points
Assignments: 70 points
Progress Journal: 55 points
Total: 220 points

EXPANDED COURSE OUTLINE

Level 1

Topic: Introduction to Educational Games and Simulations

Class Topics/Activities

In this level, learners:

- Learn what educational games and simulations are
- Learn the difference between simulations and educational games
- Learn the history of educational games and simulations
- Define key terminology and concepts
- Review an existing commercial-off-the-shelf game

Assignments

Readings

- Chapter 1 – Introduction: Taking an Evidence-Ba Approach to Games for Learning in Mayer (2014) [Course Textbook].
- Laamarti, F., Eid, M., & El Saddik, A. (2014). An Overview of Serious Games . International Journal of *Computer Games Technology*, https://doi.org/10.1155/2014/358152 [Journal Article].

Assignment

- Review a common, off-the-shelf game (https://bit.ly/2MvYMyP)

Discussion

- Introduction to Games and Simulations: Icebreaker (https://bit.ly/3au6OjR)

Weekly Progress Journal

- Tell the instructor about your game idea (https://bit.ly/3cDQO15)

Level 1 supplemental materials

- Jensen, L. (2016). *Gaming and Education: Beyond Edutainment and Gamification* . Retrieved from https://spark.adobe.com/page/BK8hG/ [Adobe Spark Presentation].
- The EduTech wiki's entry for Serious Game (http://edutechwiki.unige.ch/en/Serious_game) [Wiki Entry].
- Prensky, M. (2007). *Sims vs. Games: The Difference Defined*. Retrieved from https://www.edutopia.org/sims-vs-games [Blog Entry].

Level 2

Topic: Integrating Common, Off-the-Shelf Games

Class Topics/Activities

In this level, learners:

- Explore and critically evaluate *Minecraft Education Edition* and its associated learning resources,
- Apply what they learn from readings to their experiences with Minecraft Education Edition and its associated learning resources,
- Begin to develop ideas about the educational game they will develop in this course

Assignments

Readings

- Gee, J. P. (2005). Learning by design: Good video games as learning machines . *E-learning and Digital Media, 2*(1), 5-16. [Journal Article]
- Chapter 3 – Theory: Applying Cognitive Science to Games for Learning in Mayer, R. E. (2014). *Computer games for learning: An evidence-based approach*. MIT Press. [Course Textbook].

Assignment

- Guided exploration of Minecraft: Education Edition (https://bit.ly/3cDcnPx)

Discussion

- Games in School (https://bit.ly/3cx1qiu)

Weekly Progress Journal

- Game design document draft 1 (https://bit.ly/36FZksL)

Level 2 Supplemental Materials

- Kuhn, J. (2017). Minecraft: Education Edition. *CALICO Journal, 35*(2), 214-223. [Journal

Article]

Level 3

Topic: Serious Games

Class Topics/Activities

In this level, learners:

- Learn what serious games are
- Learn the difference between edutainment and serious games
- Review an existing serious game
- Read some of the key works on serious games

Assignments

Readings

- Sanford, K., Starr, L. J., Merkel, L., & Bonsor Kurki, S. (2015). Serious games: video games for good? . *E-Learning and Digital Media, 12*(1), 90-106. [Journal Article]
- Van Eck, R. (2015). Digital game-based learning: Still restless, after all these years. *Educause Review, 50*(6), 12-28. [Journal Article]
- Chapter 2 – Method: Conducting Scientific Research on Games for Learning, in Mayer, R. E. (2014). *Computer games for learning: An evidence-based approach*. MIT Press. [Course Textbook].

Assignment

- Review a serious game (https://bit.ly/2O2Qu1T)

Discussion

- Reflect on your gaming experiences in the course so far (https://bit.ly/3rjFfjT)

Weekly Progress Journal

- Game design document draft 2 (https://bit.ly/3auc2fd)

Level 4

Topic: Gamification of Learning

Class Topics/Activities

In this level, learners:

- Compare and contrast various perspectives on the value of gamification
- Review the history of gamification, how it is applied, and in which domains it is applied
- Establish an intellectual position in regards to the relative value of gamification to learning and defend their position

Assignments

Readings

- Return to last week's book chapter: Chapter 4 – Examples of Three Genres of Game Research in Mayer, R. E. (2014). *Computer games for learning: An evidence-based approach*. MIT Press. [Course Textbook]. ***Note***: Specifically, pay attention to pp. 118-121 and Mayer's (2014) key statement that "extraneous game elements can compete for cognitive resources needed for meaningful learning" (p. 121). [Course Textbook]
- O'Donnell, C. (2014). Getting played: Gamification and the rise of algorithmic surveillance . *Surveillance & Society, 12*(3), 349-359. [Journal Article]
- Landers, R. N. (2019). Gamification misunderstood: How badly executed and rhetorical gamification obscures its transformative potential . *Journal of Management inquiry, 28*(2), 137-140.
- Hung, A. C. Y. (2017). A critique and defense of gamification. *Journal of Interactive Online Learning, 15*(1). [Journal Article]

Discussion

- Gamification debate (https://bit.ly/3rf2BqX)

Weekly Progress Journal

- Game design document final draft (https://bit.ly/36G9nOx)

Level 4 Supplemental Materials

- Introduction to the module (https://bit.ly/3azdCMU)
- Example 1 of Gamification: Taking Care of You (https://bit.ly/3rgrZfU), a module that Dr. Schmidt developed in collaboration with Dr. Andrew Tawfik.
- Example 2 of Gamification: Nick's Dilemma (http://bit.ly/36y8uVn; password: WorkwithShiela!), a gamified case library that Dr. Schmidt developed
- Thurston, T. N. (2018). Design case: Implementing gamification with ARCS to engage digital natives. *Journal on Empowering Teaching Excellence, 2*(1), 5.
- LinkedIn Learning's Gamification of Learning lesson (https://bit.ly/2MyWij4; free)

Level 5

Topic: Epic Game Jam 1

Class Topics/Activities

In this level, learners:

- Gain experience using video game creation software.
- Build a functioning prototype of a video game
- Map out the game mechanics and learning mechanics of their game

- Consider how to balance their game objectives (e.g., play and fun) with their learning objectives (e.g., content mastery and problem solving).

Assignments

Readings

- Hirumi, A., Appelman, B., Rieber, L., & Van Eck, R. (2010). Preparing instructional designers for game-based learning: Part 1. *TechTrends, 54*(3), 27-37.

Assignment

- Build a game prototype (https://bit.ly/36zcgAL)

Weekly Progress Journal

- Balancing game and learning objectives (https://bit.ly/3rnV1ud)

Level 5 Supplemental Materials

- Is "making a game out of learning" bad for learning? (https://bit.ly/2Mw2oAT)
- *Do most educational games suck?* [archived article with working images (https://bit.ly/2MuSX4K)] [most recent version with insightful comments section (https://bit.ly/3tnOC3X)]
- Educational Video Games Just Never Got Things Right (https://bit.ly/3cB7Z3B)

Level 6

Topic: Epic Game Jam 2

Class Topics/Activities

In this level, learners:

- Continue to develop the game they proposed in their game design document

Assignments

- Weekly Progress Journal
- Continue developing your game (https://bit.ly/3au9dLp)

Level 7

Topic: Epic Game Jam 3

Class Topics/Activities

In this level, learners:

- Apply their experience with video game creation software.
- Continue to build and refine a functioning prototype of a video game
- Play and critique others' games

Assignments

Readings

- Hirumi, A., Appelman, B., Rieber, L., & Van Eck, R. (2010). Preparing instructional designers for game-based learning: Part 2. *TechTrends, 54*(4), 19–27. **Note**: Only read the section "Game Design as a Creative Act" by Lloyd Rieber (pp. 23-26)

Discussion

- Game design as a creative act (https://bit.ly/2MtaEl2)

Weekly Progress Journal

- Continue developing your game (https://bit.ly/2O6yeot)

Level 8

Topic: BIG BOSS BATTLE!

Class Topics/Activities

In this level, learners:

- Complete and submit their game prototype
- Play some of their classmates' games
- Complete the Big Boss Battle reflection form

Assignments

Assignment

- BIG BOSS BATTLE (https://bit.ly/3cB8cDV)
- Final game submission and post-mortem (https://bit.ly/3atrk46)

Weekly Progress Journal

- Final reflection (https://bit.ly/2Mw335l)

COURSE BEST PRACTICES

Student Comments

Before providing tips for how others who wish to borrow from these materials can be most successful, some of the feedback this course has received from students who have taken it is warranted. How this feedback reflects the theoretical principles that support this course design is considered.

The below comment comes from a student who developed a remarkably advanced game with solid pedagogical principles and engaging gameplay. This comment speaks to the authentic tasks that were embedded in the course.

Before I started the course, I was hoping to see some real examples of video games I could use in my

> educational context. I wasn't even dreaming about creating my own game, and I am very happy to possess the game developing skills now, although I still have a lot to learn. I would definitely recommend this course to other students because they could not only familiarize themselves with the theoretical background of games in education but also gain real game development skills. We all know that knowledge is power, but only skilled hands eat trout.

Another comment from a different student highlights the productive frustration that she experienced and how this influenced her ability to apply her knowledge and skills in her own professional practice. This could suggest that this learner plans to generalize her experiences from this course to a practice context.

> This is the most frustration but also satisfaction I've felt in a course so far. All in all, I am glad I selected this elective because it is so applicable to my current position and opened my eyes to give me a more educated way to analyze educational games that we have our students play.

Finally, another student reflects on the meaningful social interactions that promoted her own learning in the following comment.

> Taking this course has been a greatly educational experience. I learned about the use of games in education and even developed my first game ever! I also learned a lot by trying the games my classmates made. Although I couldn't quite implement their ideas in my discipline, I found it helpful to see what problems others ran into and how these problems got resolved.

Pro Tip 1: Query Your Students

Digital Games-based Learning (DGBL) is constantly evolving. The course presented here is representative of this evolution. Because DGBL moves rapidly, the evolution of this course happens in fits and spurts, as opposed to the more gradual evolution of well-established content areas such as theoretical foundations of instructional design. Given this volatility, checking in with students is imperative because it will often be the case that you are incorporating elements that are brand new and have not previously been vetted. Before this course began, I sent a survey to all students querying their interests, gaming backgrounds, and technical abilities. This was necessary for determining how to support them in designing and developing their own educational game. Others who choose to borrow from this course design are encouraged to do likewise so as to attune the course to a heterogenous mix of abilities, experience, and prior knowledge.

Pro Tip 2: Use the Most Simple Development Tools (but Provide Flexibility)

Understanding students' technological abilities is critical for selecting appropriate development tools. Students in the field of education rarely have the advanced technical abilities required to engage in "hardcore" game design. The development tools used in this course (Twine, Construct, and Minecraft) have been carefully selected and vetted over years of trial and error. Instructors can use these tools with confidence. Providing students choice and flexibility in their tool choice is also critical. More advanced students might want to use more advanced tools, such as RPG Maker (https://www.rpgmakerweb.com/), Unity (https://unity.com/), or Mozilla Hubs (https://hubs.mozilla.com/). Allowing students the opportunity to use more advanced tools provides them the agency to explore the DGBL phenomenon at a depth more appropriate to their abilities. You certainly do not want to hold an eager student back. Chances are, they will surprise you with a remarkable educational game prototype!

Pro Tip 3: Openness is Central to Course Effectiveness

Educational game design should not happen in a vacuum. Ideally, students would work together in a collaborative manner to develop their games. However, given the complexities of group work in fully asynchronous online courses, the current version of this course does not require that students work in groups (but students do have this option if they so choose). Therefore, all design and development work is shared openly for others to review, critique, and learn from. Students share all of their work in open discussion forums and are expected to review one another's work and support each other. Further, nearly all assignments are graded using a rubric, and grading expectations are communicated explicitly. Finally, although no late assignments are accepted, students can submit assignments as many times as they choose (but not discussion boards, as they are time-bound). If students receive a low score and want to improve, they have this opportunity. This last point overlaps with the following pro tip.

Pro Tip 4: Encourage Students to Take Risks and Fail

Asking students who have never designed or developed a video game (or even played video games, for that matter) to develop their own educational game introduces substantial anxiety for many. Reassuring students that they are encouraged to take risks is important, but backing this up with clearly demonstrable course design elements is even more effective. This course is designed to evaluate students not only on their final project, but also on the process of developing their project. This allows students to effectively "buffer" themselves against potential catastrophe (such as not being able to build a functional prototype or not being able to fix a bug). Indeed, the design process is worth more points (55) than the final project (45), and students are provided the opportunity to meaningfully reflect on their development process for an additional 10 points. Telling students they are encouraged to take risks and fail is antithetical to the experience most of them likely have had in formal education. Showing them that the course is intentionally designed to allow for risk and failure assures them and builds trust. This is a point that must be consistently reiterated.

Pro Tip 5: Be Prepared to Provide Heavy Amounts of Feedback (and Use the Opportunity to Give the Course a Personality)

Because the majority of students taking the course typically have limited technology skills and little-to-no background in DGBL, it is imperative that the instructor and or teaching assistant provide substantial and detailed feedback. As detailed above, the course adopts a cognitive apprenticeship perspective, and therefore the instructor should be prepared to take on the role of guide, coach, or mentor. This is a substantial time investment. However, I have found that I am able to streamline the process of providing feedback by providing the majority in video format. Typically, I will provide each student about 2 minutes of video feedback. I have found that this increases student engagement on discussion boards tremendously. Students also point to the video feedback in course evaluations as a particular highlight of the course. In addition, I provide a weekly welcome video, also 2-minutes in length, in which I simply explain the requirements for the week and give a few updates. Students mention that this helps them to feel connected and that it promotes a sense of community. This level of feedback is critical for this course design to work in the fully online format, and over only 8 weeks.

FUTURE COURSE PLANS

Plans for future changes fall into the following three categories: (1) vetting of further development tools, (2) incorporating standardized educational game evaluation methods, and (3) incorporating branching.

In terms of vetting further development tools, regardless of their perceived simplicity, some students will struggle significantly. As such, I am on a constant quest for streamlined, simple tools that can be used to promote meaningful and authentic game development experiences. However, a not insignificant constraint is finding tools that are free of cost. Tools that show promise include: Kodu Game Lab (http://www.kodugamelab.com/), Wick Editor (https://www.wickeditor.com/), and Aris (which is, sadly, no longer supported; https://fielddaylab.org/make/aris/). Developing an activity in which students try all three of these tools and evaluate them could provide insights into how they could be leveraged in the course and is something I plan to incorporate in the next version of the course.

I am also interested in incorporating standardized educational game evaluation methods because without standardized evaluation methods, teachers and designers are left to intuition and opinion to determine the relative quality of an educational game. I am aware of some attempts to standardize educational game evaluation, specifically Rice's (2007) Video Game Higher Order Thinking Evaluation Rubric and Fu, Su, and Yu's (2009) eGameFlow scale; however, I intend to do further research in this area and incorporate these instruments into a future gameplay assignment.

Finally, I would like to explore how I might incorporate moderate branching into future iterations of this course. For each assignment, I would like to provide alternative paths that would allow students more choice and variety. For example, because many students struggle tremendously with developing their final game, I plan to give an alternative that does not require that students complete a functional game. They will be given instead the option of developing an extensive multimedia presentation that documents their game design and development experiences, their struggles, how this has contributed to their understanding of DGBL, and how this has influenced their perspective on the perceived promise (or perhaps hype) of educational video games. Ideally, I would like to provide multiple pathways to establish competence for each week of the course. However, given the rate at which DGBL advances, the sustainability of this approach could be a challenge. This remains an area for future consideration.

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CHAPTER 16.

GAMES AND SIMULATIONS IN EDUCATION (ETEC 67410/77410)

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Course Title: Educational Technology (ETEC) 67410/77410: Games and Simulations in Education
Course College/School: Kent State University
Course Department/Program: Teaching, Learning, and Curriculum Studies; Educational Technology
Course Level: Graduate Masters and Doctoral class
Course Credits: 3
Course Length: 7 Weeks
Course Medium: Online
Course Keywords: graduate, educational technology, educational games, pedagogy, simulations, learning, social impact, design, K-12, higher education

CATALOG DESCRIPTION

In this course, students will have the opportunity to explore educational games and simulations. We will focus on commercial and educational games and simulations, online and multi-player games, and content-based and content-free games and simulations. We will also focus on the societal and cultural impact of games and simulations, specifically as they relate to technology and cognition.

1. Dr. Richard E. Ferdig (rferdig@gmail.com) is the Summit Professor of Learning Technologies at Kent State University's Research Center for Educational Technology. He explores the ways in which emerging technologies can be used to create innovative learning environments, including the role of game use and game development for teaching across the lifespan.
2. Dr. Enrico Gandolfi (egandol1@kent.edu) is an Assistant Professor of Educational Technology at Kent State University's Research Center for Educational Technology. His research interests include immersive technologies for education, from augmented reality to virtual reality, technologies for wellbeing, and online communities of inquiry in the context of digital gaming.
3. Dr. Emily Baumgartner (Baumgartner.emilye@gmail.com) is an Assistant Professor of Technology at Ohio Northern University in the School of Science, Technology and Mathematics. Her research interests include digital games for learning, the use of immersive technologies such as virtual reality and 360-degree video in learning, and computational thinking.

COURSE PURPOSE AND OBJECTIVES

Games and simulations are used for a variety of purposes ranging from entertainment to therapy. There is also a long tradition of using games and simulations for teaching and learning (Ferdig, 2009). This includes teaching in formal PreK-12 or post-secondary schooling as well as informal learning across the lifespan. It is a practice that has existed long before the invention of digital or electronic technologies (Wilkinson, 2016); however, it has obviously gained more attention with the increased availability of digital games and simulations.

One major goal of this class is to explore research and practice on using games and simulations for teaching and learning. This includes both educational games as well as the implementation of commercial-off-the-shelf games (COTS). Learning here could include formal content teaching (e.g., teaching math to 4th grade students using games) or informal learning (e.g., teaching science in a museum). It also includes both intended and unintended learning outcomes. For instance, a game or simulation could be used to teach someone chemistry or how to handle headaches—something we might call *intentional instruction*. Playing games could also make someone more violent or more empathic—something we might call *unintentional instruction* (e.g., it was not the purpose of the activity).

Students are expected to leave this class with a greater understanding of game and simulation research findings as well as an awareness of how those findings have been applied to instructional practice (e.g., how we teach with games). However, students are also reminded of the importance of moving beyond just the consumption of games. Therefore, a second major goal of this class is for students to begin to understand the role of game development as an instructional strategy (e.g., the production of games).

Game development here does not necessarily mean the same thing as it might in computer science, where the goal may be to graduate students who want to work as coders for gaming development companies. Rather, the focus here is on freely accessible tools that students can use as future teachers to have their learners understand new content. In other words, we encourage our students to understand the use of games in teaching and learning. But we also encourage them to think about what students might learn by modifying a game (Steinkuehler & Johnson, 2009) or developing their own (Kalmpourtzis, 2019).

A third overarching goal is for students to begin to understand the reach of digital games and simulations. Some understand there is a gaming and simulation world outside of education; many also enter the class knowing that learning about games in education is different than if they were computer science students. However, very few understand the complete reach of games and simulations across disciplines. For instance, games and simulations are taught in education, computer science, communication, business, health, media studies, humanities, music, architecture, fashion, anthropology, history, etc. They cover such topics as pedagogy, psychology, media effects, genre, and design (DiPietro et al., 2007). It is very much like the parable of the elephant, where one can only grasp its true nature by looking at it from different sides and angles.

It is worth noting that the title for the course is very dated. This course was created in the 1990s. At that time, faculty at the university (and perhaps writ large) actually called them *simulation games* to differentiate from non-digital games. Given changes in faculty and difficulties in changing course

information as it relates to programs and degrees, the title remains. Thus, while it is not a major goal for the course, the course title does provide a very interesting conversation for faculty and students to begin to differentiate between games and simulations (see Sauvé et al., 2007).

There are 11 main objectives for the course:

1. Learn to analyze games and simulations by playing games and simulations.
2. Read and respond to research and practice on the use of games and simulations.
3. Develop a prototype for a game or simulation.
4. Explore the ways in which games or simulations can be used to fulfill educational opportunities or needs.
5. Participate as an active member in a learning community about games and simulations
6. Be able to explain the fields and disciplines studying games and simulations.
7. Describe the research-based promises, benefits, and pitfalls of educational games and simulations.
8. Explore how teachers or learners choose games or simulations.
9. Investigate how games and simulations have been used for social impact.
10. Understand principles of game and simulation design.
11. Develop a final project to implement a game or simulation into a learning environment.

COURSE CONTEXT

This course is situated inside of an educational technology program called ETEC. ETEC was formerly in an educational psychology program and only recently moved to a school of teaching and learning (often known as teacher education) within a college of education. This context means that the main focus of the course is the application of games to teaching and learning environments.

The title of the course, created long before any of the current faculty were at the university, is a little strange in that it suggests being able to cover teaching and learning about both games *and* simulations in a condensed 7-week format. Moreover, it does not specify whether the games or simulations are digital or analog. However, both nuances serve as a good, first-week introductory conversation about games vs. simulations and about what we can learn from research on pre-digital game play.

The course is cross listed as both a master's level and a doctoral level class; doctoral can mean both an education doctorate (Ed.D.) or a Ph.D. At the master's level, students can take this course as an elective. They can also take it as a part of a three-part degree specialization called *immersive technologies for learning*, consisting of this class, an emerging technologies class, and a virtual and augmented reality course. The entire ETEC master's program is online. Thus, while doctoral students are traditionally in face-to-face programs, they also take this class in an online format.

Many ed tech programs across the world often deal with a duality of students. In other words, some students come in with knowledge of technology, but limited knowledge of education. Others arrive with strong education backgrounds but little to no expertise in educational technologies writ large.

Historically, close to 90% of students enrolling in this course may have played games casually, but they have no deep or wide understanding of the role of games in teaching and learning. The occasional *gamers* that take the course often have a vast understanding of gameplay (mainly multiplayer), and occasionally, game design; however, most lack an understanding of the research applying games to teaching and learning.

COURSE PEDAGOGY

There are three driving forces behind the course pedagogy. First, the course was created to act as a learning community. Drawing heavily on Vygotsky's 1978 notion of the *zone of proximal development*, learning is defined as a process of scaffolding students with the support of a more knowledgeable other. However, rather than assume that the more knowledgeable other is only the instructor, students are treated as if they, too, can serve as the expert. They are taught that each student brings both interests and experiences that will grow the larger community. Much like Gladwell's (1988) *Six degrees of Lois Weisberg*, students are told that the more connected the community, the more it will grow and the more they will learn.

The second driving force is the idea of student choice. Games and simulations, even under the umbrella of teaching and learning, is still a broad area of study. For instance, some might want to focus on play while others work on development. Some may be interested in the behavioral and emotional outcomes of play while others are concerned about training with games. As such, the course content was created in such a way that students have choice. Each week contains readings (and occasional videos) under the heading of 'getting us all on the same page.' For instance, everyone might read a research report on the latest game studies. However, after the initial reading, students are given choice as to follow-up readings, games they play, or other videos they watch. Moreover, they are all required to do an individual project that matches their educational need or opportunity.

Finally, the course pedagogy gets defined—or at least altered—by the reality that this course is always offered online. This is due to the fact that the entire program for which it serves is online. Moreover, because most of the students taking this course are teachers with day jobs, the course is run asynchronously (though not self-paced). This context helps define what gets offered related to the first two driving forces.

For instance, in order to be able to contextualize their readings, students are required to play games or simulations. They report on their play in a shared discussion forum. Participation points are then given for going in and responding to other students. The online format also impacts student choice. They may choose, for example their own content study for week 5. They can even create their own content if they want to explore more individual choice. This content is then shared back with the entire group, coming full circle as identifying them as both a learner and an instructor.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

There is no specific course textbook that is provided. Students are introduced to concepts and constructs each week; they are then provided one or two main articles to read and occasionally a video to watch to support their understanding. They are also given several supplementary articles, books, and videos to be able to further explore the concept being introduced.

This delivery decision was intentional. First, research on games and simulations continues to grow exponentially. Each time the course is taught, the instructor reviews the content to see if there are new articles or videos that better exemplify the concept or construct. This is made easier by the growing number of articles, books, and even games that are now provided open access.

Second, each student enters the course with their own background, context, and interests. While they may all share a desire to learn about games and simulations for teaching and learning, some may be teachers while others are business professionals. Some may work in elementary school while others are in high schools. And some may be interested in psychology while others are interested in mathematics. The supplementary materials each week—as well as the specific choice of topics in week 5—allow students to somewhat customize the course experience.

There is also no specific hardware requirement. While students are expected to play or engage with games and simulations each week (see the course assignments below), they do not have to play a specific game or use a specific platform (e.g., console). Much like the readings, they are provided example software titles or apps, but they are allowed to choose their play experience. This is important given the context and desired learning outcomes of each participant. Some are in classrooms where they have access to tablets. Others are in business scenarios and are planning on using PCs.

COURSE ASSIGNMENTS

There are eight main assignments provided to students in this course. Many of the assignments cut across multiple weeks; as such, students are introduced to all the assignments in the first week of the course.

1. Introduction

As discussed in the course pedagogy section, this course was created to function as a learning community. That means that each member is viewed as having something important to bring to the environment. No one is just a learner; they can also teach others or share experiences and advice that can help others grow. The one challenge to developing community, however, is that this course is taught online. Many of the students taking the course do not know each other and will never meet the instructor or other students face-to-face.

Therefore, there are two sub assignments given the first week to be able to begin to build this sense of community. First, students are asked to read the syllabus and send a message to the instructor through the learning management system (LMS). This ensures that the students have read the syllabus and know how to use an important communication tool. When responding, students must answer the following:

- Whether they have any questions about the learning environment
- That they have read the syllabus and understand it (or any questions you have)
- Any questions they have for their final project
- That they understand the need to do the "Playing Games and Simulations" assignment each week

- That they understand they are prototyping a game/simulation in week 6 (They are reminded by the instructor that this may require some of them with limited experience to begin early)
- That they understand plagiarism will get them an "F" in the course
- That they understand that late assignments will NOT be accepted and/or graded

The second sub-assignment is to introduce themselves to others, a process that can lead to community forming (McInnerney & Roberts, 2004). The introduction assignment has changed over the years; the most recent iteration in class is to have them create a *VoiceThread* (https://voicethread.com/) presentation with multiple slides:

- Slide 1 – They are asked to post a picture of themselves and describe their professional experience and interests (and personal interests/hobbies if they wish)
- Slide 2 – They are asked to post a slide that describes their goals for the course
- Slide 3 – They are asked to post a slide that includes a description of their final project idea
- Each slide must have both images and audio.

Once they post and share their VoiceThread, they must also go back in and respond to at least three other posts from their colleagues.

2. Playing Games and Simulations.

A second course philosophy is that it is difficult to have conversations about games if the student is not currently playing games or simulations. Therefore, students (and instructors) are required to spend at least 30 minutes each week playing a game or simulation. There are several rules that are associated with this assignment.

- Students can play more than 30 minutes if they like. However, they are reminded not to neglect their other assignments, pets, family members, etc.
- Students do not have to do the 30 minutes in one setting, nor do they have to do the entire 30 minutes on one game or simulation.
- Students must choose a new game/simulation each week.
- Students must post a response to a discussion forum each week. The post must include their 'time log' (simply naming the games and times played) as well as their reaction to the game or simulation played.

The discussion thread portion of the playing assignment is critical to the advancement of the learning community philosophy for a few reasons. First, they get used to talking with others about what they are playing. Second, they get to ask questions about how to play. Third, and perhaps most importantly, they can ask about or at least see other games and simulations that are being played. As such, in addition to the games being introduced in class, they are constantly introduced to new games and simulations from other learners.

3. Reading Response.

Readings are assigned throughout the course in weeks 2 through 6 (week 1 is the introduction and

week 7 is student final project submission). Scholarly articles (with the occasional popular press writing thrown in) provide a way for students to ground their understanding in research and varying perspectives on game play or game development. Learners are asked to respond to each reading in no less than one page (single-spaced, not including references). Full assignment details are provided in the course outline. However, these assignment details are mainly focused on responding to guiding questions based on the article given or the topic to be discussed that week. This course is typically taught once a year. As such, approximately 10-20% of materials are changed each year, depending on what scholarship has been produced recently or what games and simulations have been released.

Current topics that are related to readings include (listed below by weeks):

1. *Introduction (No readings)*
2. Understanding teaching and learning games
3. The learning benefits of games and simulations
4. Social impact games
5. Games, simulations, and content
    1. Accessibility
    2. Business
    3. Diversity
    4. Empathy
    5. Foreign Language Learning
    6. Health
    7. History/Social Studies
    8. Math
    9. Science
    10. Special Education
6. Game and simulation design
7. *Final Project due (No readings)*

Each week, and for each topic, students are given required readings and/or videos as well as guiding questions. They are also given links to supplementary materials such as other articles (scholarly or popular press), videos, books, or games and simulations they might want to play that week for their play time.

The fifth week of readings is a very interesting week. As described in the course pedagogy and philosophy section, the course is created as a learning community. Each student brings interests they want to both share and explore. Therefore, students can pick the topic they want for week 5. However, the course was created with the understanding that it would be impossible to predict all interests. So, students are also allowed in week 5 to create their own content. They are asked to pick (and then respond to) required readings or videos, guiding questions, and any other supplementary

materials someone might find useful (e.g., example games or simulations). With this method, the course originally started with four or five topics in week 5; it now has ten and will continue to grow.

4. Gamestar Mechanic.

The first 4 weeks of the course were created to have students explore game and simulation play as well as the research on what happens when people play (alone or with others). The second half of the course changes the focus from game and simulation play to game and simulation development. Readings and game play (the first two assignments) continue; however, learners begin working on two new assignments related to developing games or simulations.

The first assignment is to explore *Gamestar Mechanic* (http://gamestarmechanic.com/), a web-based game design learning tool. Students are expected to complete the *Gamestar Quest*. They are asked to write about their experience in light of the course readings on game development; they are also asked to show a screen capture of their successful completion of the quest. Students are also provided with two different opportunities to earn extra credit. First, they can read and respond to the teacher guide (https://sites.google.com/a/elinemedia.com/gsmlearningguide/table-of-contents). Second, students can earn extra credit if they respond to Salen's article in context of the work on Gamestar Mechanic: Salen, K. (2007). Gaming literacies: A game design study in action. *Journal of Educational Multimedia and Hypermedia, 16*(3), 301-322.

5. Developing a Game/Simulation.

The second assignment is for students to begin designing a game or simulation. By this point in the semester, students have read enough articles to understand game development takes money and time. It is unlikely someone is going to be able to create a perfect working game in just a week or two. Students are reminded that is not the point of this assignment. The goal is to begin to give them some experience in thinking about how they might take a teaching or learning need and respond to it with a game or simulation. Students are allowed to prototype their ideas on paper; they are also encouraged to begin to explore actual game development using *Gamestar Mechanic* (http://gamestarmechanic.com/), *Scratch* (https://scratch.mit.edu/), GameMaker (https://www.yoyogames.com/gamemaker), or whatever tool they choose.

Most importantly, they are asked to pick something that fits a legitimate need or opportunity they have. This provides them an opportunity to begin to consider how games and simulations can be used in live teaching and learning environments. They are also encouraged to consider games and simulations as teaching tools. In other words, instead of just creating something that someone would consume, they are urged to consider scenarios where they would have their future learners using games as a response mechanism. In this light, the creation of their prototype would be an example for future learners to follow.

Students are asked to submit a document that contains:

- A link to the prototype, screenshots of the prototype, or prototype design documents
- An explanation accompanying the prototype that includes:
    - o What you used to build it

- o The audience and a description of what the prototype is supposed to do
- o Why you built it
- o What impact you think it could have on learning

6. Participation.

Students are told in the introduction to the class that they are entering a learning community. They are reminded that they are expected to contribute beyond just turning in assignments. There are two ways that students can participate outside of traditional coursework. First, a general discussion forum is provided. The general discussion forum is typically used by the instructor to post any articles or news links that happen during the timeframe of the course. It is not a course announcements forum; rather, it is a place for the instructor to post interesting things that relate to the course content or student interests. Because this is a learning community, students are told that they, too, can share interesting things they find. They can also simply engage in conversation about things that others post.

A second way to earn participation points is to post on the game and simulation play forum. As a reminder, students must create a post each week that discusses the game or simulation they played. However, students are not required to read or respond to others' posts. Students may earn participation points by choosing to engage with others about the games or simulations they are playing.

7. Final Project.

Like many offerings, this course provides students with an opportunity to complete a final project. The goal of the final project is to help them put into practice what they have learned. It also helps them further develop their own niche within the broader topic of educational games and simulations. However, this course attracts both doctoral level (Ph.D. or Ed.D.) and masters' level students. As such, the course final projects have flexibility to them.

Doctoral students are encouraged to complete a literature review of games or simulations in their area of interest. Students are encouraged to write from the perspective that their final paper should be submitted to a conference presentation or even to a journal. Students are, therefore, encouraged to do a lot of reading in their area of interest. They are also advised to read articles in journals or conference proceedings where they hope to submit their final paper.

Masters students can also create literature reviews to become more well-versed on their topic of interest. However, they are encouraged to make a positive impact by creating or implementing a practical project. They are advised at the beginning of the semester to identify a teaching or learning opportunity or problem in their own setting or in the setting of someone they know. Students are told that past exemplars have included the development of learning games (building on the development assignment in the course), presentation or professional development materials to present to other educators, or curricular development for other students.

8. Final Project Updates.

Students are introduced to the final project in week 1, even though the final project is not due until

the end of the course (week 7). This obviously gives students time to develop and implement a plan. Students are required to provide updates three different times in the course. These updates serve two goals. First, they provide a way for the instructor to give feedback and recommendations on the project. Second, they obviously serve as an incentive for students to continue to work on the project throughout the entire course.

COURSE ASSESSMENT

The course includes 8 major (albeit related) assignments. The total for all assignments, not including extra credit opportunities, is 375 points. The weighting of those graded components as well as the rubrics are listed below; extra credit assignment points are also provided.

Required assignments (375)

1. Introductory materials (30)
    - Submit a course message (5)
    - Create a VoiceThread (16)
    - Respond to 3 VoiceThread posts (9)
2. Playing Games and Simulations – 10 points x 7 weeks (70)
3. Reading response – 10 points x 5 weeks (50)
4. Gamestar Mechanic (30)
5. Developing a Game/Simulation (40)
    - Create a working prototype (20)
    - Fulfilling an educational need or opportunity (10)
    - Writing up the background, audience, and purpose (10)
6. Participation (25)
7. Final Project (100)
8. Final Project Updates – 10 points x 3 weeks (30)

Extra credit (points vary)

1. Going beyond normal communication in the general or gameplay discussion forums
2. Creating personalized content for the week 5 reading assignment

EXPANDED COURSE OUTLINE

Week 1: Course Introduction

Class Topics/Activities

- Watch an introductory video

- Read the course syllabus
- Explore the learning management system (LMS) and learn how to message your instructor
- Discover how to engage with others through the LMS discussion forums
- Get to know your colleagues
- Play and analyze a game or simulation

Class Assignments

- Virtual Introductions
    - Use VoiceThread to create a virtual introduction with images and audio
        - Slide 1 – Post a picture of you and describe your professional experience and interests (and personal interests/hobbies if you wish)
        - Slide 2 – Post a slide that describes your goals for the course
        - Slide 3 – Post a slide that includes a description of your potential project idea
    - Respond to at least 3 other VoiceThreads
- Game or Simulation Play
    - Play 30 minutes with a game or simulation
    - Write a discussion post about your experiences playing the game or simulation; include:
        - When you played (the dates/times)
        - What you liked/disliked
        - What the game/simulation taught you about teaching/learning with games/simulations
        - What the game/simulation taught you about your topic of interest

Week 1 Resources

- Link to VoiceThread (https://voicethread.com)
- Link to VoiceThread Instructions (https://voicethread.com/howto/)

Week 2: Introduction to Games and Simulations

Class Topics/Activities

- Consider the role of games and simulations for teaching and learning
- Explore educational games
- Study commercial games that have been used for educational purposes
- Play and analyze a game or simulation

Class Assignments

- Reading Response
    - Read: Klopfer, E., Osterweil, S., & Salen, K. (2010). *Moving learning games forward: obstacles, opportunities, & openness*. MIT: Education Arcade Paper.
    - Respond (one page minimum) to some or all the following questions:
        - Can games and simulations be used positively in learning and teaching experiences?
        - Is there research-based evidence that games and simulations positively impact education?
        - The authors say they are "prepared to argue" two key points. What are those points, and do they convince you?
        - What is the role of play and how is that important to the use of games for learning?
        - They discuss a lot about learning with games. Does the same apply to simulations? Can simulations be fun?
        - What barriers have you seen in your own experience?
        - Are there certain genres of games and/or simulations that are more or less useful for teaching and learning?
    - Final Project: Project Update #1
        - Submit a word document (minimum 1/2 page) that describes your final project and the timeline you have created for getting your project completed.
        - Project ideas include (but are not limited to):
            - Games/simulations within certain content areas
            - Games/simulations and semantic learning
            - Games/simulations and special needs/disabilities
            - Games/simulations and diversity, race, and/or gender
            - Games/simulations and learning benefits
            - Games/simulations and learning negatives (e.g. violence)
            - Games/simulations and avatars/virtual selves
            - Games/simulations and social impact
            - Games/simulations design and development
            - Games/simulations for training/corporate learning
            - Games/simulations and gerontology
            - Games/simulations and neurology
            - Games/simulations and health

        - Game or Simulation Play
            - Play 30 minutes with a game or simulation
            - Write a discussion post about your experiences playing the game or simulation; include:
                - When you played (the dates/times)
                - What you liked/disliked
                - What the game/simulation taught you about teaching/learning with games/simulations
                - What the game/simulation taught you about your topic of interest

Week 2 Resources

- Example Games/Simulations
    - 50 Educational Video Games That Homeschoolers Love – https://oedb.org/ilibrarian/50-educational-video-games-that-homeschoolers-love/
    - Auti-Sim – http://gamejolt.com/games/strategy-sim/auti-sim/12761/
    - Bioharmonious – http://artworksforchange.org/bioharmonious/
    - Body and Brain Connection on Xbox 360 with Kinect – https://youtu.be/nivjpR_zGKI
    - Bury me, My Love – https://www.amazon.com/Bury-Love-Nintendo-Switch-Digital/dp/B07N2BNZPW
    - Kahoot – https://kahoot.com
    - Learning Games for Kids – http://www.learninggamesforkids.com/
    - Quizizz – https://quizizz.com
    - World of Tanks – http://worldoftanks.com/
- Additional Articles
    - Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2010). Students' perceptions about the use of video games in the classroom Click for more options. *Computers & Education, 54*(4), 1145-1156.
    - DiPietro, M., Ferdig, R., Boyer, J., & Black, E. (2007). Toward a framework for understanding electronic educational gaming. *Journal of Educational Multimedia and Hypermedia, 16*(3), 223-248.
    - Hawlitschek, A., & Joeckel, S. (2017). Increasing the effectiveness of digital educational games: The effects of a learning instruction on students' learning, motivation and cognitive load. *Computers in Human Behavior, 72*, 79–86.
    - Mitchell, A., & Savill-Smith, C. (2004). The use of computer and video games for learning: A review of the literature Click for more options. London: LSDA.
    - Schaffhauser, D. (2017). Breakout! Gaming to learn. *THE Journal (Technological Horizons*

in Education), 44(4), 6.

- Vlachopoulos, D., & Makri, A. (2017). The effect of games and simulations on higher education: a systematic literature review. *International Journal of Educational Technology in Higher Education, 14*(1), 22.
- Wideman, H. H., Owston, R. D., Brown, C., Kushniruk, A., Ho, F., & Pitts, K. C. (2007). Unpacking the potential of educational gaming: A new tool for gaming research. *Simulation & Gaming, 38*(1), 10-30.
- Yee, N. (2006). Motivations for play in online games Click for more options. *Cyberpsychology & Behavior, 9*(6), 772–775.

- Additional Videos
  - Andre Thomas – The effective use of game-based learning in education – https://www.youtube.com/watch?v=-X1m7tf9cRQ
  - Christopher See – Gamification in Higher Ed – https://www.youtube.com/watch?v=d8s3kZz1yQ4
  - Daphne Bavelier – Your brain on video games – https://www.youtube.com/watch?v=FktsFcooIG8
  - Eric Klopfer – a GLS Video by GameZombie TV – http://www.youtube.com/watch?v=C1UgaggqiHE
  - Games and Education Scholar James Paul Gee on Video Games, Learning, and Literacy – http://www.youtube.com/watch?v=LNfPdaKYOPI
  - Katie Salen on Learning with Games – http://www.youtube.com/watch?v=xV_VlhV99EA
  - Lewis Tachau – Can Online Gaming be Educational? – https://www.youtube.com/watch?v=kgEoG04IcOc
  - Michael Stevens – Why do we play games? – https://www.youtube.com/watch?v=e5jDspIC4hY
  - Paul Andersen – Classroom Game Design – https://www.youtube.com/watch?v=4qlYGX0H6Ec
- Additional Books
  - Beck, J. C., & Wade, M. (2004). Got game. *Harvard Business School Press, Boston*.
  - DeMaria, R., & Wilson, J. (2002). *High score! The illustrated history of electronic games*. McGraw-Hill, Inc.
  - Dörner, R., Göbel, S., Effelsberg, W., & Wiemeyer, J. (2016). *Serious Games*. Basel, Switzerland: Springer International Publishing.
  - Ferdig, R. E. (Ed.). (2009). *Handbook of research on effective electronic gaming in education*. IGI global.
  - Gee, J. P. (2005). *Why video games are good for your soul: Pleasure and learning*. Common Ground.

- Gee, J. P. (2007). *Good video games+ good learning: Collected essays on video games, learning, and literacy*. Peter Lang.
- Gee, J. P. (2016). *Gaming lives in the twenty-first century: Literate connections*. Springer.
- Sanger, J., Wilson, J., Davies, B., & Whitakker, R. (1997). *Young children, videos and computer games: Issues for teachers and parents*. Psychology Press.

Week 3: The Learning Benefits of Games and Simulations

Class Topics/Activities

- Understand the promises, benefits, and pitfalls of games for teaching and learning
- Explore how teachers or learners choose games
- Consider how games and simulations impact lifelong learning
- Play and analyze a game or simulation

Class Assignments

- Reading Response
  - Read: Phillips, V., & Popović, Z. (2012). More than child's play: Games have potential learning and assessment tools. *Phi Delta Kappan, 94*(2), 26-30.
  - Watch: Adrian Camm: Learning Through Games: Student Success Stories – http://www.youtube.com/watch?v=BjZi860zdlw
  - Respond (one page minimum) to some or all the following questions:
    - How can teachers use games and simulations to positively impact student learning? How do games and simulations change the role of the teacher?
    - What characteristics must a game possess to enhance learning? What factors should be evaluated by teachers and parents when choosing an educational game or simulation?
    - What experiences have you had with games and simulations in an educational/work setting? What was the connection between the type of play you were engaged in and learning?
    - Are there certain subjects or tasks that lend themselves better to the use of video games and simulations? Why?
    - How might games affect the lifelong learning process?
  - Final Project: Project Update #2
    - o Submit a word document (minimum 1/2 page) that describes your progress towards your final project.
    - o Include an updated timeline if necessary.
    - o You may also submit project or product materials for me to review.
  - Game or Simulation Play

        - o Play 30 minutes with a game or simulation
        - o Write a discussion post about your experiences playing the game or simulation; include:
            - When you played (the dates/times)
            - What you liked/disliked
            - What the game/simulation taught you about teaching/learning with games/simulations
            - What the game/simulation taught you about your topic of interest

Week 3 Resources

- Example Games/Simulations
    - Apps:
        - Education APPolicious – https://bit.ly/2MKDP3a
        - GeoGuesser – https://apple.co/3tFRaL2
        - Stack the States – https://apple.co/2MDKbl9
        - Super Why – https://to.pbs.org/3p3jlQu
        - Words with Friends – https://apple.co/2NcYmx9
    - Computer:
        - Financial Football- https://www.financialfootball.com/
        - Civilization 6 – https://civilization.com/
            - Jack Archer's Video on Civilization V in the Classroom – https://www.youtube.com/watch?v=8o6zvm60VxA
        - Lemonade Tycoon – http://www.shockwave.com/gamelanding/lemonade.jsp
        - Maths Games – https://www.mathsgames.com/
        - Nobel Prize Educational Games – http://educationalgames.nobelprize.org/educational/
        - Recycle Roundup (Nat Geo) – *https://kids.nationalgeographic.com/games/action-and-adventure/recycle-roundup-new/*
        - Simulate Learning Disabilities – https://u.org/3oWU8qM
        - Skoolbo – https://skoolbo.com/
        - The Longest Journey – https://tlj.fandom.com/wiki/The_Longest_Journey
    - Console:
        - Brain and Body Connection (Xbox) – https://amzn.to/3a6Geyl
        - Dreams (PS4) – https://www.playstation.com/en-us/games/dreams/
        - Escape Adventure Island (Wii) – https://amzn.to/2O9zmr9

        - National Geographic Challenge (Wii) – https://amzn.to/36V7ZYl
- Additional Articles
    - Ahrens, A., & Zaščerinska, J. (2014). Perspective of game theory in education for sustainable development. *Education in a Changing Society, 1*, 99-108.
    - Auman, C. (2011). Using simulation games to increase student and instructor engagement. *College Teaching, 59*(4), 154-161
    - Bonnetain, E., Boucheix, J., Hamet, M., & Freysz, M. (2010). Benefits of computer screen-based simulation in learning cardiac arrest procedures. *Medical Education, 44*(7), 716-722.
    - Cavus, N., & Ibrahim, D. (2009). m-Learning: An experiment in using SMS to support learning new English language words. *British Journal of Educational Technology, 40*(1), 78-91.
    - Dye, M. W. G., Green, C. S., & Bavelier, D. (2009). The development of attention skills in action video game players. *Neuropsychologia, 47*(8), 1780-1789.
    - Griffiths, M. (2002). The educational benefits of videogames. *Education and Health, 20*(3), 47-51.
    - Mayer, B. (2015). Using games to connect students with content and skills. *LibrarySparks, 13*(3), 14-17.
    - Petsche, J. (2011). Engage and excite students with educational games. *Knowledge Quest, 40*(1), 42-44.
    - Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of game-based learning. *Educational Psychologist, 50*(4), 258-283.
    - Thirunarayanan, M. O., & Vilchez, M. (2012). Life skills developed by those who have played in video game tournaments. *Interdisciplinary Journal of Information, Knowledge & Management*, 7205-220.
- Additional Videos
    - 10 Exact Video Game Moments That Made Fans Rage Quit – https://www.youtube.com/watch?v=NeQIhm-pgo4
    - Games for Learning – Taking fun seriously – https://www.youtube.com/watch?v=qq_7zyg5qoA
    - Gaming can make a better world: Jane McGonigal on TED.com – https://www.ted.com/talks/jane_mcgonigal_gaming_can_make_a_better_world
    - Rethinking Learning: The 21st Century Learner | MacArthur Foundation – https://www.youtube.com/watch?v=c0xa98cy-Rw
    - Self-Directed Learning Through Game – Gabriel Yanagihara (TED Talk) – https://www.youtube.com/watch?v=E6zWtifWjXo
    - Tabletop Roleplaying Games as Social Practice | John Arcadian – https://www.youtube.com/watch?v=QJwsWsTa1hI

- Tsunami Simulator in 2nd Life – https://www.youtube.com/watch?v=R9-1PdjDLt0+
- Your Brain on Games – Daphne Bavelier – https://www.youtube.com/watch?v=FktsFcooIG8

- Additional Books
  - Aldrich, C. (2009). *The complete guide to simulations and serious games: How the most valuable content will be created in the age beyond Gutenberg to Google*. John Wiley & Sons.
  - Kapp, K. M., & O'Driscoll, T. (2009*). Learning in 3D: Adding a new dimension to enterprise learning and collaboration*. Wiley.
  - Nystrom, R. (2014). *Game programming patterns*. Genever Benning.
  - Squire, K. (2011). *Video games and learning: teaching and participatory culture in the digital age.* New York: Teachers College Press.

Week 4: Social Impact Games

Class Topics/Activities

- Define and explore social impact games.
- Consider the claim that video games desensitize players.
- Understand the ways in which games have humanitarian and educational efforts that impact communities globally.
- Play and analyze a game or simulation

Class Assignments

- Reading Response
  - Read:
    - Ruggiero, D. (2013). The Four Keys of Social Impact Games. In Foundations of Digital Games Conference (FDG2013, Chania, Greece, 14–17 May 2013). *http://www.fdg2013.org/program/workshops/papers/IDGEI2013/idgei2013_2.pdf*
    - Knight Foundation (n.d.). *Social Impact Games: Do They Work? https://knightfoundation.org/reports/games-and-community-building-final-report/*
  - Respond (one page minimum) to some or all the following questions:
    - What are some of the challenges associated with social impact gaming?
    - Do social impact games need to be designed differently than other games?
    - How do games make a social impact?
    - Do games have to be digital to make an impact on society? Are there more advantages to having games being digital or in-person?
    - All these resources talk about games making a social impact, are there ways simulations can be used to do the same?
  - Final Project: Project Update #3

        - Submit a word document (minimum 1/2 page) that describes your progress towards your final project.
        - Include an updated timeline if necessary.
        - You may also submit project or product materials for me to review.
    - Game or Simulation Play
        - Play 30 minutes with a game or simulation
        - Write a discussion post about your experiences playing the game or simulation; include:
            - When you played (the dates/times)
            - What you liked/disliked
            - What the game/simulation taught you about teaching/learning with games/simulations
            - What the game/simulation taught you about your topic of interest

Week 4 Resources

- Example Games/Simulations
    - Data Dealer – https://datadealer.com/
    - Find the Future: The Game – *https://bit.ly/3aH68aQ*
    - Inside the Haiti Earthquake(Imagery may be graphic/disturbing) – http://insidedisaster.com/haiti/experience
    - Quandary – https://quandarygame.org/
    - Spent – http://playspent.org/
    - Unmanned – http://unmanned.molleindustria.org/
- Watching Others Play/Talking with Others About Game Play
    - Discord – https://discord.com/
    - Gamepedia – https://www.gamepedia.com/
    - Reddit(search for game talk) – https://www.reddit.com/
    - Steam – https://store.steampowered.com/about/
    - Tv – https://www.twitch.tv/
- Additional Articles
    - Caperton, I. H. (2013, July 25). Taking Games for Good to a New Level | Stanford Social Innovation Review.
    - Center for Games & Impact (n.d.). Impact-Based Research.
    - Dolan, E. W. (2010, March 15). Prosocial Video Games Increase Likelihood of Helping Others | PsyPost

- Farber, M. (2013). Gaming for Social Good | Edutopia
- Ghimire, S. (2017). The Social Benefits of Video Gaming | Medium
- Jenkins, H. (2008). Eight Myths About Video Games Debunked. Retrieved from http://www.pbs.org/kcts/videogamerevolution/impact/myths.html
- Kühn, S., Kugler, D. T., Schmalen, K., Weichenberger, M., Witt, C., & Gallinat, J. (2019). Does playing violent video games cause aggression? A longitudinal intervention study. *Molecular psychiatry, 24*(8), 1220.
- Markey, P. M., Markey, C. N., & French, J. E. (2015). Violent video games and real-world violence: Rhetoric versus data. *Psychology of Popular Media Culture, 4*(4), 277.
- O'Riordan, T., Millard, D. E., & Schulz, J. B. (2016). How should we measure online learning activity?. *Research in Learning Technology*, *24*, 1-28.
- Prescott, A. T., Sargent, J. D., & Hull, J. G. (2018). Metaanalysis of the relationship between violent video game play and physical aggression over time. *Proceedings of the National Academy of Sciences, 115*(40), 9882-9888.
- Raphael, C., Bachen, C., Lynn, K-M., Mckee, K., & Baldwin-Philippi, J. (2010). Games for civic learning: A conceptual framework and agenda for research and design. *Games and Culture, 5*, 199-235.
- Ruggiero, D. (2013). The Four Keys of Social Impact Games. In Foundations of Digital Games Conference (FDG2013, Chania, Greece, 14–17 May 2013). http://www.fdg2013.org/program/workshops/papers/IDGEI2013/idgei2013_2.pdf
- Shi, J., Boak, A., Mann, R., & Turner, N. (2019,August). Adolescent Problem Video Gaming Urban and Non-urban Regions. *International Journal of Mental Health and Addiction,17*(4), 817-827.
- Stevens, G. (2012). Gaming is driving social change but we need more players. The Guardian.
- Swain, C. (2007, September). Designing Games to Effect Social Change. In DiGRA Conference. Available online at: https://pdfs.semanticscholar.org/15f1/7d179a7272cb5a0ec0db524d7596731b7535.pdf

- Additional Videos
  - Alan Gershenfield – Mind the Gap: Games, Impact, Potential, Reality Speaker https://www.youtube.com/watch?v=VX0ZgYysQK8
  - Elizabeth Sarquis and Alejandro Fenn – Global Gaming Initiative: Using Smartphone Games to Affect Social Change (https://www.youtube.com/watch?v=WQSpDNvYW70&list=PL1G85ERLMItArgj_xXGBbt_BL_uyhGgRJ&feature=share&index=3
  - Games for Change: Making a Social Impact https://www.youtube.com/watch?v=63iVWFaklpI
  - James Simpson – The power of truly social games https://www.youtube.com/watch?v=DO7uaoMX60o&feature=youtu.be

    - Jane McGonigal – Gaming can make a better world https://www.ted.com/talks/jane_mcgonigal_gaming_can_make_a_better_world
    - Jessica Hammer – Stronger Together: Helping Ethiopian Girls Help Themselves https://www.youtube.com/watch?v=9fWeNLbFk9E&list=PL1G85ERLMItArgj_xXGBbt_BL_uyhGgRJ&feature=share
    - Myers Briggs and Character Creation – Psychology in Game Design – Extra Credit – https://www.youtube.com/watch?v=QKnNO5pxRGQ
    - Sabrina Aggarwal – Sanitation: A massive Opportunity for Games in India & Africa (https://www.youtube.com/watch?v=Qm8bk5bMmD8&feature=share&list=PL1G85ERLMItArgj_xXGBbt_BL_uyhGgRJ&index=7)
    - SOS Slavery Trailer (https://www.youtube.com/watch?v=FHmJYUg4PTw&feature=youtu.be)
    - TEDxYouth (https://youtu.be/O2N-5maKZ9Q)
- Additional Books
    - Abt, C. C. (2002). *Serious games*. Lanham, MD: University Press of America.
    - Bogost, I. (2007). *Persuasive games: The expressive power of videogames*. Cambridge, MA: MIT Press.
    - Burak, A., & Parker, L. (2017). *Power Play: How Video Games Can Save the World*. New York, NY: St. Martin's Press.
    - Flanagan, M. (2013) *Critical play: Radical game design*. Cambridge, MA: MIT Press.
    - McGonigal, J. (2011) *Reality is broken: Why games make us better and how they can change the world*. New York: Penguin Press.
    - McGonigal, J. (2015). *SuperBetter: A revolutionary approach to getting stronger, happier, braver and more resilient.*
    - Michael, D. R., & Chen, S. (2006). *Serious games: Games that educate, train, and inform*. Boston, MA: Thomson Course Technology PTR.
    - Ritterfeld, U., Cody, M. J., & Vorderer, P. (2009). *Serious games: mechanisms and effects*. New York: Routledge.
    - Ruggiero, D. (2017). *Why we design games: frameworks from indie to AAA*. Focal.
    - Willson, M., & Leaver, T. (Eds.). (2017). *Social, casual and mobile games: the changing gaming landscape*. Bloomsbury Publishing USA.

Week 5: Games Simulations and Content

Class Topics/Activities

- Explore games and simulations within specific contexts and content areas.
- Use Gamestar Mechanic to learn about game design.

- Play and analyze a game or simulation

Class Assignments

- Reading Response
    - Read:
        - This week, there are 10 sets of choices for reading about games, simulations and content. See the Week 5 resource section. Pick one of the sections.
          OR
        - If you can not find an area that interests you, you can earn up to 10 points extra credit by creating your own content. To do so, simply follow the same format as you see each week under the "Getting us all on the same page." You must include:
            - At least one required reading and video
            - At least 4-6 questions
            - And at least 8 supplementary materials (2 videos, 2 articles, 2 games, and 2 websites)
        - Respond (one page minimum) to the reading. Questions are given in each of the content sections.
    - Gamestar Mechanic
        - Optional – Read: Salen, K. (2007). Gaming literacies: A game design study in action. *Journal of Educational Multimedia and Hypermedia*, *16*(3), 301-322.
        - Required:
            - Visit Gamestar Mechanic – http://gamestarmechanic.com/
            - Click on "Get Started" and create a new account.
            - Complete all the 'quests' (the free ones).
            - Submit a Word document that has a screenshot of "100% complete"
            - Additionally, in the Word document, write at least 2 paragraphs about what you learned about Game Design by playing GSM.
        - Extra Credit
            - **Extra Credit 1**: In addition to the game play, there is an opportunity to create a game in "workshop." Create a game and include a screen shot, a description of what you created in the workshop, and how you might use it to teach someone something.
            - **Extra Credit2**: Review the **teacher guide** (https://sites.google.com/a/elinemedia.com/gsmlearningguide/table-of-contents). Provide at least a two-paragraph review of the guide, particularly focusing on the sections called "Lessons on Game Design" and "Lessons with Core Curriculum Subjects."

        - **Extra Credit 3**: Read Salen's article. Provide at least a two-paragraph summary of what you learned from Salen.
    - Game or Simulation Play
        - Play 30 minutes with a game or simulation
        - Write a discussion post about your experiences playing the game or simulation; include:
            - When you played (the dates/times)
            - What you liked/disliked
            - What the game/simulation taught you about teaching/learning with games/simulations
            - What the game/simulation taught you about your topic of interest

Week 5 Reading Response Resources

Games, Simulations, and Accessibility

- Read: Darin, T., Andrade, R., & Sánchez, J. (2018, January). *CLUE: A Usability Evaluation Checklist for Multimodal Video Game Field Studies with Children Who Are Blind*. In Proceedings of the 51st Hawaii International Conference on System Sciences.
- Watch: Video Making Games Better for Gamers with Colourblindness and Low Vision – https://www.youtube.com/watch?v=xrqdU4cZaLw
- Questions:
    - Should video games be implemented if they aren't accessible?
    - How strongly should teachers rely on gaming programs to teach concepts? How much/often should they be used?
    - What are the benefits of using games and simulations in addressing accessibility issues?
    - What are your own experiences with accessibility in games and simulations? Did you ever think about accessibility issues or have you ever played a game with someone who has accessibility needs?
    - How should designers plan for accessibility?
- Example Games/Simulations
    - AccessibleGames – https://www.accessiblegames.biz/
    - Ablegames – https://ablegamers.org/accessiblee32017/
    - Phet.colorado.edu – https://phet.colorado.edu/en/accessibility/prototypes
- Additional Articles
    - Cordeiro, P., Conrad, C., & Cheiran, J. (2017). Redesigning towards accessibility: from a Facebook trivia game to an educational, accessible web game. *Simpósio Brasileiro de Jogos e Entretenimento Digital. Brazil, Curitiba*.

- Westin, T., Bierre, K., Gramenos, D., & Hinn, M. (2011, July). Advances in Game Accessibility from 2005 to 2010. In *International Conference on Universal Access in Human-Computer Interaction*(pp. 400-409). Springer, Berlin, Heidelberg.
- Yuan, B., Folmer, E., & Harris, F. C. (2011). Game accessibility: a survey. *Universal Access in the Information Society, 10*(1), 81-100.

- Additional Videos
  - Making Games Better for Players with Cognitive Disabilities https://www.youtube.com/watch?v=ObhvacfIOg0
  - RockyNoHands: The Gamer Who Can Beat You With His Mouth https://www.youtube.com/watch?v=ZMvikz2cA-8&t=59s
  - Should games always be accessible? https://www.youtube.com/watch?v=aZ9-PHbiEvs
- Additional Books
  - Dundon, R. (2019). *Teaching Social Skills to Children with Autism Using Minecraft®: A Step by Step Guide*. Jessica Kingsley Publishers.
  - Mangiron, C., O'Hagan, M., & OrerO, P. (2014). *Fun for all: translation and accessibility practices in video games*. Bern: Peter Lang.
  - Matamala, A., & Orero, P. (2016). (Eds.) *Researching audio description*. Springer.

Games, Simulations, and Business

- Read:
  - Popescu, Maria Magdalena, Romero, Margarida, & Usart, Mireia (2013). Serious games for serious learning-Using SG for business, management and defence education. *International Journal of Computer Science and Research and Application, 3*(1), 5-15.
  - Teach, R. & Murff, E. (2009). Learning inhibitors in business simulations and games. *Developments in Business Simulation and Experiential Learning, 36*, 191-197.
- Questions:
  - Can Games/Simulations be used to train or educate adults?
  - Can you learn to lead others through a PC/App game?
  - Do virtual businesses found in games require skills needed to run a real business?
  - Have business simulations and games changed the perception of what it would take to start your own business or manage an existing business?
  - Do business games and simulations create misrepresentations of how to run an organization?
  - Can games and simulations be used to collaboratively test business or other organizational ideas?
- Example Games/Simulations
  - Corporation Inc. – https://bit.ly/2YXRuXd

    - Diner City – https://bit.ly/3d0z9kJGazillionaire – http://www.gazillionaire.com/gazillionaire.php
    - Papa's Burgerita – https://bit.ly/39ZL7c8
    - Roller Coaster Tycoon Walkthrough – https://www.youtube.com/watch?v=PvewR66iCUE
    - Tiny Tower – https://apple.co/3tIL1xI
    - Zapitalism – http://www.zapitalism.com/index.php
- Additional Articles
    - 15 Business Simulation Games ClassroomAid
    - Bista, S., Dahal, K., Cowling, P., T.rB. (2007). Unraveling the Evolution of Defectors in Online Business Games. Retrieved from https://arxiv.org/ftp/arxiv/papers/1305/1305.2979.pdf
    - Dieguez-Barreiro, J., Gonzalez-Benito, J., Galende, J., & Kondo, E. (2011). The Use of Management Games in the Management Research Agenda. Retrieved from https://dialnet.unirioja.es/servlet/tesis?codigo=26633
- Additional Books
    - Edery, D. & Mollick, E. (2008). *Changing the Game: How Video Games are Transforming the Future of Business*. FT Press.

Games, Simulations, and Diversity

- Read: Glaubke, C. R., Miller, P., Parker, M. A., & Espejo, E. (2001). *Fair Play? Violence, Gender and Race in Video Games* . https://files.eric.ed.gov/fulltext/ED463092.pdf
- Questions:
    - Why do you feel video game designers target specific genders and races in simulation/video games?
    - Should the simulation/video games be more diverse? Why or why not?
    - From the simulation/video games you have personally played, what do you feel is the most used stereotype and why?
    - "Urban/Street" games, such as Grand Theft Auto, have come under fire for portraying racial stereotypes and characterize women as misogynistic. What other simulation/video games could impact our perceptions on gender and/or race?
- Example Games/Simulations
    - Grand Theft Auto and Red Dead Redemption series – https://bit.ly/2YWUzHd
    - Persona 5 – https://bit.ly/2YXL0HN
    - The Sims 4 – https://bit.ly/3rv0mQc (Also on Steam)
- Additional Articles
    - DeVane, B. & Squire, K. D. (2008). The Meaning of Race and Violence in Grand Theft

Auto: San Andreas. *Games and Culture, 3*(3-4), 264-285.

- Everett, A. & Watkins, C.S. (2007). The Power of Play: The Portrayal and Performance of Race in Video Games. The Ecology of Games, 141-164.
- Jenson, J. & de Castell, S. (2010). Gender, Simulation, and Gaming: Research Review and Redirections. *Simulation Gaming*, 41(1) 51-71.
- Lee, J.J. (2013). Game Mechanics to Promote New Understandings of Identity and Ethnic Minority Stereotypes. Digital Culture & Education, 5(2), 127-150.
- Martin, C. (2008). Children's Video Games as Interactive Racialization. CLCWeb: Comparative Literature and Culture, 10(2) 1-10.
- Mou, Y., & Peng, W. (2009). Chapter LIII Gender and Racial Stereotypes in Popular Video Games. In R.E. Ferdig's (Ed.) Handbook of Research on Effective Electronic Gaming in Education, 922-937. Hershey, PA: IGI Global.
- Nakamura, L. (2011). "It's a N*in Here! Kill the N*!" User-Generated Media Campaigns Against Racism, Sexism, and Homophobia in Digital Games. The International Encyclopedia of Media Studies, Media Studies Futures (1st ed., Vol. 6).
- Noble, R., Ruiz, K., Destefano, M., & Mintz, J. (2003). Conditions of Engagement in Game Simulation: Contexts of Gender, Culture and Age. DIGRA Conference, 1-14.
- Venegas, M. (2007). Interpretations on the Racialized Experience of Video Games. McNair Scholars Research Journal, 8(1), Article 14, 95-109.

- Additional Videos
  - Andray Domise – Colour Coded: Race, Gender, and Representation in Video Games – https://www.youtube.com/watch?v=yGl4kWJWdI0
- Additional Websites
  - Complicated Pixels: Lack of Racial Diversity in Video Games? – https://bit.ly/2LvGj4S
  - How to tackle gaming's lack of racial diversity – https://bit.ly/3aQf2Tx

Games, Simulations, and Empathy

- Read: Bearman, M., Palermo, C., Allen, L. M., & Williams, B. (2015). *Learning empathy through simulation: a systematic literature review*. Simulation in healthcare, 10(5), 308-319.
- Watch: Catharina Bøhler – https://www.youtube.com/watch?v=s1ge8hwsFOk&ab_channel=TEDxTalks
- Questions:
  - What are the advantages of using video games as a medium to teach empathy?
  - Can games make us better people?
  - How do you measure the "success" of an empathy game?
  - When building empathy through games, is it more impactful to "be" the person you're building empathy for, or to "interact" with the person you're building empathy for?

- Example Games/Simulations
    - My Child Lebensborn – http://www.mychildlebensborn.com/
    - Spent – http://playspent.org/
    - That Dragon, Cancer – http://www.thatdragoncancer.com/#home
- Additional Articles
    - Teding van Berkhout, E., & Malouff, J. M. (2016). The efficacy of empathy training: A meta-analysis of randomized controlled trials. *Journal of counseling psychology, 63*(1), 32.
- Additional Videos
    - Cultivating empathy through video-games – https://www.youtube.com/watch?v=_RtnxIz8DaYoA
    - Gaming can make a better world – https://bit.ly/2OjIF8a
    - Question of Empathy –Are There Positive Effects from Gaming? https://www.youtube.com/watch?v=fftjo1CepQEo
- Additional Websites
    - Edutopia – https://www.edutopia.org/article/teaching-empathy-video-games

Games, Simulations, and Foreign Language Learning

- Read: Bonner, E., & Reinders, H. (2018). Augmented and virtual reality in the language classroom: Practical ideas Click for more options. *Teaching English with Technology, 18*(3), 33-53.
- Watch: Domaz, S. (2018). Race to proficiency: Augmented reality mobile game in the foreign language classroom. https://youtu.be/4yo9lhv0ND0
- Questions:
    - How can computer-assisted language learning (CALL) move beyond flashy flashcards and cloze exercises into a communicative medium that includes task-based learning?
    - How can digital games encourage learners to take the next step of communicating face to face with people?
    - With typing and swiping, do you think there is still a need for handwriting in language learning?
    - What are some ways impoverished or rural community schools can implement augmented reality, virtual reality, or expanded reality technology?
- Example Games/Simulations
    - Learn 33 Languages Free – Mondly (Google Play) – http://bit.ly/39ZMrM7
- Busuu: Learn Languages – Spanish, English & More (Google Play) – http://bit.ly/3q4Y8H0
- Additional Articles
    - Ali Mohsen, M. (2016). The use of computer-based simulation to aid comprehension

and incidental vocabulary learning. *Journal of Educational Computing Research, 54*(6), 863-884.

- Tsai, Y. L., & Tsai, C. C. (2018). Digital game-based second-language vocabulary learning and conditions of research designs: A meta-analysis study. *Computers & Education, 125*,345-357.

- Additional Videos
  - Augmented Reality in Education. (2011). Augmented reality during language acquisition (Spanish 101). (https://www.youtube.com/watch?v=NYjz4MfR9VM)
  - International Symposium on Mixed and Augmented Reality (ISMAR). (2018). Arbis pictus: A study of language learning with augmented reality. https://www.youtube.com/watch?v=fjdw8I85zRg
- Additional Websites
  - Kessler, G. (2019, April). Augmented reality for language learning. http://blog.tesol.org/augmented-reality-for-language-learning/
  - Trucano, M. (2014). Promising uses of technology in education in poor, rural and isolated communities around the world – http://bit.ly/2YWcTQr
  - University of Oregon. (n.d.). Virtual and augmented reality language training (VAuLT). https://casls.uoregon.edu/classroom-resources/vault/

Games, Simulations, and Health

- Read: Primack, B.A., Carroll, M.V., McNamara, M., Klem, M.L., King, B., Rich, M.O., et al. (2012). Role of video games in improving health-related outcomes: A systematic review. *American Journal of Preventative Medicine, 42*(6), 630-638. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3391574
- Watch: 10 Surprising Health Benefits of Playing Video Games (https://www.youtube.com/watch?v=LNycSARuGcE)
- Questions:
  - Can games be beneficial to one's mental or physical health? Can they be detrimental?
  - The authors bring up several different areas of health that can be improved with games. What are they?
  - Are there some types of health concerns that are likely to be more helped by games than others?
  - Do you think that there are some socio-demographic groups (e.g. race, age, gender) that are more likely to benefit?
  - What are some of the tradeoffs of using a video game for exercise rather than the actual activity (e.g. using a simulator vs. the actual activity)?
  - Although we have great video game systems (Wii, Kinect) that can encourage physical activity, we still have high levels of obesity/overweight in our society? What is the disconnect?

- What can we do to make video games more effective and fix the disconnect between availability and use?

- Example Games/Simulations
  - XBOX/PS/SWITCH
    - Biggest Loser – https://bit.ly/3qckIxn
    - EA Sports – https://www.ea.com/sports
    - Ring Fit Adventure – https://ringfitadventure.nintendo.com/
  - PC/Mac
    - The Sims 4 – https://www.ea.com/games/the-sims/the-sims-4
    - Health games – https://bit.ly/373zCi9
    - Lumosity(free trial, but may cost) – https://www.lumosity.com/en/
    - Beat Saber (Oculus) – https://www.oculus.com/experiences/rift/1304877726278670/?locale=en_US
  - Health Simulations
    - 4 Global health games you shouldn't miss – https://www.psi.org/2016/04/4-global-health-games-you-shouldnt-miss/
    - Healthy Simulations – https://www.healthysimulation.com/medical-simulation/
    - Public Health Fun! The use of games in Public Health Education – https://bit.ly/3qbAZ61

- Additional Articles
  - 7 health benefits of playing video games – https://bit.ly/2YVruvC
  - Advantages & Disadvantages of Video Games – https://bit.ly/3p6TPJT
  - Griffiths, M. (2005). Video games and health. *BMJ, 331*, 122–3
  - This is a whole journal devoted to the subject titled "Games for Health" – https://bit.ly/3aNSvXf
  - This empirical article gives some insight into the downside of video game usage—addiction. Gentile, D.A., Choo, H., Liau, A Sim, T., Li, D., Fung, D. et al. (2010). Pathological video game use among youths: A two-year longitudinal study. *Pediatrics, 127*, 319-329.

- Additional Videos
  - A great TED talk that explains the psychology behind games and how they can improve our health care. (https://www.youtube.com/watch?v=gqxVfFYuiD0)
  - Panel of guests at Ohio State University on benefits of games (https://www.youtube.com/watch?v=slN0O0cLQWo)
  - United Healthcare installs Dance Revolution in school (https://www.youtube.com/

watch?v=OHX5K-5K4Wc)

- Additional Websites
  - Games for Health Europe https://www.gamesforhealtheurope.org/
  - Health Games Database https://www.cdgr.ucsb.edu/database
- Additional Books
  - Beale, I. (2011*). Video games for health. Principles and strategies for design and evaluation*. Nova Science Pub, Inc.

Games, Simulations, and History/Social Studies

- Read: Watson, W. R. (2010). Games for social studies education. In A. Hirumi (Ed.), P*laying games in school: Video games and simulations for primary and secondary education*(pp. 173-202). Washington DC: International Society for Technology in Education.
- Watch Kurt Squire on Civic Engagement Through Digital Games (Big Thinkers Series; Video) (https://www.youtube.com/watch?v=ZtSy78xTf5M)
- Questions:
  - Do you think using video games can help students learn about historical figures, events, or facts better than in a traditional classroom?
  - What types of video games or simulations are best suited to be used in asocial studies classroom? Does the game selected affect what is learned?
  - Can video games and simulation recreate social studies topics and make learning more interesting?
  - What skills can be gained by using video games in the social studies classroom?
  - Have high stake tests limited what teachers can teach in the classroom?
- Example Games/Simulations
  - Age of Empires – https://www.ageofempires.com/
  - Civilization – https://civilization.com/
  - Minecraft – https://education.minecraft.net/
  - SimCity – https://www.ea.com/games/simcity
- Additional Articles
  - Devlin-Scherer, R., & Sardone, N. B. (2010). Digital simulation games for social studies classrooms. The Clearing House, 83(4), 138-144.
  - Evans, R. W., & Passe, J. (2007). Dare we make peace: A dialogue on the social studies wars.*The Social Studies, 98*(6), 251–256.
  - Maguth, B. M., List, J. S., & Wunderle, M. (2015). Teaching social studies with video games.*The Social Studies, 106*(1), 32-36.
  - McCall, J. (2011, October 3). Using simulation games in the history classroom.

Retrieved from https://bit.ly/2Z8cHOs

- Additional Books
  - Beck, J. C., & Wade, M. (2004). *Got game: How the gamer generation is reshaping business forever*. Boston: Harvard Business School Press.
  - McCall, J. (2013). *Gaming the past: Using video games to teach secondary history*. Routledge.
  - Prensky, M. (2005). *Don't bother me Mom I'm learning!: How computer and videogames are preparing your kids for 21st century success and how you can help!*St. Paul, MN: Paragon House.
  - Toppo, G. (2015). *The game believes in you: How digital play can make our kids smarter*. Macmillan.

Games, Simulations, and Math

- Read: Gillispie, L., Martin, F., & Parker, M. A. (2010). Effects of a 3-D video game on middle school student achievement and attitude in mathematics. *Electronic Journal of Mathematics & Technology, 4*(1), 68-80.
- Watch: Learning STEM Skills by Designing Video Games (Is School Enough? Series) https://www.youtube.com/watch?v=qkAietIUKVU
- Questions:
  - How should video games be implemented into the math curriculum?
  - How strongly should teachers rely on gaming programs to teach concepts? How much/ often should they be used?
  - What are the benefits of using games and simulations in teaching math?
  - What are the drawbacks and limitations of teaching math through video games?
  - Dimension U is a gaming program that must be purchased for use in the schools. Many of the free programs that are simpler (Like Math Invaders and Number Crunchers). Does money have to be spent to get high quality video games that will teach and motivate students?
  - What are your own experiences with math games and simulations? Did you find them highly educational and motivating?
  - Are there certain games and/or simulations that are more or less useful for teaching and learning?
- Example Games/Simulations
  - Brainpop – https://www.brainpop.com/math
  - Cool Math Games (Many students play them, and teachers let them use them, but many do not teach math concepts) – https://www.coolmathgames.com/
  - Dimension U(Games mentioned in the video, you must pay to play the games) – https://bit.ly/2Z66ylR

- IXL – https://www.ixl.com/
- King of Math(iTunes) – https://apple.co/2O9zZRx
- Luminosity – https://www.lumosity.com/en/
- Math Invaders– http://www.vectorkids.com/vkinvaders.htm
- NumberLine Touch – https://apple.co/3q1Hxnu
- SoftSchool Math Games – https://www.softschools.com/math/games/
- SumDog – https://www.sumdog.com/us/

- Additional Articles
  - Etuk, N. (2008). Educational gaming–From edutainment to Bona Fide 21st-century teaching tool. *Multimedia & Internet@Schools, 15*(6), 10-13.
  - Moorefield-Lang, H. & Evans, M.A. (2011). Rhythmatical- A game to combine music and mathematics for mobile devices. *Music Reference Services Quarterly, 14*(1/2), 46-51.
  - Remsen, J., & Hummel, J. W. (1985). Courseware overview: Math invaders. *Journal of Learning Disabilities, 18*(6), 363.
- Additional Videos
  - Angles – BrainPOP – https://bit.ly/3jDoqxR
- Additional Books
  - Martinovic, D., Freiman, V., & Karadag, Z. (Eds.). (2013). *Visual mathematics and cyberlearning*(Vol. 1). Springer.
  - Stahl, G. (2013). *Translating Euclid: Designing a Human-Centered Mathematics*. Morgan & Claypool.

Games, Simulations, and Science

- Read
  - Echeverri, J.F., & Sadler, T.D. (2011) Gaming as a platform for the development of innovative problem-based learning opportunities. *Science Educator, 20*(1), 44-48.
  - Gende, D. (2011, April 1). Science Simulations: A Virtual Learning Environment | Powerful Learning Practice.
- Watch: Paul Andersen: Classroom Game Design-TedxTalks (Video) https://www.youtube.com/watch?v=4qlYGX0H6Ec
- Questions:
  - What are the benefits of a virtual lab over a traditional hands-on lab?
  - What do you think games and simulations teach children about the concept of failure?
  - Gaming provides a platform for problem-based learning. What kind of skills will students develop in a problem-based learning environment?
  - Do you think integrating video games into school curriculum will decrease the number

of high school dropouts?

- In the video, Andersen talks about using a leader board to display students' scores in his class. What are your thoughts about creating a competitive environment in a classroom?
- In the video, Andersen talks about starting students at "level 1" at the beginning of each grading period which equates to 0 points. This means that all students start with an "F" in his class but must work or "level up" to gain points toward earning a higher grade. What are your thoughts on this

- Example Games/Simulations
  - Angry Birds (mobile app) – Students control trajectory and force by "pulling" on a slingshot thus affecting speed, velocity, and other factors pertinent to physics principles – http://www.angrybirds.com/
  - Biodigital Human– Students can explore the body in 3D using this Chrome app. – https://bit.ly/2Ndu4uw
  - Digestion Game – Younger students will learn about the digestion process with this interactive, animated simulation through the digestive tract https://bit.ly/2O9B63F
  - Fantastic Contraption- A physics puzzle game where students use the law of physics to advance. – http://fantasticcontraption.com/
  - Frog Dissection– Students keep their hands clean while performing a frog dissection with this simulation game. – http://www.roketoyun.com/fullscreen/frog_dissection
  - Guts and Bolts- Students can learn about organs and human systems by building them within this game. – https://bit.ly/3tC3VWO
  - NASA Space Place– Students can learn about astronomy and space by playing games on the NASA Space Place site. – https://spaceplace.nasa.gov/menu/play/
  - Orbiter– Students learn about space flight in this real-time 3D simulator for the PC. – https://bit.ly/3oY77Zb
  - Portal 2(computer game) – Students develop an understanding of physical principles, such as mass and weight, acceleration, momentum, gravity, and energy – https://www.learnwithportals.com/
  - Poke a Muscle– Older students can learn about the muscles in the body with this fast-paced, interactive game. – https://bit.ly/2YVkr6e
  - Skeletal System– Students construct the skeletal system or click to identify the different bones in this game. – https://bit.ly/3aLq7Fj
- Additional Articles
  - Ash, K. (2008, April 28). Building Gaming into Science Education | Education Week.
  - Ash, K. (2011, June 15). Programming Digital Fun into Science Education | Education Week.
  - Campbell T., Shaing K.W., Hui-Yin H., Duffy A.M., & Wolf P.G. (2010). Learning with

web tools, Simulations, and other technologies in science classrooms. *Journal of Science Education and Technology, 19*(5), 505-511.

- Chen, C.-H., & Howard, B. (2010). *Effect of live simulation on middle school students' attitudes and learning toward science*. *Educational Technology & Society, 13*(1), 133–139.
- Krigman, E. (2013, November 11). The Latest Tools for Teaching STEM: Video Games | U.S. News.
- Ohio State University (2010, February 14). Computer simulations can be as effective as direct observation at teaching students | Science Daily.
- Squire, K., & Patterson, N. (2010). Games and simulations in informal science education (WCER Working Paper No. 2010-14). Wisconsin Center for Education Research.

- Additional Videos
  - Paul Andersen: Using Game Design to Improve My Classroom (video) – this video further explains the concepts introduced in the TedxTalks video https://www.youtube.com/watch?v=XGE6osTXym8
- Additional Websites
  - Anatomy Arcade – An arcade filled with games to help students learn the various body systems. – http://www.anatomyarcade.com/
  - Onlinelabs.in – Has online labs and resources for chemistry, physics, and biology. – http://onlinelabs.in/
  - PBS Science Games – A collection of science games for the younger students. – https://pbskids.org/games/science/
  - PhET.colorado.edu – Offers over 125 free interactive simulations in the fields of physics, chemistry, biology, earth science, and mathematics (Lesson activities are available) – https://phet.colorado.edu/
  - Sciencekids.co.nz – Experiments, games, and online activities for kids of all ages. – https://www.sciencekids.co.nz/
- Additional Books
  - National Research Council. (2011). *Learning Science Through Computer Games and Simulations*. Committee on Science Learning: Computer Games, Simulations, and Education, Margaret A. Honey and Margaret L. Hilton, Eds. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Games, Simulations, and Special Education

- Read: Epp, C. D., & Makos, A. (2013, July). *Using Simulated Learners and Simulated Learning Environments within a Special Education Context*. In AIED 2013 Workshops Proceedings Volume 4.
- Watch: Temple Grandin: The world needs all kinds of minds – https://bit.ly/2ZbTxY1

- Questions:
    - Does the use of simulation allow for generalization of the special education student? Or will the student have difficulty applying the concepts learned through simulation into their everyday challenges?
    - What characteristics does a simulation environment need to meet the needs and challenges of special education learners to ensure generalization and in depth learning to occur?
    - Can a simulation game meet the needs of all students at all ability levels? How or how not?
    - Do simulated learners and environments give an accurate picture of reality?
- Example Games/Simulations
    - PC/Internet
        - ABCya – https://www.abcya.com/
        - Build-a-lot – https://bit.ly/2OooWnD
        - Do2Learn – https://do2learn.com/academics/overview.html
        - Mangomon – http://www.mangomon.com/special-education-online-games/
        - Mavis Beacon Teaches Typing – https://www.broderbund.com/education
        - Second Life – https://secondlife.com/
        - Starfall – https://www.starfall.com/h/
        - The Sims Series (Also on Steam) – https://bit.ly/2Z78SZH
    - Nintendo 3DS Console
        - My Little Baby 3D – https://bit.ly/3qfBrjm
        - Puppies World 3D – https://bit.ly/3cQrdlX
    - Nintendo Wii
        - Food Network Cook or be cooked – https://amzn.to/3p6UTNT
    - XBOX ONE/PlayStation 4
        - Zoo Tycoon – https://amzn.to/2LyglxP
        - Zumba Fitness World Party – https://amzn.to/3ryUQw7
- Additional Articles
    - González, J. L., Cabrera, M. J., & Gutiérrez, F. L. (2007). Using videogames in special education. In *Computer Aided Systems Theory*–EUROCAST 2007 (pp. 360-367). Springer Berlin Heidelberg.
    - Palmer, R., THE Journal (2013) The Top 10 iPad Apps for Special Education
- Additional Videos
    - Ajit Narayanan: A word game to communicate in any language – https://bit.ly/

3jxQaDL

- Auti-sim https://bit.ly/3tEKJHZ
- XBOX Kinect Classroom Special Education PE-Schools https://www.youtube.com/watch?v=U6WwPBBDGR0+

Week 6: Game and Simulation Design

Class Topics/Activities

- Learn about the difference between playing and making games and simulations.
- Explore tools for game and simulation design.
- Prototype a game or simulation.
- Play and analyze a game or simulation

Class Assignments

- Reading Response
  - Read:
    - Kafai, Y. B. (2006). Playing and making games for learning instructionist and constructionist perspectives for game studies. *Games and culture, 1*(1), 36-40. OR
    - Groff, J., Clarke-Midura, J., Owen, V. E., Rosenheck, L., & Beall, M. (2015). *Better Learning in Games: A Balanced Design Lens for a New Generation of Learning Games*. MIT Education Arcade and Learning Games Network.
  - Review:
    - Simulation Design Guide by McCall – http://bit.ly/2YYj8Dw
    - Principles of game design by Laird – https://bit.ly/37d8opx
    - 48 Differences Between Good and Bad Video Games by Desurvire and Chen – https://bit.ly/2Z0umrg
    - The 13 Basic Principles of Gameplay Design by Allmer – http://bit.ly/3q38KWN
    - 10 Game Design Principles for the Next 10 Years by Fisher – http://bit.ly/3jyqRS0
    - Making Learning Irresistible: 6 Principles of Game-like Learning by Salen – http://bit.ly/2MESBc1
    - Improving Game Accessibility – http://bit.ly/36YrjnQ
    - Includification's "Practical Guide to Game Accessibility" – https://accessible.games/accessible-player-experiences/
    - The 3 Primary Principles of Game Design – https://bit.ly/3jMr5oT
    - Seven Principles of Game Design and Five Innovation Games That Work –

http://bit.ly/3q4GB1F

        - 6 Tips to Design Effective eLearning Simulations – https://bit.ly/3qbUATF
    - Respond (one page minimum) to the reading. This week, no specific questions are given. Rather, consider the ways in which these articles impact your view of game play and game design. Then respond appropriately.
- Go Build (Prototype) a Game or Simulation
    - Please submit a Word document that has two main components:
        - As many screenshots as necessary to show me various aspects of your game (you can also include a link to the game and/or video).
        - An explanation to accompany the game. The explanation should include:
            - What you used to build this game
            - The game's audience and a description of what the game does
            - Why you built this game
            - What impact you think this game could have on learning (albeit a prototype)
        - Novice developers – Here are some options:
            - Use Gamestar Mechanic and build your own game. This is available under "Workshop."
            - Use MIT's *Scratch or Scratch JR*
                - Scratch main page – https://scratch.mit.edu/
                - Scratch Jr main page – https://www.scratchjr.org/
                - Check out the Getting Started Page – https://scratch.mit.edu/help/
                - Check out the SCRATCH Educator Page – https://scratch.mit.edu/educators/
            - Use GameMaker Studio 2 by YoYo Games
                - Download the latest version – https://www.yoyogames.com/gamemaker
                - Check out the tutorials – https://www.yoyogames.com/learn
            - Use Adobe XD
                - This is less useful for Game Design but can be very useful for designing mobile apps/games https://www.adobe.com/products/xd.html
- Advanced developers – Here are some options:
    - Alice – https://www.alice.org/
    - Blender – http://www.blender.org/

- Construct – https://www.construct.net/en
- Game Editor – http://game-editor.com/Main_Page
- OpenSim – http://opensimulator.org/wiki/Main_Page
- RPG Maker – http://www.rpgmakerweb.com/
- The Top 10 Free Game Dev Tools – https://www.gamedesigning.org/gaming/game-development-tools/
- Torque – http://www.torquepowered.com/products/torque-3d
- Unity 3D – http://unity3d.com/
- Unreal Engine – https://www.unrealengine.com/en-US/what-is-unreal-engine-4

- Game or Simulation Play
  - Play 30 minutes with a game or simulation
  - Write a discussion post about your experiences playing the game or simulation; include:
    - When you played (the dates/times)
    - What you liked/disliked
    - What the game/simulation taught you about teaching/learning with games/simulations
    - What the game/simulation taught you about your topic of interest

Week 6 Resources

- Additional Books
  - Brackeen, D., Barker, B., & Vanhelsuwé, L. (2004). *Developing games in Java*. New Riders.
  - Davison, A. (2005). *Killer game programming in Java." O'Reilly Media, Inc.".*
  - Eberly, D. (2006). *3D game engine design: a practical approach to real-time computer graphics*. CRC Press.
  - Harbor, J. (2004). *Beginning Game Programming*. Centage Learning Irish, D. (2005). *The game producer's handbook*. Course Technology Press.
  - Kenneth C. F. (2013). *3D game programming all in one*. Nelson Education.
  - Koster, R. (2013). *Theory of fun for game design." O'Reilly Media, Inc.".*
  - Rabin, S. (Ed.). (2014). *AI Game programming wisdom 4 (Vol. 4)*. Nelson Education.
  - Rhodes, G. (2006). *Macromedia Flash professional 8 game development*. Charles River Media, Inc.
  - Rollings, A., & Adams, E. (2003). *Andrew Rollings and Ernest Adams on game design*. New Riders.
  - Rouse III, R. (2004). *Game design: Theory and practice*. Jones & Bartlett Publishers.

- Salen, K., Tekinbas, K. S., & Zimmerman, E. (Eds.). (2006). T*he game design reader: A rules of play anthology*. MIT press.
- Sylvester, T. (2013). *Designing games: A guide to engineering experiences*. " O'Reilly Media, Inc.".

Week 7: Final Course Project

Class Topics/Activities

- Complete a culminating activity that puts your game and simulation learning into practice.
- Play and analyze a game or simulation

Class Assignments

- Submit your final project.
- Game or Simulation Play
  - Play 30 minutes with a game or simulation
  - Write a discussion post about your experiences playing the game or simulation; include:
    - When you played (the dates/times)
    - What you liked/disliked
    - What the game/simulation taught you about teaching/learning with games/simulations
    - What the game/simulation taught you about your topic of interest

COURSE BEST PRACTICES

Several best practices have been developed and tested during the many iterations of the course. They include the following.

1. Video games are everywhere. It is important to provide students both options and autonomy in exploring video games for education. The medium itself has broad boundaries, and every student has subjective motivations and interests related to video games for learning. Some may be familiar with the latest trends, while others need to be introduced to the basics. This variety strengthens the course but must be properly managed and respected; having personal projects is key for reaching this goal.
2. Video games are complex and should not be taught as either the solution to any educational challenge or something to avoid. As such, students are better served when our instruction presents digital play as a complex topic with both opportunities and risks. Debunking stereotypes and prejudices toward the medium is one of the first and most important processes at the beginning of the course.
3. Video games need to be experienced. It is important to have students playing with the medium for properly understanding its potential and leading factors. This activity may be

related to the course topics but also be associated with the overall class dynamics, allowing students to know each other and collaborate. For instance, esports can be used as a main introductory assignment, with teams of students playing together toward a common goal.

4. Video games keep changing. There is an ongoing turnover of titles, practices, and devices related to gaming and we have tried to mirror this dynamism in our course. Therefore, it is critical to update course materials and reference titles at every iteration of the course, without forgetting gaming communities and related social media.
5. Students particularly appreciate when they are in charge of the inquiry process, trying to shed light on what the medium is, can, and should be. Providing discussion and reflection instances during the course is therefore a meaningful process when students and instructors can learn from each other.
6. Students are different and enter with different levels of expertise. It is critical to provide many different types of opportunities, particularly with game development, to push student thinking. Where possible, providing beginner, intermediate, and expert paths through content can stimulate student thinking as well as motivating them.
7. Video games are multi-faceted. Students should be exposed to different types of gaming, from mainstream titles to independent productions, from educational games to escapist experiences. This richness is important and must be understood for harnessing what video games can offer and support.
8. Student projects are due at the end of the course. However, projects should not be left until the end. Project updates are required throughout the course as a necessary way to keep students on track.
9. Many students have never participated in courses where discussion is valued. As such, they may not have examples of what good responses look like. It is critical for instructors to model such experiences, particularly when they engage in friendly disagreements about content.
10. Not all gaming experiences are safe. Some students, particularly those who explore games that are collaborative and online, experience negative behaviors. Faculty need to prepare students for such experiences; they must also be prepared to support and scaffold students in engaging with others outside the university. Having conversations before it happens has been integral to student success.

FUTURE COURSE PLANS

Technology changes every day. The same could be said for gaming. As such, even the process of preparing this chapter has shown us areas of needed growth based on what is happening in the gaming community. We can envision five main additions that we plan to implement in future.

First, we are going to focus more on the online outlets surrounding videogames (e.g., *Twitch.tv, Reddit*, and *Discord*). These platforms are indeed meaningful spaces where users perform, debate, discuss, and learn from each other. The connotation of games *as services* is increasingly important; the boundaries of this medium go beyond the mere act of playing. We intend to cover both learning opportunities and disruptive/toxic behaviors related to these settings. Our objective is to present this topic in its whole complexity.

Second, we plan to include immersive technologies in our activities and materials. Immersive virtual reality is becoming accessible for the majority of players with devices like *Oculus Quest* and *PlayStation VR* hosting novel gaming and instructional experiences. The role of embodiment and multisensorial involvement is well-suited for modifying how digital gaming is designed and experienced and, as such, must be addressed.

Third, we will give more attention to augmented reality and gaming, exploring how geolocation and situational interest may interact with game mechanisms and motivations. Titles like *Ingress* (https://www.ingress.com/) and *Pokémon Go* (https://pokemongolive.com/en/) have drastically changed our playing habits, pointing at innovative ways to engage users and informing new possibilities in terms of game-based learning.

Fourth, eSports are going to be part of our coursework as a topic and as an activity (e.g., an ice-breaker session for students). Online competitions are a core part of digital entertainment and, as such, they need to be properly studied. They also need to be embraced for understanding how video games are evolving toward new scenarios. They support social interactions and cooperation, allowing students to work with each other and become familiar with gaming audiences.

Our final goal is less about the course and more about the program. This course is a stand-alone course. We would eventually like this course to be offered as a series of gaming courses. We are hoping to partner with gaming companies to develop a collaborative model. Students would get live experiences and content useful for the real world; companies would get access to future employees who had valuable skillsets. This may best be achieved by collaborating with many of the other disciplines (in and outside of education) mentioned in this book.

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PART V.

GAME DESIGN AND DEVELOPMENT

CHAPTER 17.

INTRODUCTION TO GAME DESIGN, DEVELOPMENT, AND CRITICISM (GAME 201T)

KEVIN MOBERLY [1]
OLD DOMINION UNIVERSITY

Course Title: GAME 201T: Introduction to Game Design, Development, and Criticism.
Course University: Old Dominion University
Course College/School: College of Arts and Letters
Course Department/Program: Interdisciplinary Studies Game Design and Development Major
Course Level: Undergraduate
Course Credits: 3
Course Length: 15 Weeks
Course Medium: Face-to-face, Online Synchronous.
Course Keywords: Introduction to Game Design and Development, Iterative Design, Rapid Prototyping, Entrepreneurship, Critical Analysis, General Education, Face-to-Face and Online, Synchronous Delivery.

CATALOG DESCRIPTION

An introduction to the core concepts and methodologies that inform game design, development, and criticism. This course will provide students with a critical overview of each of these content areas and will demonstrate how their specific concerns intersect in the design, production, and reception of contemporary games. It will also teach students hands-on methodologies through which to translate these concepts into creative and critical praxis.

COURSE PURPOSE AND OBJECTIVES

Introduction

We are living in what is arguably the golden age of gaming and game design. After decades of being dismissed as frivolous, games have emerged as one of leading cultural and economic forces of

1. Kevin Moberly is an Associate Professor of Rhetoric, Digital Media, and Game Studies in the English department at Old Dominion University in Norfolk, Virginia. He is also the program director of the Interdisciplinary Studies Game Design, Development and Criticism major. His research focuses on understanding how digital manifestations of popular culture reflect, contribute to, and transform contemporary cultural, political, and historical discourses. In particular, he is interested in the ways that contemporary computer games encode labor, often blurring already uneasy distinctions between work and play.

our times (Ebert 2010).[2] As such, games and game-like experiences have become a ubiquitous part of many areas of contemporary life above and beyond entertainment. **Not only are more people playing games and engaging in game-like activities, but a greater diversity of people actively seek out these experiences.**

What is more, low-cost, professional design and development solutions such as the Unity (2021) **and Unreal Engines** (2021) **have made game design and development more accessible than ever.** Taken in conjunction with the user communities that have emerged around these solutions and with digital distribution platforms such as Steam and Itch.IO, the cost and the technological barriers to designing, developing, and publishing games has dropped dramatically in recent years.

The gaming industry, as a result, is undergoing a rapid expansion and diversification. Spurred on by a passion for games and by the declining costs of entry into the industry, an increasingly diverse number of people have turned to game design and development as both a career path and as an artistic endeavor. This, in turn, has not only led to an exponential growth in game studios and communities dedicated to producing games, but to a corresponding increase in both the volume and the types of games being produced, especially as independent studios, independent designers, and hobbyists experiment with existing genres or attempt to develop new genres in order to reach more diverse audiences (Takahashi 2017).

Taken in conjunction with the degree to which gamers and the gaming industry value innovation, **the result is not only that new opportunities and applications for games are constantly being developed, but that new ways of understanding games, gaming, and the potentials of game design and development are also constantly emerging.**

Challenges

The radical expansion and diversification of games, gaming, and the gaming industry, however, poses a number of significant challenges for both established studios and for aspiring game designers and developers:

1. **The market for games has become increasingly competitive** as a direct consequence of the degree to which, as explained above, the barriers to designing, developing, and publishing games have diminished. More studios are not only publishing more games, but a greater diversity of games, making it increasingly difficult for both established companies and emerging designers and developers to establish a foothold, much less stand out (Wright 2018).
2. **The audiences for games have become much more discerning.** While good gameplay and compelling aesthetics will always be important, the culture of experimentation and innovation that has come to characterize the gaming industry in recent years has led audiences to variously demand "more" than just better graphics and improved mechanics from their games. At the same time, however, this culture of experimentation and innovation has also made it increasingly difficult for designers and developers to figure out what exactly constitutes this "more" (Tailford 201).

2. Note on URLs: I distribute my syllabi electronically to students through my university's course management system. This method of delivery allows me to directly link to sources or other resources. I have included the full URLs of these links in the reference section at the end of the chapter.

3. **Game designers and developers can no longer ignore the diversity of their audiences.** For decades, the mainstream gaming industry labored under the illusion that gamers constituted a limited, homogenous, and relatively stable population. Many mainstream studios used this misconception to justify limiting the scope of the games they produced and the type of experiences that these games recognized as legitimate (Moosa 2017). Given the radical expansion of games and gaming in recent years, as well as the attendant changes that this expansion has brought to the industry, **it has become increasingly difficult, if not dangerous for game designers and developers to willfully ignore the diversity of their potential audiences and experiences.** Doing so risks alienating players and critics who, as discussed above, have variously come to expect "more" from the games they play (Webb 2020).

The Course

This course is designed to help you take advantage of the opportunities afforded by the radical expansion and diversification of games, gaming, and the gaming industry while simultaneously recognizing and negotiating the attendant challenges.

Accordingly, this course does not seek to teach you a single, unified answer to the challenges inherent in designing and developing successful games. Given the degree to which the gaming industry privileges innovation and experimentation, such an answer would be outdated by the time you could implement it. This course instead seeks to introduce you to the core concepts and methodologies that inform game design and development as a creative, critical, interdisciplinary, and entrepreneurial undertaking.

Specifically, this course will employ a variety of hands-on exercises, including three formal challenges, to model the game design and development process from ideation to working prototype. In doing so, it will show you how to use the core principles that inform agile development, iterative design, rapid prototyping, and a number of other key design and development strategies to produce unique solutions to the complex problems that are inherent in game design and development (Infallible Code 2019, GDC 2016, Unity 2018).

Finally, this course will teach you how to employ a variety of critical and analytical approaches that will not only help you better understand the social, economic, and political impact of games and gaming in contemporary society, but will also help you locate and thereby make sense of your own work and your own identity as both a gamer and a game designer or developer within these larger conversations.

COURSE OBJECTIVES

Through a mixture of theoretical readings, class discussion, and applied exercises, this course will:

- **Survey** the key concepts, debates, and methodologies that inform game design, development, and criticism.
- **Explore** how these concepts intersect in the design, production, and reception of contemporary games.

- **Study** the social, economic, cultural, and political impacts of games, gaming culture and the gaming industries on society.
- **Provide** you with hands-on experience using these concepts to create a variety of games and game-related materials.

Assessment Objectives

Upon completing this course, students should be able to:

- **demonstrate** familiarity with the core concepts and methodologies that inform in game design, development, and criticism as a creative, professional, and entrepreneurial undertaking.
- **articulate** the impacts of games, gaming culture, and the gaming industry on society.
- **apply** these concepts to achieve meaningful solutions to a variety of creative and critical problems in game design, development, and criticism.

COURSE CONTEXT

GAME 201T is the first course in Old Dominion University's Game Design, Development, and Criticism major. Designed to introduce students to game design and development as a creative, critical, and professional undertaking, it is required of all majors in the program. Interested non-majors can also take the course for ODU's Impact of Technology (T) general education credit. Although almost all of the students who enroll in the course are very invested in and passionate about gaming, only about a quarter have any previous experience designing and developing games. Of these, only a handful have attempted to translate their interest in game design and development into anything beyond the invention stage. They have often generated ideas for games and sometimes produced preliminary sketches of characters, assets, and scenes; however, only a small minority of the students who take the class have produced a paper or a digital prototype of a game. Likewise, many have never used a game engine or specialized software to produce games or assets for a game.

Complicating matters is the fact that the majority of the students who enroll in GAME 201T are also relatively new to the rigors of university-level coursework. Although they tend to be very familiar and comfortable with the test-based, skill-and-drill methodologies that characterize secondary education in the United States, they are less familiar with the more open-ended structure of university courses with their emphasis on self-discipline and personal responsibility. Likewise, they often have very little experience with the highly subjective nature of the assignments that are part and parcel of a course dedicated to game design and development. Which is to say, students tend to approach the major and minor assignments of the course as exercises in determining the single correct answer and likewise avoiding wrong answers rather than as a matter of perhaps contradictory rhetorical choices, some of which might be more effective than others, but only in certain circumstances and for certain audiences.

The onset of the COVID-19 pandemic brought an additional set of challenges to the course. In the Fall 2020 semester, approximately three-fourths of Old Dominion University's classes were moved online as a precautionary measure to limit the spread of the virus, including the two sections of GAME 201T I was teaching. Old Dominion University possesses a robust and well-supported infrastructure

to support online learning, so moving my sections of GAME 201T online was not a technological challenge. However, as is well documented in the research, online education poses a particular set of challenges for the first- and second-year university students who constitute the primary audience of the course (Beaudoin 2009, Gillett-Swan 2017). These challenges include a sense of alienation and disconnection from the instructor and their peers, a reluctance to participate due to the limitations of the distance technology, and the difficulties inherent in maintaining schedules or meeting due dates without the structure that the traditional, face-to-face university structure provides (Mann 2005, Rovai 2005, Li 2017). The result is that students who enrolled in my two Fall 2020 sections of GAME 201T faced the additional challenge of negotiating the difficulties inherent in online education, as well as the stress of the uncertainty of the pandemic.

The difficulties inherent in teaching the course during the COVID-19 pandemic thus exacerbated what I believe is the central challenge of GAME 201T—the fact that while many of the students who enroll in the course are excited about the subject and its possibilities, they are often intimidated by many aspects of it, including the open-ended nature of its major assignments and the technologies these assignments require them to use. In particular, many students express concerns about whether or not they will be asked to code or script as part of the course. The answer I give is always the same. I tell them that they will probably be required to code or scripting at one point or another and perhaps throughout the whole course. I am careful to add, however, that when the time comes, coding or scripting will feel like an opportunity rather than an imposition; it will be a means to an end of achieving the larger vision they are working towards. Although I do not know how many of my students believe me when I tell them this on the first day of the class, this is the primary goal and challenge of GAME 201T—to help students translate their enthusiasm and passion for playing games into the type of creative and critical performances that are required to build games. As I discuss at length in the next session, I accomplish this goal by leveraging the possibilities of critical play to create a low-stakes, open learning environment that is consciously designed to encourage students to explore and experiment with core the concepts and methodologies that inform game design, development, and criticism.

COURSE PEDAGOGY

The central challenge of GAME 201T is not simply to introduce students to the types of creative and critical performances that comprise game design, development, and criticism as professional and entrepreneurial endeavors, but to do so in a manner that helps them make the transition to the sort of more open-ended, subjective discourses that many university courses privilege and which are also crucial to success in creative industries that privilege innovation such as the gaming industry. It is important to recognize that this is very much the same challenge that Patricia Bizzell (1982), Kenneth Bruffee (1984), David Bartholomae (1986), and many other advocates of social constructivist pedagogy identify in writing studies—the challenge of helping students make a transition between the discourses with which they are familiar and those that are unfamiliar. Understood in this sense, the central challenge of GAME 201T is helping students make a transition from the sort of performances that are inherent in playing games to those that comprise game design and development as a creative, critical, and entrepreneurial undertaking. As Bizzell, Bruffee, and Bartholomae recognize, making this sort of transition can be difficult for students, as it requires them to relinquish positions of privilege

and expertise in communities in which they have established themselves and start anew in unfamiliar communities where they have very little experience and therefore standing.

As discussed above, this is doubly the case with GAME 201T. Students generally take the course in their first or second semester at Old Dominion University and as a result, are very new to the discourses and performances that the university classroom privileges. Likewise, they often do not have a substantial amount of experience with game design or development. Much of the same can be said about the core technologies around which the course is constructed. It is not simply that many have never tried working with a game engine or sophisticated 3D modeling software. Many of the students who enroll in the course also do not have experience with courseware such as Blackboard, which ODU uses, and in some instances, with technologies such as email.

Accordingly, I consciously integrate critical play and exploration into GAME 201T in an attempt to lessen the sense of apprehension and disorientation that students experience in the course. GAME 201T is, after all, not the capstone course in the major but the first. Moreover, many non-majors take the course for general education credit out of curiosity or because they want to learn more about games. Recognizing this, I try my best to replicate the atmosphere of low stakes, open-ended experimentation that I remember from the introductory art and technical theater courses I took as an undergraduate. Which is to say, I scaffold all of the major assignments of the course—the invention, development, and design challenges—as a series of low stakes exercises for which students receive the full amount of points just for attempting. These exercises, however, are not just busy-work. Taken in combination, they represent discreet parts of each of the larger challenge assignments so that students find that by completing the smaller assignments, they have completed the majority of the work required for each of the larger challenges. Likewise, I do not grade the challenges on whether or not students succeed at the goals they establish for themselves. Dealing with setbacks, unexpected difficulties, and outright failure is one of the most important performances that students who are interested in working in game design or development must master. As a result, I grade these major challenge assignments entirely on the basis of informal postmortems that, structured as a series of questions, require students to reflect on their goals, their successes, failures, and future plans. In doing so, I attempt to encourage students to explore and experiment with the possibilities inherent in game design and development in a way that simultaneously requires them to reflect on their own progress and development.

I specifically construct GAME 201T to help students make the transition to two primary modes of performance that I believe are crucial to aspiring game designers and developers. The first is a critical mode of gameplay that, grounded in analysis and close-reading techniques, helps students approach games as a collection of choices, good or bad, that can be systematically analyzed, quantified, and reverse-engineered. As discussed above, the vast majority of the students who enroll in GAME 201T not only possess a considerable amount of expertise playing games but are also very invested in specific franchises, titles, and designers. At the same time, these students tend to play games to win rather than to understand how they create meaning and value from their discrete mechanics and aesthetic elements. Likewise, students tend to approach the titles, franchises, and designers they are passionate about through a kind of ludic auteur-theory, one that is often grounded in a kind of close-reading methodology, but which often leaves unexamined larger questions about the genre, culture,

economics, distribution, industry practices, and any number of other external factors that impact the design and development of games and franchises.

One of the objectives of GAME 201T is, in this sense, to help students translate their passion for games and gaming culture into a kind of interpretive and analytical praxis that will help them identify, assess, and ultimately understand the underlying rhetorical strategies through which games create experiences through the complex interplay of mechanics and aesthetic elements. Accordingly, the course not only introduces students to a number of representative theoretical concepts via its assigned readings and videos. It challenges students to apply these concepts through discussions, activities, and homework to a number of small-scale, browser-based games. In doing so, GAME 201T attempts to teach students a heuristic, critical approach to gameplay, one that in keeping with McKenzie Wark's (2007) notion of "trifling," empowers them to actively interrogate and experiment with the games they play in order to better understand the affordances and the limitations of their underlying rhetorical strategies.

The second major objective of GAME 201T is to teach students how to translate the insights they gain through this analytical praxis into concrete design and development outcomes through application. As with the critical methodologies discussed above, the key to achieving this goal lies in helping students make the transition from the familiar to the unfamiliar—from what is often their default approach to design and development as a waterfall process to the iterative design, rapid prototyping, and agile development methodologies privileged by the gaming industry. I accomplish this objective primarily through the three challenges that comprise the course's major assignments. As described above, these challenges are composed of a number of small-scale, scaffolded assignments designed to provide students with hands-on experience with the specific performances that intersect in ideation, game design, and development. These challenges, however, are also scaffolded in the sense that they not only build on each other, but overlap. The development challenge, for example, explicitly requires students to use many of the same brainstorming, research, and evaluation methodologies introduced by the ideation challenge. Likewise, the design challenge is also predicated on the iterative design and rapid prototyping methodologies introduced during the development challenge. Taken together, these challenges are designed to simultaneously provide students with hands-on experience with many of the core performances that comprise ideation, game design, and development, as well as to help them understand how these performances intersect with each other and depending on the task.

The course's three major challenge assignment culminate in the game project and the design expo that is held in lieu of a final exam. This project asks students to produce either a paper or digital prototype of the game that they have been developed through the successive challenge assignments. Alternatively, students have the option to substantially revise their final submissions for one of the challenge assignments. For example, students can turn the mini proposal that they produced as part of the ideation challenge into a formal design document. Likewise, they can add additional features to the digital prototype that they produced as part of the development challenge or further develop the game assets they produced as part of the design challenge. Whatever option they chose, students must construct a physical display for the game expo held during the final exam period of the class. Advertised and open to visitors from outside of the class, this expo explicitly requires students to present and explain the work they have accomplished during the course of the semester to unfamiliar

audiences. In its final moments, then, GAME 201T requires players to construct themselves and perform as experts—to justify and explain their work to non-specialist audiences.

Implementing this experiential pedagogy proved much more complicated during the Fall 2020 semester, when the threat of the pandemic mandated moving both of my sections of GAME 201T online. In order to preserve the sense of structure and real-time interaction that characterizes face-to-face university classrooms, I scheduled both sections synchronously rather than asynchronously. I also made a point of maintaining as much of the structure of the traditional classroom as well. For instance, I took attendance before each class and used that time to ask students questions about where they were connecting from and how they were doing in order to minimize their sense of alienation and disconnection. I also made a point of connecting to each classes' Zoom session early and staying after to talk with students if they wanted. I held office hours in Discord and in Minecraft and logged into the Minecraft server regularly to engage students. I distribute almost all of my course materials digitally, though Blackboard, so that did not require much if any adjustments.

Replicating many of the hands-on activities I developed for the class was a bit more difficult. Cognizant of the research on the relative ineffectiveness of lecture-based pedagogies, I typically organize each class meeting around a collaborative activity that requires students to apply concepts from the assigned readings (Carrió 2011, Lisette 2011). I then reconvene the class and to share what each group has produced and to reflect on what that work reveals about the key concepts from the reading. While Zoom does allow for group work via its breakout room function, it proved difficult if not impossible to replicate many of the more tactile of these activities, especially those involving crafting, Legos, and the like. I addressed this difficulty through two strategies. First, I assigned much of the crafting exercises as homework rather than as an in-class activity. For instance, instead of having students make paper bag puppets in class and use these puppets to present main points about a reading, I provided them with links to tutorials on making puppets from common everyday objects and had them puppets before the class. Second, I tried as much as possible to find digital alternatives to as many of the exercises as possible. As I discuss in the course outline below, I used the collaborative features of Miro's (2021) online collaborative whiteboard app to implement Brenda Romero's (2008) "The Easiest Game Design Exercise Ever (Really)." I also had the class meet regularly in Minecraft and Discord, which worked well for activities such as the environmental storytelling exercise. I had students construct exhibits for their final Game Expo as Google Slide presentations, which I then compiled into a virtual gallery. I distributed the link to the gallery to the college and invited visitors to meet with students about their work during a Zoom session for the final exam.

Ultimately, though, my most successful strategy for dealing with the stresses of the pandemic and the subsequent transition online was to present these challenges as symptomatic of the larger challenges of working and succeeding in a creative industry, especially one such as the gaming industry in which volatility, uncertainty, and change is very much the state of the art. In short, I presented the difficulties of meeting through Zoom and completing assignments and exercises despite the limitations of the technology as a design and development challenge in and of itself. I not only asked students to actively help me recreate the experience of the class and its exercises in the face of the limitations imposed by distance delivery, but prompted them to reflect on our shared successes and failures in doing so. I thus incorporated the challenges of teaching and being a student during the pandemic as an object lesson in cultivating the spirit of resilience and innovation that is a perquisite for succeeding not only in the

mainstream gaming industry but in arguably many other aspects of the larger employment landscape that students will confront upon graduating.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Textbooks and Texts

- **Fullerton, Tracy.** *Game Design Workshop: A Playcentric Approach to Creating Innovative Games, Second Edition.*
- **Schell, Jesse.** *The Art of Game Design: A Book of Lenses, Second Edition.*
- **Linkedin Learning:** Linkedin Learning (formally Lynda.com) is a repository of tutorials on a broad range of subjects, including many aspects of game design and development. As an ODU student, you have unlimited access to Linkedin Learning. We'll be using some of these tutorials in class.
- **Other readings as assigned** (available through Blackboard).

Software

- **Minecraft: Java Edition:** GAME 201T will experiment with using Minecraft as an alternative classroom. You will work and play together with students in two other courses to transform the MonarchCraft server into a virtual learning environment. **Note:** it is very important that you purchase the Java version. The Windows 10 version will not work with our server.
- **Discord:** GAME 201T will use Discord to facilitate class meetings in Minecraft and content streaming.
- **Free Website Hosting:** You'll need this to build and host your design portfolio (details below).
- **Blackboard:** GAME 201T course uses Blackboard to facilitate communication between the instructor and students. Specifically, I use Blackboard to post announcements, course readings and assignment sheets. I also use it to manage assignment submissions and post grades.
- **A Tube Sock**: of any color and style, but preferably clean.

COURSE ASSIGNMENTS

The major writing assignments required for completion of this class are listed as follows:

- **Invention Challenge**
- **Design Challenge**
- **Development Challenge**
- **Design Portfolio**
- **Final Project / Design Expo.**

Assignment sheets will be distributed detailing the specific requirements of each major assignment. All major assignments are due by midnight on the day assigned and must be formatted as

detailed on the assignment sheet. Assignments must be submitted electronically through Blackboard's Assignment Manager.

I will not deduct points for late assignments; however, you can earn achievement points by turning in turning in assignments on time**. Also, recognize that I might not be able to provide feedback on assignments that are submitted substantially past their deadlines.**

Design Portfolio

As a game designer or developer, you will need an effective portfolio to showcase your work to prospective employers. Accordingly, this assignment is designed to help you get started building your portfolio. It will teach you template-based web design strategies that you can use to showcase and document your work. In order to complete this assignment, you will need to sign up for an account with Wix, Weebly, Google Sites, or another free website building and hosting service (Brandl 2021).

Invention, Design, and Development Challenges

This sequence of assignments is designed to model the game design and development process from inspiration to implementation. Through experiments in ideation, you will learn how to generate and evaluate the feasibility of a game concept. You will then learn how to transform this concept into a series of objectives and how to use these objectives to guide the design and development of specific game mechanics and assets.

This sequence of assignments is also designed to introduce you to many of the underlying, entrepreneurial concerns that inform the game design process, including how to pitch a game idea, how to locate and evaluate resources, and resiliency in the face of setbacks or failure.

You are required to post a brief postmortem to your portfolio for each of these challenges that discusses the choices you made, as well as the successes and setbacks you encountered while completing the challenge. These postmortems should also discuss how the content of the course (readings, homework, in-class exercises, etc.…) contributed to the completion of the challenge.

Assignment sheets detailing the specific requirements of each challenge will be distributed in class.

Final Project / Design Expo

In lieu of a final exam, you will create and demonstrate a working game during a public design expo, which will be held on the date of the final exam. You will be required to submit a reflection essay that discusses their choices, successes, and setbacks in completing their proposed final projects. An assignment sheet detailing the specific requirements of this assignment will be distributed in class.

COURSE ASSESSMENT

Grading:

Assignments and Course Requirements

- **Major Assignments:**
    - Invention Challenge: 150 points
    - Design Challenge: 150 points
    - Development Challenge: 150 Points
    - Design Portfolio: 150 Points
    - Final Game Design Project: 150 Points
    - Game Design Expo: 100 Points
- **Minor Assignments:**
    - Homework 150 Points

EXPANDED COURSE OUTLINE

*The following course outline is taken from a face-to-face section of GAME 201T that meets twice a week. Where appropriate I have added footnotes that describe how I adapted key exercises for online, synchronous delivery of the course.

Week One: Playing with Stuff

First Class Meeting

Assignments

- **Read:** Course Syllabus

Class Topics / Activities

- **Discuss:** Introduce the course and course policies and provide an overview of course technologies.
  Discuss: the challenges inherent in game design and development and explain how GAME 201T attempts to answer these challenges.

Second Class Meeting

Assignments

- **Read:** Schell, Jesse. "Chapter 1: In the Beginning, There Is the Designer" and "Chapter 2: The Designer Creates an Experience" from *The Art of Game Design.*
- **Homework (20 points):** Assign students to use the mypokecard.com Pokémon card generator (MyPokéCard.com 2021) to create Pokémon cards representing themselves. These cards should explicitly reference one of more of the roles that Fullerton and Romero identify in next week's readings. Require students to post these cards to a premade, public discord channel entitled Pokéclass.

Class Topics / Activities

- **Exercise:** dump a large quantity of Legos onto a central table or desks in the classroom.

Divide students into teams of 2-3 and challenge them to use exactly 12 Lego pieces and 15 minutes to build something that represents the students they are grouped with.[3]

    - After the 15 minute-building session has elapsed, have each group show-off their creations and explain how these represent their respective group members.

- **Discuss:** use the Lego exercise as the impetus for a discussion / reflection about how games create experience through rules, aesthetics, mechanics, etc.,

Week Two: Role Play

First Class Meeting

- Class canceled for Labor Day Holiday.

Second Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter One: The Role of the Game Designer." *Game Design Workshop.*
- **Watch:** Romero, Brenda (2017). "The Role of a Game Designer" and "Types of Game Designers."
- **Play:** HexGL (Despoulain 2021)**.**
- **Homework (10 points): S**tudents chose one of the classic Atari games assigned for the next class and write a brief paragraph explaining how the game employs any four of the formal structures that Fullerton identifies in Chapter Two.

Class Topics / Activities

- **Discuss:** the Pokémon cards students created as a means of further introducing the students to one another and also introducing them to the possibilities of game design and development per the roles and categories Fullerton and Romero discuss in the readings.
- **Exercise:** Have students play *HexGL* for five minutes write job ads for a team of designers and developers to produce a similar game.
- **Housekeeping:** distribute the Invention Challenge assignment sheet and discuss the sub-assignments that comprise it.

3. The Lego exercise does not translate well to online classes. However, the avatar creator included with Nickelodeon's (2021) "Loud House Cartoon Creator" can be adapted to achieve much of the same purpose. Divide students in groups of 2-3 and ask them to use the avatar creator to produce avatars that represent each other. Have students share their screens and present the avatars they created. Then engage students in an open-ended discussion about the rules, mechanics, affordances, and limitations of the types of play in which students engaged in the process of completing the exercise.

Week Three: Formal Structures

First Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter Two: The Structure of Games." *Game Design Workshop*
- **Read:** Koster, Raph (2013). "Chapter Three: What Games Are." *A Theory of Fun for Game Design.*
- **Watch:** Romero, Brenda (2017). "What is a Core for a Game?"
- **Play:** Classic Atari Games (Davis 2021).
- **Homework (20 points):** Students complete the initial quest in Minecraft to affiliate themselves with the course's town on the MonarchCraft server. They claim a plot of land using the Grief Prevention plugin and build a house for themselves in creative mode either freeform or by following a tutorial. Students document this assignment by submitting screenshots and coordinates to a preestablished directory channel in Discord.

Class Topics / Activities

- **Discuss:** the insights students discovered in the process of completing the Atari Games homework assignment.
- **Exercise:** divide students in groups of 4-5 and assign each group one of the specific structures that Fullerton discusses (players, rules, procedures, etc.). Give them 15 minutes to imagine what centipede would look like if they drastically altered that structure.
- **Discuss:** how approaching games as structures and patterns helps students better understand how games create experience for players.

Second Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter Three: Working with Formal Elements." *Game Design Workshop.*
- **Watch:** Extra Credits (2014). "The Magic Circle – How Games Transport Us to New Worlds."
- **Play:** The Impossible Quiz (Slapp-Me-Do 2021).

Class Topics / Activities

- **Exercise (step 1):** Divide students into groups of 4-5 and ask them to pretend that they have been hired as game librarians and tasked with creating a categorization schema to organize games based on what they think are the six most relevant formal elements Fullerton discusses in chapter three. Allow them 15 minutes to generate this schema.
- **Discuss:** Have each group present and justify their schemas to the rest of the class. Of all the elements Fullerton lists, why did they choose those six?
- **Exercise (step 2):** allow each group 10 minutes to use the schemas they generated to first

attempt to categorize *Halo* and then *The Impossible Quiz.*

- **Discuss:** how *The Impossible Quiz* challenges / complicates the traditional categories / elements that comprise games. Present Huizinga's Magic Circle as a partial answer to these complications—as a way of understanding the relationship between the formal elements that comprise games.
- **Housekeeping**: take questions about the upcoming Brainstorming Exercise and the Goals / Obstacles / Mechanics Exercise for the Invention Challenge.

Week Four: What's the Big Idea

First Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter 6: Conceptualization." *Game Design Workshop.*
- **Watch:** Romero, Brenda (2017). "Generating Ideas for a Game."
- **Play:**Gods Will be Watching (Deconstructteam 2021).
- **Invention Challenge:** Brainstorming Exercise Due.

Class Topics / Activities

- **Exercise:** divide students into groups of 4-5 and assign them two of the "Brainstorming Best Practices" Fullerton describes in chapter 6. Ask them to take 15 minutes to use those techniques to imagine how to transform *Gods Will be Watching* into an *X-Com* clone.
- **Discuss:** students share the results of this exercise. Specifically ask them to reflect on the benefits / downsides of the techniques.

  Discuss: The Invention Challenge's brainstorming exercise in light of Fullerton's chapter and Romero's video. Make the point that creativity is often a function of / response to crisis, and that each of the brainstorming options students can select are games in themselves designed to put their minds in a state of crisis.
- **Housekeeping:** discuss the upcoming Obstacles / Mechanics Exercise for the Invention Challenge.

Second Class Meeting

Assignments

- **Read:** Schell, Jesse (2014). "Chapter 6: The Game Begins with an Idea" *The Art of Game Design.*
- **Watch:** Freeman, Jessie (2106). "Game Design 101."
- **Play:** Swooop (2021).
- **Invention Challenge:** Goals / Obstacles / Mechanics Exercise Due.

Class Topics / Activities

- **Discuss:** have students compare and contrast the brainstorming techniques Schell discusses with those that Fullerton and Romero mention.
- **Exercise:** divide students into groups of 4-5 and, building on the notetaking methodology Freeman discusses in his video, ask them to use the Minecraft Book Editor (Minecraft Tools 2021) to record 15 observations about effective and ineffective aspects of *Swooop's* gameplay.
- **Housekeeping:** Discuss the upcoming Trading Cards Exercise for the Invention Challenge.

Week Five: Dramatic Systems

First Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter Four: Working with Dramatic Elements." *Game Design Workshop.*
- **Watch:** Romero, Brenda (2018). "Game Systems."
- **Play:** A Dark Room (Doublespeak Games 2013).
- **Invention Challenge:** Character Trading Cards Due.

Class Topics / Activities

- **Exercise:** Students meet in Minecraft and Discord. Briefly introduce the concept of affect and then assign them to work in creative mode in groups of 4-5 for 40 minutes to build a structure that recreates the affect of *A Dark Room* as closely as possible.
- **Discuss:** how game designers achieve affect through the combination of the dramatic elements Fullerton enumerates. Specifically discuss how *A Dark Room* creates affect through its interface / systems and the difficulty of recreating that via the relatively static elements available in *Minecraft*.
- **Housekeeping:** Discuss the upcoming Environment / Backstory Treatment Exercise for the Invention Challenge.

Second Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter Five: Working with System Dynamics." *Game Design Workshop.*
- **Watch:** Romero, Brenda (2018). "Chance in Games" and "Strategy in Games."
- **Play:** Cookie Clicker (Orteil 2020).
- **Invention Challenge: Environment / Backstory Treatment Due.**

Class Topics / Activities

- **Exercise:** divide students in groups of 4-5 and allow each group 30 minutes to complete and

play Brenda Romero's (2008) "The Easiest Game Design Exercise Ever (Really)."[4]

- **Discuss**: have students present their games to the class. Use the games to facilitate a discussion of games as systems by asking students to identify specific elements Fullerton mentions in chapter five of her textbook.
- **Housekeeping:** discuss the final stage of the Invention Challenge, the mini proposal, due at the end of next week.

Week Six: Pete and Repeat Sat on a Prototypical Horse

First Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter 7: Prototyping." *Game Design Workshop.*
- **Watch:** Romero, Brenda (2017). "Defining the Core Loop of a Game."
- **Play:** Pixel Race (Arabaci 2021).

Class Topics / Activities

- **Exercise:** divide students into groups of 4-5 and allow each group 45 minutes to paper-prototype and play the "Up the River" game from chapter 7 of Fullerton's textbook.[5]
- **Discuss:** what building the "Up the River" game reveals about paper prototyping as a methodology, as well as what it reveals about designing the game loop, per Romero's video. Ask students to brainstorm how they can paper prototype *Pixel Race*.
- **Housekeeping:** discuss the final stage of the Invention Challenge, the mini proposal, due next class meeting.

Second Class Meeting

Assignments

- **Read:** Schell, Jesse (2014). "Chapter 7: "The Game Improves Through Iteration." *The Art of Game Design.*
- **Read:** Luton, Will (2009). "Making Better Games Through Iteration."
- **Read:** Zimmerman, Eric (2003). "Play as Research: The Iterative Design Process."
- **Watch:** Dewett, Todd (2019). "Learning from Failure."
- **Play:** Kingdom Rush (Ironhide Game Studio 2013).

4. Miro's (2021) online collaborative whiteboard application offers a good online alternative to the pen and paper mechanics of Romero's exercise. Create a Miro whiteboard and divide it into several large squares. Assign each group one of the squares and ask students to build their games in the square using Miro's post-it-notes and other affordances. Students can then playtest their games with the aid of an online dice program and by using post-it-notes as player-pieces.
5. When teaching GAME 201T online, I assign this exercise as homework a week before this class meeting and have students make brief google slide presentations that showcase the games they built. I compile these presentations into a gallery of links which I published through Blackboard. On the day of the class meeting, I have each student briefly discuss and justify the alterations they made to the game as part of the exercise.

- **Invention Challenge Due.**

Class Topics / Activities

- **Exercise:** divide students in groups of 4-5 and have each group complete the "Spaghetti Tower Marshmallow Challenge"(Doorley 2021).[6]
- **Discuss:** have students watch Tom Wujec's (2010) Ted Talk, "Build a Tower, Build a Team." Use this video to prompt discussion about what strategies worked and did not work during the spaghetti tower exercise. Use the combination of the exercise and the video to discuss how iterative design incorporates testing and setbacks into its methodology.
- **Housekeeping:** distribute the Development Challenge assignment sheet and discuss the sub-assignments that comprise it.

Week Seven: Digital Prototyping

First Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter 8: Digital Prototyping." *Game Design Workshop.*
- **Watch:** Extra Credits (2015). "Making your First Game—How to Start your Game Development."
- **Play:** Line Rider (Emergent Studios 2020).
- **Homework (20 points):** have students research three game engines they can use to complete the development challenge and rank these engines using Abhinav Narain's (2016) six questions from next class's reading.

Class Topics / Activities

- **Exercise:** divide students into groups of 4-5 and have each group work for 10 minutes using Line Rider to prototype a track. Have the groups then spend 20 minutes attempting to recreate classic Atari arcade games with Gamefroot (2021).
- **Discuss:** *Line Rider* and Gamefroot as digital prototyping tools. Referencing last week's paper prototyping exercise, compare and contrast the advantages and disadvantages of paper versus digital prototyping. Ask students to identify best use cases for each.
- **Housekeeping**: discuss the Development Challenge's Technology-self Assessment exercise due in a week.

Second Class Meeting

Assignments

- **Read:** Schell, Jesse (2014). "Chapter 26: The Team Builds a Game with Technology." *The Art of*

6. The spaghetti tower marshmallow challenge is one of the key exercises in the class, but is also difficult to reproduce online. An alternative is to have students watch an episode of Junkyard Wars in class and take bets throughout the episode on which team they predict will win. Then have students watch Tom Wujec's (2010) Ted Talk and use his discussion of the spaghetti tower marshmallow challenge as a starting point to analyze the success and failure of each team in the Junkyard Wars' episode.

Game Design.

- **Read:** Narain, Abhinav (2016). 6 Crucial Questions to Ask Before Choosing Your Game Engine.
- **Watch:** Bradley, Christian (2016). "Choose a Game Engine."
- **Play:** Missile Game (Mather 2020).

Class Topics / Activities

- **Exercise:** students meet in Minecraft and Discord. They work in groups of 4-5 in creative mode to prototype randomly assigned machines that employ Redstone components to complete simple tasks.
- **Discuss:** Redstone as a technology. How Redstone both extends the capabilities of players in the game and how it limits them. Discuss *Minecraft* as a game engine rather than a game and the relationship between game engines and game assets / data.
- **Housekeeping:** discuss the Development Challenge's Technology-self Assessment exercise due next class.

Week Eight: Agile Development

First Class Meeting

Assignments

- **Read:** Apostol, Raluca (2016). "Agile Game Development – A Quick Overview."
- **Read:** Clinton, Keith (2010). "Chapter One: The Crisis Facing Game Development" and "Chapter Two: Agile Development." *Agile Game Development with Scrum.*
- **Play:** Cross Code (Radical Fish Games 2012).
- **Development Challenge: technology self-assessment due.**

Class Topics / Activities

- **Exercise:** divide students into groups of 4-5 and have them work together to deliver 5-minute paper bag puppet presentations (Stedman 2014) designed to provide their classmates with an overview of agile development and its advantages based on selections from the assigned readings.[7]
    - Allow each group 25 minutes to create their puppets and plan their presentations. Stipulate that every group member must have a speaking part.
- **Discuss:** what the presentations reveal about the exigency and the affordances of agile development. How an agile development methodology might have impacted the process of putting together the presentations.
- **Housekeeping:** introduce the pre-Halloween sock puppet party. Students make sock puppet versions of their favorite video game characters and, on the class before Halloween, use these

7. The best way to translate this exercise for online delivery is to assign students to make puppets before the class meeting based on tutorials that show how to make a variety of different puppets from common household items.

puppets to deliver elevator pitches for the prototypes they are making as part of the development challenge.

Second Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter Nine: Playtesting." *Game Design Workshop.*
- **Watch:** Extra Credits (2012). "Playtesting – How to Get Good Feedback on Your Game."
- **Play:** Biolab Disaster (Szablewski 2021).
- **Homework (20 points):** students work in groups over the weekend to refine their roller-coaster designs based on results observed during playtesting.

Class Topics / Activities

- **Exercise:** Students meet in *Minecraft* and Discord. They work in groups of 4-5 for 40 minutes to prototype roller coasters. The instructor then ride each roller coaster in survival mode so that her player-character can die.
- **Discuss:** what building and testing the roller coasters reveals about the way that Fullerton and Schell discuss the relationships between iterative design, rapid prototyping, and playtesting.

Week Nine: Playtesting

First Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter Ten: Functionality, Completeness, and Balance." *Game Design Workshop.*
- **Read:** Schell, Jesse (2014). "Chapter 25: Good Games Are Created Through Playtesting." *The Art of Game Design.*
- **Play:** CodeCombat (CodeCombat, Inc. 2021).
- **Development Challenge:** Students write brief justifications for the tutorials they plan to use to complete the development challenge.

Class Topics / Activities

- **Exercise:** students meets in Minecraft / Discord for a final round of rollercoaster playtesting.
- **Discuss:** what the students changed and why based on playtesting results.
- **Exercise:** students then play *Code Combat* for 10 minutes.
- **Discuss:** how *Code Combat* incorporates playtesting and iterative design into its coding-based gameplay. Discuss how *Code Combat* achieves functionality, completeness, and balance. Pose the question of whether or not the Minecraft roller coasters players created achieved functionality, completeness, and balance? How would students have to alter their playtesting methodologies to test for this?

- **Housekeeping:** discuss the Development Challenge due next week.

Second Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter Eleven: Fun and Accessibility. "*Game Design Workshop.*
- **Watch:** GDC (2020). "Tools Tutorial Day: Playtesting *Overwatch."*
- **Play:** Elevator Saga (Wolffelt 2020).

Class Topics / Activities

- **Exercise:** Pre-Halloween sock puppet costume party. Students use the sock-puppets they created to pitch the games (3-5 minutes) they are working on for the Development Challenge.
- **Discuss:** using chapter eleven of Fullerton's textbook as a provocation, discuss what was fun and accessible about the sock puppet exercise and what was not. Discuss how sock puppets function as a technology and how they change the medium of the elevator pitch.
- **Housekeeping:** discuss the development challenge due next class.

Week Ten: The Language of Design

First Class Meeting

Assignments

- **Read:** Macklin, Colleen and John Sharp (2016). "Chapter Six: Design Values." *Games, Design, and Play: A detailed approach to iterative game design*
- **Watch:** Extra Credits (2017). "How Games Speak – Learn the Language of Design."
- **Play:** Candy Box 2 (Aniwey 2018).
- **Development Challenge Due.**

Class Topics / Activities

- **Exercise:** have the class meet in Minecraft and Discord. Divide students into groups of 4-5 and allow them 30 minutes to work in creative mode to reproduce one of a number of randomly assigned national landmarks.
- **Discuss**: what the arrangement and combination of the individual blocks players uses to recreate the landmarks reveals about isolated meaning, associated meaning, and dynamic meaning per the Extra Credits video. Then discuss how Chapter Six of Colleen Macklin's and John Sharp's textbook complicates these categories.
- **Housekeeping:** distribute the Design Challenge assignment sheet and discuss the sub-assignments that comprise it.

Second Class Meeting

Assignments

- **Read:** Stout, Mike (2016). "A Beginner's Guide to Designing Video Game Levels."
- **Watch:** Extra Credits (2018). "How Games Challenge Us – Empathy and Intuition in Puzzle Design."
- **Play:** Nothing to Hide (Ncase 2020).
- **Homework (20 points):** randomly assign students brief fairy tales and ask them to use Inklewriter (2012) to transform one of the key moments of the fairy-tale into a branching narrative. Have students submit links to the story-games they create.

Class Topics / Activities

- **Exercise (part 1):** students play *Nothing to Hide* for 7 minutes.
- **Discuss:** how the different levels of *Nothing to Hide* make use to the components parts that Stout identifies in his level-design tutorial. Discuss how *Nothing to Hide* represents an empathy puzzle game and how it achieves this through Stout's components.
- **Exercise (part 2):** divide groups into groups of 4-5 and, following Stout's guidelines, allow them 15 minutes to produce a bubble diagram then a rough map for a new level of *Nothing to Hide* that is designed to elicit a specific response from players.
- **Discuss:** the new levels students created and what this reveals about the levels as a collection of puzzles designed to achieve specific effects and affects.

Week Eleven: Game Narratives and Storytelling

First Class Meeting

Assignments

- **Read:** Schell, Jesse (2014). "Chapter 15: One Kind of Experience Is the Story." The Art of Game Design.
- **Read:** Campbell, Colin (2019). "How to write a Video Game Story: I took a Game Writing course. Here's what I learned."
- **Watch:** Extra Credits (2018). "The Three Pillars of Game Writing – Plot, Character, Lore."
- **Play:** Last Horizon (Coolmath.com LLC 2021).
- Class Topics / Activities
- **Exercise (part 1):** students spend 10 minutes playing the fairy-tale games their classmates produced for homework.
- **Discuss:** what creating these story-games reveals about the similarities and differences between traditional storytelling techniques and branching narratives. Discuss branching narratives as puzzles and how they use plot, character, and lore. Discuss the affordances and limitations of branching narratives.

- **Exercise (part 2):** have students play Last Horizon for 5 minutes.
- **Discuss:** Last Horizon as a story-machine versus a branching narrative. Pose the question of whether or not storytelling is inherently a game.
- **Housekeeping:** discuss the Research Exercise due next class as part of the Design Challenge.

Second Class Meeting

Assignments

- **Read:** Schell, Jesse (2014). "Chapter 17: Stories and Games Take Place in Worlds." *The Art of Game Design.*
- **Read:** Schell, Jesse (2014). "Chapter 18: Worlds Contain Characters." *The Art of Game Design.*
- **Watch:** Extra Credits (2013). "More Than Exposition – Building Worlds without Info Dumps."
- **Play:** Good Impression (Ellian 2016).
- **Design Challenge**: Research Exercise Due.

Class Topics / Activities

- **Exercise (part 1):** divide the class into groups of 4-5 students. Randomly assign them an apocalyptic event and ask them to alter the environment of the classroom in 12 specific ways to illustrate the effects of that event. Allow the groups 25 minutes to complete this task.[8]
- **Exercise (part 2):** have the students leave the room and reconstitute the class into groups of 4-5 different students. Send the groups back into the classroom and ask them to generate a narrative account of what happened there based on the clues left behind from the previous phase of the exercise. Allow the groups 10 minutes to complete this task.
- **Discuss:** have each group share their narrative account. Discuss what this exercise reveals about environmental storytelling from a designer's perspective (part 1 of the exercise) and from a player's perspective (part 2). Discuss how traditional elements of storytelling, including characters, both change and stay the same in environmental storytelling. Discuss how this exercise helps students understand environmental storytelling in *Good Impression* and other mainstream games.

Week Twelve: World Building

First Class Meeting

Assignments

- **Read:** Schell, Jesse (2014). "Chapter 19: Worlds Contain Spaces." *The Art of Game Design.*
- **Read:** Schell, Jesse (2014). "Chapter 20: The Look and Feel of a World Is Defined by Its

8. This exercise can be replicated online through Minecraft. Prior to the class meeting, the instructor should create a village of houses or alternatively locate a premade village on the Minecraft server. During the class meeting, assign students to work in groups of 4-5 for 30 minutes in creative mode to place objects or otherwise alter the houses they have been assigned to reflect the effects of a random apocalyptic event. One the groups have finished this task, the instructor divides the class into new groups of 4-5 and asks them to explore the whole village and produce a narrative account of what happened there.

Aesthetics." *The Art of Game Design.*

- **Watch:** Extra Credits (2016). "Understanding the Fantasy – How to Shape a Game's Design."
- **Play:** Entanglement (Gopherwood Studios 2021).
- **Homework (20 points):** Have students find an in approximately 100 words annotate a tutorial on how to make a tutorial. Compile these into a resource that the class can reference to complete the Design Challenge.

Class Topics / Activities

- **Exercise:** Divide students into groups of 4-5. Have them work for 20 minutes with Twine's online story-generator (Interactive Fiction Technology Foundation 2021) to make text-based representations of randomly assigned famous movie starships. Stipulate that each group must keep the starship they have been assigned secret from the other groups.[9]
- **Discuss:** have each group rotate around the room and play / explore the Twine starships the other groups have created. Challenge each group to try and guess the name of each starship. Discuss how each Twine starship invokes the aesthetics of the original through their architecture and arrangement of space.
    - Finally, discuss the aesthetic affordances and limitations of Twine as an engine. Discuss strategies to recreate the theme and fantasy of *Entanglement* through these affordances and limitations.

Second Class Meeting

Assignments

- **Read:** Schell, Jesse (2014). "Chapter 16: Story and Game Structures can be Artfully Merged with Indirect Control." *Art of Game Design.*
- **Watch:** Extra Credits (2015). "Exploration in Games – Four Ways Players Discover Joy."
- **Play:** Contre Jour (Mokus 2011).

Class Topics / Activities

- **Discuss:** the difference between direct and indirect control using the examples Schell gives.
- **Exercise (part 1):** have students play *Contre Jour* for 10 minutes. Ask them to document 5 examples of direct control in the game and 5 examples of indirect control.
- **Discuss:** the differences between the four different forms of exploration enumerated in the Extra Credits video.
- **Exercise (part 2):** have students play *Contre Jour* for 10 minutes. Ask them identify examples of each of the four types of exploration.
- **Discuss:** the relationship between exploration and indirect control in games and how to

9. As with the paper bag puppet exercise, the best way to facilitate this exercise online is to have the students use Twine to model starships as homework, and the compile links to the finished stories into an online gallery that students can explore and discuss in class.

leverage this relationship as a game designer.

- **Housekeeping:** Discuss Design challenge due next class.

Week Thirteen: Game Sound and Music

First Class Meeting

Assignments

- **Read:** Kilford, Matthew (2021). "Composing Music for Video Games."
- **Read:** Kiel, Alyssa (2019). "Sound Design for Video Games: A Primer."
- **Watch:** Scruffy (2019). "'Invisible' Sound Design in *Breath of the Wild.*"
- **Listen:** Seabrook, Andrea (2008). "The Evolution of Video Game Music."
- **Play:** Onslaught Arena (Lost Decade Games 2010).
- **Design Challenge Due**

Class Topics / Activities

- **Exercise (part 1):** Have students watch six minutes of a *Myst* playthrough video—four minutes with the sound on and 2 minutes with the sound off.
- **Discuss:** what watching the playthrough with the sound off reveals about the ways that sound and music work in the game.
- **Exercise (part 2):** Have students watch six minutes of a *Katamary Damacy* playthrough video—four minutes with the sound on and 2 minutes with the sound off. do the same for a playthrough video.
- **Discuss:** what watching the playthrough with the sound off reveals about the ways that sound and music work in the game. Compare and contrast the way sound and music works in *Myst* and *Katamary Damacy.*
- **Housekeeping:** distribute the Final Project / Game Expo assignment sheet and discuss it.

Second Class Meeting

- Class Canceled for Thanksgiving Holiday.

Week Fourteen: Next Steps

First Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter 15: Understanding the Game Industry." *Game Design Workshop.*
- **Read:** Koster, Raph (2013). "Chapter Eleven: Where Games Should Go" *A Theory of Fun.*
- **Play:** Tiny Monsters (Kuckir 2021).

Class Topics / Activities

- **Exercise:** Divide Students into groups of five. Give each group 15 minutes to list as many ways as possible that the gaming industry has changed from the 2008 description that Fullerton provides in her chapter.
- **Discuss:** compare and contrast the lists that students generate. Using the provocation in Koster's chapter as inspiration, have students identify strategies through which they can stay relevant in the gaming industry despite its changes.

Second Class Meeting

Assignments

- **Read:** Fullerton, Tracy (2008). "Chapter 16 Selling Yourself and Your Ideas to the Game Industry." *Game Design Workshop.*
- **Read:** Koster, Raph (2013). "Chapter Twelve: Taking Their Rightful Place" A Theory of Fun.
- **Watch:** DaveControl (2019). "Games as Art."
- **Play:** Shell Heroes (Csharks 2021).
- **Homework (20 points):** Students create a promotional flyer for their exhibit in the upcoming game design expo.

Class Topics / Activities

- **Exercise:** divide the class into groups of 4-5 students. Assign each group a random, little-known art game. Give students 15 minutes to research the game and to put together a 5-minute pitch designed to convince the head curator of the Louvre to include the game in an exhibition dedicated to Video Games as art.
- **Discuss:** the criteria that groups explicitly and implicitly reference to make the case for the games they were assigned. Compare and contrast these to the criteria that Dave Control employs in his video. Make the point that definitions of art as often as much about groups and categories of people as different production values. Pose the question of what sorts of players are included and excluded by definitions as games as art.
- **Housekeeping:** discuss the upcoming Final Project / Game Expo assignment.

Week Fifteen: Conclusions

First Class Meeting

Assignments

- **Read:** Schell, Jesse (2014). "Chapter 30: Games *Transform* their Players." *Art of Game Design.*
- **Read:** Schell, Jesse (2014). "Chapter 31: Designers Have Certain *Responsibilities*." *Art of Game Design.*
- **Read:** Schell, Jesse (2014). "Chapter 32: Each Designer has a *Motivation*." *Art of Game Design.*
- **Watch:** Extra Credits (2017). "Politics in Games – All Media is Political."

- **Play:** Zork I (Infocom 1980).

Class Topics / Activities

- **Exercise (part 1):** class meets in Minecraft and Discord. Divide students into groups of 4-5 and give each group to work together for 30 minutes to work in creative to create a garden maze with specific waypoints and monuments that embody their experience in the class during the semester.
- **Exercise (part 2):** students explore each other's mazes for 10 minutes.
- **Discuss:** what the combination of all of the mazes reveals about the collective experience of the course. Discuss how the course has transformed students. Discuss strategies that students have learned in negotiating the course and how to transfer these strategies as they move forward. Pose the question of whether or not the course was a game?
- **Housekeeping:** discuss the upcoming Final Project / Game Expo assignment.

Second Class Meeting

- Reading day for final exams.

COURSE BEST PRACTICES

- **Construct yourself as a fellow explorer rather than as the expert in the class**. Require students to be experts whenever possible, especially about the games they enjoy playing. Pose the exercises and the course discussions as problems that you can only solve with the help of students.
- **Assign a textbook, but not the newest version**. A good textbook such as Fullerton's or Schell's can go a long way in helping structure the course. Textbooks can also provide you with a repository of ready-made exercises and offer students with a familiar sense of structure. Textbooks, however, can be cost-prohibitive. Since there are usually only very slight differences between early and later editions of textbooks, consider assigning older editions to cut down on costs for the students.
- **A little document design goes a long way:** although it is not explicit from the template required for this chapter, I spend a considerable amount of time designing my course documents. I use contrasting colors, clear sections, and compelling layouts to help students more easily understand the course and to also set the tone of the course.
- **Triangulate all readings.** One of the primary performances that any introductory-level university class teaches students is how to read at the college level. Likewise, one of GAME 201T's goals is to provide students with the critical literacy that they need to evaluate and take advantage of the vast amount of resources dedicated to game design and development.
    - To this end, try to supplement textbook chapters with *YouTube* videos and readings taken from popular or well-known gaming sites such as *Gamasutra*. Try to find readings that offer slightly different takes on the same subject or which offer contradictory views. Call attention to these contradictions during discussions by presenting them as a shared problem that you and the students must work through to achieve

understanding.

- **Make students responsible for the course readings** by designing in-class, collaborative assignments that explicitly require them to use information from the readings to complete. As detailed in the course outline above, the general formula I employ is to assign students group exercises based on the readings. I then use these exercises to foster discussion and reflection about the readings.
- **Ask students for help.** Although we often face a considerable amount of pressure to perform as experts in the classroom, one of the best ways to engage students is to ask them for help and to draw on their expertise. This can be as simple as asking students to use their phones to report when a particular game was published. Instructors, however, can also ask students for help with more complex subjects, including the games or other technologies in the course or determining the best outcomes for major assignments. Doing so both requires and rewards students for performing as experts.
- **Rotate between groups during exercises.** Doing so will give you a chance to keep the students on task and direct flagging groups towards the exercise's objectives. Rotating between groups also allows you to engage with students on a more personal level. It gives students a chance to ask questions about upcoming assignments that they might be hesitant to ask in front of the whole class.
- **Recognize that students may not have a considerable amount of experience with many of the core technologies of the course**; these technologies not only include game engines like *Unity* or *Unreal*, but also courseware like Blackboard and even technologies that faculty take for granted, such as email. Incorporate small-scale, low stakes assignments and in-class exercises explicitly designed to teach students how to use these technologies.
- **Major and minor assignments need not be due on the day classes meet.** Posting and collecting assignments though courseware like Blackboard means that you can place due dates at the end of each week or on days the class does not meet. Doing so will help address the tendency of students to skip classes on days that assignment are due to finish them. It will also give you more time discuss / model the assignments in class before they are due.
- **Invite visitors to speak to the class**, but not just visitors who have experience working in the AAA gaming industry. Instead try to find visitors who have experience working in diverse and underrecognized aspects of game design and development such as independent game designers and designers working for companies that produce games as training and simulation. Doing so will help students better understand the diversity opportunities available to them.
- **Offer bonus points on all assignments** and use these points to encourage and direct experimentation. For example, offer students 5 bonus point if the web-based mini proposal they produce for the invention challenge includes images, another 5 bonus points if it contains a section above and beyond those stipulated on the assignment sheet, and 5 more bonus point if it is comprised of multiple webpages. Doing so will challenge students to take initiative and reinforce best practices for digital portfolios.
- **Provide students with models of all assignments.** This practice helps alleviate the anxiety that students feel about the otherwise open-ended nature of the major assignments. Models

also provide students with invaluable experience designing their own solutions by reverse-engineering and modifying solutions that others have developed.

- **Allow students to revise all major assignments for a higher grade.** Revision is one of the key affordances of portfolio grading. It also underscores one of the key-principles of iterative design: the ability to learn from setbacks.
- **Recognize that students will ask a lot of questions in a course of this nature**, and will often ask the same questions. This is a symptom of the open-ended assignments at the heart of the course, which students can find daunting. Oftentimes students will ask the same question over and over again not because they do not understand the assignment, but because they are unsure of their approach to the assignment. Use these questions as an opportunity to engage and challenge students.
- **Gradually try to answer question with questions.** One of the overriding objectives of a course like GAME 201T is to empower students to construct themselves (and thereby perform) as experts rather than novices. Gradually avoid giving students direct answers to their questions and instead use a directed series of questions such as "what are the benefits and the costs of that solution" to prompt them to take responsibility for the decisions the open-ended assignments require of them.

FUTURE COURSE PLANS

As I explain in the introduction to GAME 201T's course syllabus, one of the primary challenges that aspiring game designers and developers face is the fact that the gaming industry is inherently unstable and volatile. Accordingly, GAME 201T does not attempt to provide students with a single, unified answer or approach to game design and development. Likewise, it does not pretend to be able to teach students how to make a successful game or even how to succeed in the gaming industry.

GAME 201T instead takes a methodological, entrepreneurial approach to these questions. Employing a variety of hands-on exercises, including a number of formal design and development challenges, it teaches students how to exploit the potentials of iterative design, rapid prototyping, and critical analysis to produce unique solutions to the complex problems inherent in game design and development. In doing so, GAME 201T approaches the problematics of working and succeeding in the gaming industry as a design and development challenge in and of itself. It teaches students how to transform their aspirations into actuality in the face of the volatility, ambiguity, and uncertainty that has become the state of the art not only in the mainstream gaming industry, but arguably, in many aspects of the larger employment landscape that students will encounter upon graduating.

GAME 201T, in other words, attempts to prepare students for the inherent uncertainty of the gaming industry by teaching them how to teach themselves: how to locate resources and solve problems as they arise. That said, there are a number of areas that I would like to further develop in the class. For instance, I have found that many students respond better to course exercises that have a narrative component. Accordingly, I would like to incorporate the major challenges in the game into a larger, quest-like narrative structure. Likewise, I would like to make *Minecraft* and *Discord* a more central part of the course. Many of the students who enroll in GAME 201T are already intimately familiar with both of these technologies and thus they have a lot of potential to either replace courseware like Blackboard entirely or at least remedy some of Blackboard's deficiencies. Finally (and perhaps

most significantly), I would like to give students more options in terms of assignments and perhaps even in the sequence of assignments. Instead of assigning a single ideation, development, and design challenge, I would like to give students the ability to pick between two or three different versions of each. This would allow students interested in design and development to better configure the course to their interests, and would also allow students who come to class to class with more experience in game design and development more leeway in shaping the course to their own needs.

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CHAPTER 18.

MAGIC PRODUCTION STUDIO (IGME-580)

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ROCHESTER INSTITUTE OF TECHNOLOGY

Course Title: MAGIC Production Studio (Instance of Interactive Games and Media's Production Studio (IGME-580))
Course University: Rochester Institute of Technology (RIT)
Course College/School: B. Thomas Golisano College of Computing and Information Sciences / RIT Center for Media, Arts, Games, Interaction & Creativity (MAGIC)
Course Department/Program: School of Interactive Games and Media (IGM) / MAGIC Spell Studios
Course Level: Undergraduate
Course Credits: 3
Course Length: 14 weeks (150 minutes per week), and a 150-minute presentation during finals week
Course Medium: Face-to-face (Game Studio Model)
Course Keywords: Production, Game Development, Media Development, Game Distribution

CATALOG DESCRIPTION

The IGM Production Studio[4] course allows students to work as domain specialists on teams completing one or more large projects over the course of the semester. The projects will be relevant to experiences of the Interactive Games and Media programs, but will require expertise in a variety of sub-domains, including web design and development, social computing, computer game development, multi-user media, human-computer interaction and streaming media. Students will learn to apply concepts of project management and scheduling, production roles and responsibilities, and their domain skill sets to multidisciplinary projects. Students will complete design documents,

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4. NOTE: This chapter describes the generic description for a 'production studio course' offered through the academic program in the School of Interactive Games & Media (IGM), and a specific implementation of that course that was adapted and offered in concert with the RIT Center for Media, Arts, Games, Interaction & Creativity (MAGIC) from 2015-2019.

progress reports and final assessments of themselves and their teammates in addition to completing their assigned responsibilities on the main projects.

The MAGIC Production Studio course instance centers on an indie-focused, small-scale production of a game for PC, with possible derivatives to other modern platforms (consoles such as XBOX and distribution platforms such as Steam or Itch.io). Coursework for the semester is entirely focused on the creation and deployment of the game, with an eye towards both the creative and software engineering process, production values, and dissemination. Students in the course are required to assign rights for work created to MAGIC Spell Studios, LLC, which retains the game and rights to distribute and market such utilizing a 'free to play' model or a modest fee to cover costs and distribution (but also grants students a non-exclusive right to use in perpetuity – this protects students in the event of any legal action regarding publishing and distribution, but also allows them to use their work for portfolios, resumes, and derivative works). Participating students receive title credits as designers and/or developers (as deemed appropriate by supervising faculty) in return for their efforts, should the end result be of distributable quality and design. All aspects of the course revolve around the production and deployment of this single, class-wide, project.

COURSE PURPOSE AND OBJECTIVES

The purpose of the general course is to provide an authentic production experience to students. While students create projects (both individually and in multidisciplinary teams) in a number of courses before enrolling in production studio, they often work on projects whose primary focus is an academic outcome, either a skill-building exercise in a development area such as graphics, programming, UX/UI, etc. or a topic-themed exploration such as games for health or games for change. In other words, while the product is a significant artifact of the course, it is secondary to the overall learning objectives related to the course experience along a particular vector. In contrast, the IGM Production Studio course is similar to offerings in the discipline of software engineering, in that the course shares a focus on design and development processes for large-scale software development. It is also similar in some respects to a 'capstone course' in that it asks students to synthesize their knowledge from multiple earlier courses and electives into professional practice.

The MAGIC Production Studio variant extends the production model, as the purpose of the course is to create a studio publishable game, in which students share shipped title credits. This resets the focus of the course to address details related to a deliverable product, with the educational outcomes embedded in the studio model. As such, students must focus on the details that define a deliverable experience. This includes the realization that not all products meet the threshold of publishable work, and even if they do, they are subject to stringent certification processes for their target hardware and dissemination platforms, usability and functionality requirements significantly beyond typical academic work, and must be packaged in such fashion that they are not only functional, but marketable.

One of the objectives of the MAGIC Production Studio is to have students contribute to a large, complex project in clearly defined, multi-disciplinary roles. While role-based project work is common throughout the curricula, students must interview for their position on the team, complete with resume and portfolio review. The students work as sub teams (core development, level design, art and animation, music and sound, UI, etc.), complete with sub team leads who are responsible for

coordinating work and reporting to faculty and other key stakeholders in the production process. Expectations are that teams are diverse and include students from programs outside game design and development.

Another objective is to provide academic experience in the production process, working from ideation through the delivery of a completed work. While the faculty expect students to refine their skills in design and development towards the completion of the project, several steps in the process blend technical and communication skills. These include feature pitches, system architecture designs, user experience pitches, development of playtest protocols, product documentation, and conveyance of platform criteria and testing.

Furthermore, a third objective of this course is to have students work on a game project that is more than just an entertainment project. Each of the chosen projects in MAGIC Production Studio combine entertainment with another domain, such as art, social dynamics, or behavioral reflection. As such, students must balance the entertainment goals of a product with the alternative domain goals, without diminishing each's counterpart.

A final objective of this course is to have students concentrate upon the details that are often overlooked in product development elsewhere in the curriculum. In many ways, the last objective is one of the most important as it speaks to a commonly overlooked problem in game development programs – authentic product creation experiences that demonstrate a level of professionalism on par with indie game development and small studio efforts, that adhere to the platform requirements needed to distribute a product on modern channels, and *reach the general public as an audience*.

COURSE CONTEXT

The IGM Production Studio experience is not a required course in the game design and development curriculum, but it is often highly desired by junior and senior undergraduate students. While faculty have different interpretations of the intent behind IGM Production Studio, the MAGIC Production Studio derivative placed both academic and industrial value upon the process of creating a publishable work. As such, students attracted to the course often have strong technical skills and many have already experienced some level of real-world development through a required cooperative education experience. Students had many reasons for enrolling in the course. Some wanted the challenge of working on a large-scale game product. Some wanted the accolade of working on a published game with title credits. Others were interested in the process of publishing and distributing games on multiple hardware and distribution platforms. Finally, some wanted the experience of working in a studio model.

Another important aspect of the course context is that participation was not limited to the students in the Game Design and Development major within IGM. The course was also offered as a School of Individualized Study experience and the faculty facilitated the enrollment of students for various disciplines and majors throughout the campus including computer science, industrial design, digital music, digital humanities, and more.

COURSE PEDAGOGY

Our primary belief in the development of MAGIC Production Studio is that students can best learn

the production process by providing an authentic, grounded experience. One of the major advantages for the authors was the creation of MAGIC Spell Studios, an entity within the RIT MAGIC Center that was a production house for student and faculty affiliated creative works. The studio provided resources to the students, including access to commercial technology and software. In addition, students had access to staff in specific roles, including product promotion and communications, distribution channel setup and deployment, development, play test analysis, entrepreneurship (through interactions with the RIT Simone Center for Innovation & Entrepreneurship), and technology need analysis.

While the faculty wanted the students to have an authentic process, the faculty also moved between academic and industrial roles with the students. This created a viable structure for success. An assigned grade in the class did not correlate to product viability. Rather, grades were assigned by the student's analysis and reflection of the development and deployment process. As products developed were a reflection of the studio, not all course efforts were deemed worthy of publication. Often, product development would extend beyond a particular offering of the course into the following semester or year through continued independent study, work-study, funded research and development activity, etc.

We also believed that a critical part of the experience was starting with ideas that were not of the student's making. We often found that when a student embarked on a passion project, they were often too close to the subject matter to properly process critique. Conversely, students often struggle when presented with complex projects not of their design. Students have to find where they can contribute and have to find internal value and significance with their contribution.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

There are no specific course texts related to this experience (students were encouraged to utilize the Game Production Handbook by Chandler (Chandler, 2013) as a resource). However, the faculty provided external URLs and brought in industry guest lecturers to speak towards the production experience from studios such as Activision, Warner Bros. Games, Valve, Microsoft, etc. The latter is of great importance as it allows the faculty to draw parallels between where the students currently are in their development cycle and what they may experience as they get closer to product deployment and engagement with the professional field.

Students had access to the equipment and software that is part of MAGIC Spell Studios. This includes access to high-end hardware for game design and development, software from Microsoft, Autodesk, and Adobe as well as game development platforms such as Unreal and Unity.

Students also had access to all initial faculty-led documentation, including design documents and content sketchbooks.

Along with these materials, students also had access to the MAGIC infrastructure, including virtualization platforms, repositories, version control systems, production scheduling software, and other utilities. Students also have the option to use well-known commercial and open source collaboration and work management packages, including Github, Slack, Discord, Trello, and other tools.

COURSE ASSIGNMENTS

Students contributed to a weekly production cycles. As an assignment, the cycle would start with a stand-up meeting in which sub team leads communicated their goals and challenges for the week. The stand-up would vary from an informal presentation to formal pitches depending upon the nature of the weekly work. For example, if a sub team lead presented alternatives to a critical piece of the user experience, such as a game feature, or change in the aesthetic, it was fully expected that a presentation with prototype examples would be presented to the class. Students were also expected to check in with the Associate Producer to convey their weekly goals and intended progress. During the week, students would interact with necessary parties, including other students and personnel within the studio. Weekly cycles concluded with presentations of the progress and contributions to weekly reports.

Another critical assignment was the milestone sprint. These sprints were based upon features in the games and dependency chains among the subgroups. As such, sub team leads proposed the sprint schedule to the Associate Producer, who added these to the overall project calendar. Sprint deadlines were negotiated among the teams to ensure dependencies were observed and that delays could be minimized. Weekly production cycles referred to the milestone sprint as necessary, and any adjustments to the schedule needed to be cleared by the Associate Producer and the affected sub teams.

Checkpoints were another critical component of the course. These checkpoints occurred in weeks three, six, nine, and twelve in the semester. Checkpoints were not the same as milestone sprints in that they were set based upon a calendar schedule rather than a feature completion schedule. The rationale for this timing was twofold – the industry is often based upon calendar deadlines that have nothing to do with the state of the game and that the game should always be in a consistent state at the end of each production day. Faculty and invited guests from industry would contribute to the checkpoint evaluation. During the evaluation, sub team leads were expected to describe the progress, and also discuss tough decisions for feature inclusion and elimination. Along with lead reports, all students were expected to discuss their individual contributions and the impact on the entire project.

Another set of assignments included peer evaluations. Peer evaluations addressed a range of issues including contributions, professionalism, accountability, and other factors related to the cohesion of the team. While peer evaluation is a part of a number of classes, in MAGIC Production Studio it had a direct impact on work. In some cases, students were reassigned based upon the peer evaluation results. In the most egregious cases where an individual's actions directly impacted the team performance, much harsher penalties were involved, although this was exceedingly rare given both the optional nature of the coursework, and the overall alignment of goals from student and course objectives – i.e. the desire for production quality portfolio pieces.

Additional assignments included the documentation and the associated materials. This included process documentation including design documentation, timelines, debug reports, play test reports, art and aesthetic documentation, storyboards, technical guides, instruction guides, as well as contribution to materials such as the web site and the promotional resources. Students were also expected to create "how-to" resources for the next iteration of the class. In all, students were told that their documentation should capture their process including workflow, decision processes, and the

evolution of their project, thus capturing the journey from start to product completion. Typically the entire class would construct a 'book' of the entire process from start to finish, under the watchful eye of the project manager and Associate Producer.

The predominant assignment during the semester was the final deliverable. The final deliverable consisted of the final game in a state that would be considered production ready in the industry. The final submission consisted of the source and multiple executables for a range of target hardware and distribution platforms, as well as player forward documentation as needed (instructions, guided tutorial pre-levels, etc.). Students were told that their game needed to be of the same quality level as comparable games on commercial distribution channels, and several examples were discussed in class.

Finally, students were expected to conduct play tests and to participate in critique sessions with industry experts. Part of this experience required students to reflect on the game and to make adjustments or respond to critique in a professional manner. In addition, all of the games from the class were shown to the public at numerous events where developers could observe players interacting with their creation including the Imagine RIT festival, a yearly event in which the campus is open to the public that regularly attracts 20,000 visitors and onlookers.

COURSE ASSESSMENT

One of the interesting points of this class is there are a number of number of assignments, but only three contribute to the overall grading of the course. While at first this may seem like a mismatch in which students may ignore "non-graded" work, the additional components are considered to be mastery pass components. This means that if a student does not appropriate contribute to a mastery category in a manner consistent with the expectations of the faculty, the result is failure in the course. Generally speaking, the following rubric was used to guide assessing student performance, which are described and weighted below:

- Peer assessment
- Documentation and Associated Materials
- Final Deliverable (i.e. the game)

Peer assessment comprises 15% of the overall grade and is administered four times throughout the semester, including finals week. The faculty developed a peer assessment instrument that includes questions on contributions, quality of work, social dynamics, production flow behaviors, communication practices and other categories. Peer assessment occurs at both the sub team and course level. The faculty reinforces positive peer evaluations. In cases of negative peer review, students may be reassigned role and task, moved to different sub teams, or in the most egregious cases, failed from the class (peer assessment is one of the mastery categories of the course).

Documentation and associated materials are 15% of the overall grade. The faculty start with a definition of required materials including design documentation, art and aesthetic documentation, development documentation, play test logs, workflow reports, weekly production cycle reports, milestone reports, and presentations. Students must also submit a plan for additional documentation as per the assignment description. The assessment of documentation is based upon completeness,

matching the expectations of the target audience, and appropriate depth such that the reader can understand and recreate any of the processes and procedures involved.

The final deliverable is assessed at 70% of the overall grade. While at first reading the weight on the deliverable seemed excessive, the faculty told the students that the model paralleled the games industry, in which effort did not always correlate to a successfully shipped title. As such, the expectation is that the final deliverable is feature complete and has a professional feel. Technical requirements include that the game must work on a variety of target hardware and distribution platforms, including various configurations of PCs and services such as Steam and/or Xbox Live. While this was in theory somewhat draconian, in practice there were several milestones throughout the semester leading up to the final deliverable, and as such this was a scaffolded experience that had several safeguards in place to avoid outright failure.

EXPANDED COURSE OUTLINE

Week 1: Course Introduction

Class Topics/Activities

- Introduction to the semester project
- Selection of roles for the production
- Selection of team leads
- Introduction to the studio resources

Assignments

- Resume and portfolio presentation
- Role justification presentation

Week 2: Weekly Production Cycle

Class Topics/Activities

- Weekly production cycle
- Presentation of milestone sprint goals

Assignments

- Weekly production reports
- Contributions to documentation

Week 3: Checkpoint 1

Class Topics/Activities

- Weekly production cycle
- Checkpoint presentation including results of playtest

- Playable session

Assignments

- Weekly production reports
- Contributions to documentation
- Checkpoint presentation
- Presentation of milestone sprint report
- Peer evaluation

Week 4: Weekly Production Cycle

Class Topics/Activities

- Weekly production cycle
- Presentation of milestone sprint goals

Assignments

- Weekly production reports
- Contributions to documentation

Week 5: Weekly Production Cycle and Playtest

Class Topics/Activities

- Weekly production cycle
- Playtest activity

Assignments

- Weekly production reports
- Contributions to documentation
- Playtest protocol
- Playtest report

Week 6: Checkpoint 2

Class Topics/Activities

- Weekly production cycle
- Checkpoint presentation including results of playtest
- Playable session

Assignments

- Weekly production reports
- Contributions to documentation
- Checkpoint presentation
- Presentation of milestone sprint report
- Peer evaluation

Week 7: Weekly Production Cycle

Class Topics/Activities

- Weekly production cycle
- Presentation of milestone sprint goals

Assignments

- Weekly production reports
- Contributions to documentation

Week 8: Weekly Production Cycle and Playtest

Class Topics/Activities

- Weekly production cycle
- Playtest activity (larger, public facing event – "mid term")

Assignments

- Weekly production reports
- Contributions to documentation
- Playtest protocol
- Playtest report

Week 9: Checkpoint 3

Class Topics/Activities

- Weekly production cycle
- Checkpoint presentation including results of playtest
- Playable session

Assignments

- Weekly production reports
- Contributions to documentation

- Checkpoint presentation
- Presentation of milestone sprint report
- Peer evaluation

Week 10: Weekly Production Cycle

Class Topics/Activities

- Weekly production cycle
- Presentation of milestone sprint goals

Assignments

- Weekly production reports
- Contributions to documentation

Week 11: Weekly Production Cycle and Playtest

Class Topics/Activities

- Weekly production cycle
- Playtest activity

Assignments

- Weekly production reports
- Contributions to documentation
- Playtest protocol
- Playtest report

Week 12: Checkpoint 4

Class Topics/Activities

- Weekly production cycle
- Checkpoint presentation including results of playtest
- Playable session

Assignments

- Weekly production reports
- Contributions to documentation
- Checkpoint presentation
- Presentation of milestone sprint report
- Peer evaluation

Week 13: Weekly Production Cycle and Public Playtest

Class Topics/Activities

- Weekly production cycle
- Presentation of milestone sprint goals
- Larger public playtest (invited group, institute event)

Assignments

- Weekly production reports
- Contributions to documentation
- Playtest

Week 14: Weekly Production Cycle

Class Topics/Activities

- Weekly production cycle
- Discussion of expectations for final deliverable packaging

Assignments

- Weekly production reports
- Contribution to documentation

Finals: Final Presentation

Class Topics/Activities

- Presentation of completed game
- Post-mortem discussion

Assignments

- Final deliverable
- Final documentation/materials
- Final peer evaluation

Typically, each week of the course would meet in person in the MAGIC Spell Studios laboratory, and discussion would be led by supervising faculty, calling on each team to present their work for the week, discuss successes, failures, and points of integration with other teams. We used a SCRUM-style workflow such that items raised in the discussion would then be turned into tasks in a ticketing system to be completed for the following week, and reported on, thus beginning the cycle again. Some weeks focused on playtesting and analysis, and were devoted to bringing in participants external to the class to give outside feedback on the prototype in development. The course ran on a M-W-F schedule, and thus teams would present on Monday, we would hold an entire class discussion on

Wednesday and present tasks for the next week, and then Fridays were reserved for time for students to work in groups and to get help from faculty and staff on various issues.

COURSE BEST PRACTICES

We have offered MAGIC Production Studio four times. Three of the offerings led to a viable product at the end of the experience and one did not. There are a number of practices deemed important to the experience:

First, it is an important practice is to create diversity among the teams. While students predominately entered the course through the Game Design and Development academic programs, the faculty engaged students in other majors to participate. This also included the engagement of external participants to act as domain matter experts or to provide guidance and critique. Part of the diversity was also created through the staff of MAGIC Spell Studios, many of which had different backgrounds and preparation across a wide variety of fields ranging from technical to artistic to humanistic.

A second critical practice was to address the need for play test culture. Students did not always realize the significance of play testing and even when they did, they did not know how to conduct play tests to address specific questions in the design and development process. The faculty made efforts to provide tutorials and guidance around the play test process, to aid in instrument construction, and perhaps most importantly, to model examples wherein developers did not interact with their subjects directly during the test.

A third important aspect was role accountability. It was extremely important to have students interview for their position on the team. From a faculty perspective, we wanted to create a balance between the skills needed for the project and the potential growth of the student. By having a role-oriented approach based on a process similar to hiring, we were also able to insist on greater accountability, and addressed it directly in class. The point was not to shame people into doing their work but rather to show students that accountability mattered, and that contributions across a wide spectrum of fields was critical to success. Too often in group-based project work, students feel that their teammates are not pulling their weight or are able to hide in the crowd, and also can sometimes feel that students in other fields or areas of expertise have it 'easier' than they do based on a lack of understanding of that sub domain.

A fourth area of focus was to help students navigate critique culture. Feedback from industry experts often had two effects on the students. Good feedback often made students feel that they had accomplished their goals, often resulting in a lull in the production process. Critical feedback would create a sense of demoralization, which could also influence creativity and productivity. It is important for faculty to anticipate both scenarios and help students interpret the feedback without blunting the impact of the critique. Promoting a culture that critique was about the *work*, but not a judgement of the *personnel*, was critical to the long term success of the course as an educational experience. The faculty organized critiques of the entire course afterward, with professor Phelps presenting to a university-wide audience on the course, its successes, and its failures (Phelps, 2016a; Phelps 2016b).

A fifth skill emphasized in the class was communication. We purposely chose a model that was

hierarchical, complete with leads, student managers, staff roles, and faculty roles. Students had to communicate within the hierarchy when in production mode, while maintaining communication at the individual level with the faculty. Additionally, we utilized tools such as Slack and ticketing systems such as Jira to structure communications and formal interactions. Over the offerings of the course, the faculty experimented with a number of organizational models to see which helped in communication flow.

Sixth, we purposefully encourage faculty to choose projects that are not of the student's design. While we believe there is certainly a place for student created project activities in the curriculum, there is value in having students contribute to a project that is not of their own initial design, emphasizing instead the needed ability for them as creators and developers to assume responsibility for a product whose initial vision was not theirs, but to which they are expected to contribute. It is important for faculty to help students navigate challenges as to how to maintain interest and to promote their contributions to the effort. We also suggest faculty choose projects that are beyond simple entertainment products to help students think of design issues beyond game features and mechanics.

Finally, we encourage faculty to consider high-risk options that are equivalent to the demands of a production quality deliverable. We purposely created criteria for publication as stretch goals for both the student body. At one level, this was a function of the studio itself, as its reputation is based on the products delivered. At another level, we wanted title credits to have meaning for the students.

The MAGIC Production Studio experience has led to the delivery of three game titles. The first title was *Splattershmup: A Game of Art and Motion* (n.d.), which allowed players to experience the process of creating action paintings in the style of Jackson Pollack. This game was featured at the Games Learning Society 2015 conference where it was a finalist for learning game of the year, at the Blank Arcade at DiGRA 2015, and at the 2016 Indie Arcade at the Smithsonian American Museum of Art. The second title was *Hack, Slash & Backstab* (n.d.) that was a dungeon crawler. The game explored the tensions between personal and team goals, and received the 2nd place award for visual excellence at the Intel Game Design Challenge held at the Game Developer's Conference in 2017. The final title was *Fragile Equilibrium* (n.d.), which addressed issues of mental state and reflection in gameplay. This game was presented by jury inclusion at the Miami@Play art games exhibition in 2018, at the International Communication Association Game Studies Division pre-conference in 2019, was a selection at the Open Worlds Arcade at the Akron Museum of Art, and was the winner of the award for visual excellence at the International Conference on Interactive Digital Storytelling in 2019. All three were distributed on major platforms and have won multiple awards at festivals and competitions. It is additionally worth noting that the production and design process of *Fragile Equilibrium* is extensively covered in an accompanying journal article by Phelps, Wagner and Moser (2020), while that of *HSB* is covered in a forthcoming article by Phelps, Egert, and Consalvo (in press).

Students involved with the projects have title credits on the works. It is worth noting that title credits proved to be of significant value for students in their search for a first job in the field. Communications with alumni reveal that the MAGIC Production Studio experience led to a better understanding of industry processes as well as a quicker and easier time in integrating with a production team in the professional industry. The experiences in engaging with these projects are

regularly cited by alumni of these courses as a profound and important stepping stone to their future careers.

FUTURE COURSE PLANS

Unfortunately, the MAGIC Production Studio variation of IGM Production Studio no longer exists. One reason is that the authors have moved on to other responsibilities outside MAGIC (and to other universities). The other reason is that courses that extend beyond an academic unit and have goals that exceed the academic mission often prove to be points of contention with upper administrations. Cohabitation of universities with academic game studios create complex issues around ownership, liability, curricular residence, and faculty evaluation. Sadly, the political and logistical needs to create such truly authentic experiences are not always readily embraced.

The authors continue to take the lessons learned from the course and apply them to other experiences. For example, Dr. Egert continues to offer IGM Production Studio in a similar manner. Students are required to create something that is highly polished and are expected to self-promote their work. Prof. Phelps infused several of the Production Studio concepts into his new lab at American University as well as with work at University of Canterbury in Christchurch, New Zealand.

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CHAPTER 19.

GAME CONTENT PRODUCTION 1 (DIG 3713)

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UNIVERSITY OF FLORIDA DIGITAL WORLDS INSTITUTE

Course Title: DIG 3713: Game Content Production 1
Course University: University of Florida
Course College/School: College of the Arts
Course Department/Program: Digital Worlds Institute
Course Level: Undergraduate
Course Credits: 3
Course Length: 16 weeks
Course Medium: Online with 3+ Online Face-to-Face Sessions
Course Keywords: Video Games, Production, Unity, Design, Development, Pipelines

CATALOG DESCRIPTION

Game Content Production 1 is engineered to equip students with the basic technical knowledge and skills in the field of design, conceptualization, and visualization for game content production. Students will learn to work within the multi-disciplinary game industry to develop a general understanding of complex pipelines and processes. Through a carefully crafted set of assignments which build upon each other, the course simulates an accurate development environment in video game production.

COURSE PURPOSE AND OBJECTIVES

The primary purpose of this course, Game Content Production 1, is to continue introducing and reinforcing the various disciplines and pipelines involved in making a complex video game using today's technology.

Empowering and educating students to act as an indie development studio of one requires teaching new game creators a solid working knowledge of current agile-method, digital interactive entertainment production processes; concept prototyping, game design (documentation, world

1. Nick Heitzman (nheitzman@gmail.com) has been helping to create video games for over 20 years and teaching new game developers' aspects of art and design at The Guildhall at SMU for 7 years, and more recently 3 years at the University of Florida's Digital Worlds Institute program. He loves making, mentoring, and playing video games almost to the point of obsession.

building, encounters, and mythology), scripting, comprehensive art asset creation (characters, props, environments, user interface, particles, and post-processing), audio design, and quality assurance.

Professional tools freely available to augment teaching strategy are readily available with Unity providing the two and three-dimensional editor and engine, Autodesk Maya plus Mudbox for original 3D art creation, Digital Worlds students Adobe Creative Cloud suite with Photoshop for basic 2D art and Audacity for Audio, Substance providing advanced material and shader support, Microsoft Visual Studio or its many alternatives are perfect for scripting and code support – it has never been easier for new game developers to acquire the most powerful current tools and technology for free instructional use – leaving this course to provide the instructional secret sauce needed for making all that technology sing together in perfect harmony.

Such powerful programs available also means a near-infinite number of possible game types and genres available for creation during this course. What will the 'Player' actually be in this new world? Will the final product be two-dimensional, or three, or a hybrid that blends factors of both? Does the design call for role-playing elements, or strategy – education or informational segments? Action, platforming, stealth, survival, rhythm? Is multiplayer, battle royale, or will we need an artificial intelligence companion a component of the design? The student developer has the ability to even create something that cannot be classified within thousands of existing game genre types.

This diversity of design is taught and encouraged in Game Content Production courses. It is not uncommon to have a final game product begin with an interactive tutorial start to the game, leading to a cinematic narrative introduction seamlessly blending into the first game level showcasing top-down 2.5D role-playing. With multiple transitions to interior or other-dimensional spaces which expand into mini-games that all teach elements to successfully encountering with the end-game Boss in a hybrid strategy bullet-hell action sequence. There are so many ways to tell stories available today, a merging of styles into an epic tale maintains interest and entertainment.

Game Content Production exists to practice learning and using the tools of game development, along with expanding the gameplay delivery mechanisms as they complement each other in the creation process – becoming the producer, designer, artist, and engineer solely responsible for all aspects of development.

COURSE CONTEXT

The Digital Worlds Institute offers a range of game development courses from creating simple mobile games, through to team-based original complex game creation, in the areas of 2D, 3D, augmented reality (AR) and virtual reality (VR).

Game Content Production 1 (DIG3713) in this syllabic context is the online alternative to the face-to-face corresponding undergraduate DIG3713 offering. The course is a semester long deep-dive into solo creation of a full game product. It is a part of both the Digital Worlds Major and Minor, and is a requirement for moving on to Game Content Production 2 (DIG3715) which, adds full 3D game development in interdisciplinary teams of 4-5 Digital Worlds and Computer Science games students.

DIG3713 exists in a midpoint between the introductory Creating Mobile Games (DIG2632) class, where students from Digital Worlds and other University of Florida programs are first exposed to

modern video game creation – and Game Content Production 2 which expands into interdisciplinary team-based game production.

Each of the Digital Worlds games courses has both multi-sectional face-to-face and online class components all working toward the same learning outcome goals.

COURSE PEDAGOGY

The challenge with designing the online version of Game Content Production 1, was to keep it as fast-paced, flexible and fun as the face-to-face version without sacrificing any of the learning outcomes.

Distilling 2-3 years of game development instruction into a semester, and keeping it from becoming overwhelming is easier in a face-to-face setting where the learning can be dynamically shifted to play to class strengths and schedules. Without that flexibility I had to establish a structure that touched on all the key points of each milestone in the development schedule, and was fun enough to maintain interest for everyone – avoiding situations such as the more coding proficient students loving the scripting and technical exercise – but dreading art or creative design, vice-versa and everything in between.

I came up with the idea of making the game content class into a complex, multi-part game itself.

With the overarching theme of galactic space travel as the focus of the class game fun, lessons became recorded briefings from galactic control – which were only part of a weekly 'mission'. Each mission was broken out into a space system map with waypoints that linked to the 'comms briefings', 'intel' or external sites and documents, and a specific 'Expedition' which was the mission objective assignment or milestone.

Sixteen Missions in total, each building upon the next – structured like a development milestone schedule – in total they explored an entire fictional galaxy with sixteen unique individual planetary systems comprised of multiple waypoints. All of the class components have full graphics with animations; comms briefings (lectures) look like video transmissions from the home planet to the deep space student explorer. External documentation and other templates were designed to replicate Galactic Headquarters admin material. Space maps with blinking progress points move the student from activity to activity toward the goal. I also decided to incorporate virtual agile development methodology with mission 'whiteboards' which documented plans, notes, sprints along with key vocabulary critical to that part of the expedition.

This theme was woven into every aspect of the course in Canvas and satellite sections hosted with Articulate 360's Rise software. The Canvas discussion boards became the Crew introduction and mission communication hub.

Students were encouraged to adopt their galactic adventurer persona while I maintained the role of Missions Director. Guiding them through each adventure as well as hosting live face-to-face Zoom meetings which are critical to delivering upgrades in technology, tools, processes, and scripts as all the software, particularly Unity, constantly upgrades and improves over time. Missions recorded over the Summer 2019 semester had already had multiple tech evolutions by the time the course first went live

Fall 2019 – even more year later in Fall 2020. The only way to keep the course current is through the hybrid mission briefings to deliver all that has changed since the initial mission recordings.

This is because of time dilation effects students experience conducting missions in deep space so far from Missions Control – of course. Luckily, we can have sub light communications gatherings to keep our explorers current.

Course Texts, Games, Software, and Hardware:
Course support material fell into three basic categories defined as templates, reference media, and Unity projects, along with external supporting links for dynamic content.

First the mission templates for documentation such as the game design document, test reports, asset lists, readme patch lists, . Second are media and program examples; level maps, previous student game builds at the milestones of varying quality, Unity mini-projects showcasing complex game systems such as the Player types, Enemy AI behaviors, level and teleport mechanics.

The final support material category is current external links to industry examples of course subject material. Such as game design tutorial sites, license free fonts, music, audio, textures, sprites – all the material that establishes the industry standard making it key to communicating what is expected for their games. These sites are fluid and some change every semester as earlier websites go offline, other sites become the leaders in demonstrating specific parts of game creation. This list is dynamic and ever-changing.

Hardware relies on student Windows PC or Mac laptops, which the students already possess. The choice of Unity over Unreal as the editor and engine used, makes even lower end laptops competent for course game creation – and the support by all the course software for Windows, Linux, and Mac mean no technology barriers to development.

Having taught Master's game development at the SMU Guildhall using Unity and Unreal, I knew the cost of hardware to smoothly run the Unreal 4 editor starts at $2500 laptops and goes up from there. That is too high a requirement cost for undergraduates to take the Digital Worlds games courses. Unity avoids this cost entirely.

COURSE ASSIGNMENTS

Game Content Production assignment structure follows the standard game industry development schedule. With the major milestones designed around key class assignments, while in between smaller sprints deliver the lectures and instruction that supports the milestones.

Early game level progress is reviewed in the Prototype Milestone. The Midterm – or Alpha Milestone delivers the overall architecture of the entire game in an unfinished, but systems proven, version. Beta Milestone allows a content lock on all art, design and code so that the period between Beta and Gold Master – or the Final Milestone can be spent on finishing existing content, and evolving conveyance, narrative, and packaging the game build so the end product is not only a solid Final game version, but a solid portfolio piece as well.

The missions between the milestones provide the components that support development. The Player,

enemies, transition mechanics, prototype and iteration exercises, through all aspects of various possible game types. Inventories, collectables and counters, endless runner parallax systems, spawn points, visual novel graphic design. Key points of the most common game genres are examined and explored so student developers are exposed to a variety of game mechanics successful in delivering experiences and entertainment.

Game package mechanisms are also demonstrated; splash screens, icons, cursors, user interface and user experience best practices, narrative delivery methodology, button-driven and interactive start scenes, transitions, intros, outros, credits – all the various pieces that make a solid game executable product.

COURSE ASSESSMENT

- **10 Expeditions** (mission end assignments) = **1000 points** = **40%** weighted.
- **14 Whiteboards** (mission notes and vocabulary definitions) = **1400 points** = **20%** weighted.
- **4 Milestones** (Prototype, Midterm Alpha, Beta, and Final Gold Master) + **3 Game Design Document** updates (Prototype, Midterm Alpha and Final) = **700 points** = **40%** weighted.

EXPANDED COURSE OUTLINE

Mission 00 Orientation

Map Waypoints

- Missions Director Briefing
- Missions Structure (Syllabus) Overview
- Critical External Resource Links
- Photoshop Games Setup
- Unity Hub Install and Course Setup
- Introduction to Design Architecture

Expedition Deliverables

- Orientation Quiz (does not count toward final grade, but is a pre-requisite to pass for the next mission)

Mission 01 Orbital Recon

Real-Time Comms Session 1

- 10 – 20 participants
- Online evening meeting to introduce myself and meet the class
- Field any initial questions or assistance I can provide as the class begins

Map Waypoints

- Game Design Process
- Development Scheduling and Milestones
- Example Games Review
- Unity Packages Overview
- Scope, Pipelines, Planning Development
- Scheduling to Define Workflow

Expedition Deliverables

- Whiteboard Terminology 01
- Project Schedule

Mission 02 Red Tape

Map Waypoints

- Game Design Document (GDD) Examples Review
- De-engineering Game Designs
- GDD Creation Exercise
- Unity Editor Tour and Functionality Review

Expedition Deliverables

- Whiteboard Terminology 02
- Game Design Document v1.0

Mission 03 Personnel

Map Waypoints

- Animated Player Construction; Top-Down and Side-Scrolling
- Character Design Process
- Non-Player Characters (NPCs)
- Enemy Behavior Scripts
- Animated Sprite Sheets
- Character Animation Basics
- Unity 2D/3D Physics Systems
- Sorting Layers and Scene Organization

Expedition Deliverables

- Whiteboard Terminology 03
- Animated GIF – Custom Player Animations

Mission 04 Interface

Map Waypoints

- Dialogue Manager and Triggers System
- UI Conveyance Mechanics
- Inventory, Health, Counters
- Activation/Deactivation Triggers
- Locks and Keys
- Expedition Deliverables
- Whiteboard Terminology 04
- Screenshot – Interface

Mission 05 Prototype Milestone

Map Waypoints

- Prototype Milestone Games Examples
- Rough Level Maps
- Unity Sprite Shapes and Rapid Prototyping
- Level Scale and Systems Review
- Introduction to Encounter Pacing
- Elevators and Teleporters
- Bounce and Friction
- Game Build Process Exercise

Expedition Deliverables

- Whiteboard Terminology 05
- Prototype Game Executable

Mission 06 Bugs!

Map Waypoints

- Post-Prototype Feedback Evaluation
- Missing Content vs. Bugs
- Bug Replication and Solutions Pipeline

- Prioritizing Missing Content and Bugs

Expedition Deliverables

- Whiteboard Terminology 06
- Prioritized Bug Report

Mission 07 Alpha Milestone

Real-Time Comms Session 2

- 10 – 20 participants
- Online evening meeting progress check with feedback
- Unity best project quality settings exercise
- Tile map creation and use
- Parallax layer planning

Map Waypoints

- Alpha Milestone Games Examples
- Scope Review and Cutting Content
- Game Managers, Checkpoints, Game Controller
- Stealth and Stealth Respawn
- Enemy and Hazard Encounter Design
- Design Consistency and Quality Control
- Game Build ReadMe.txt Process

Expedition Deliverables

- Whiteboard Terminology 07
- Alpha (Midterm) Game Executable Build
- Game Design Document v2.0

Mission 08 Auxiliary

Map Waypoints

- Auxiliary Game Scene Flow-Charts
- Button-Driven Start Screen
- Interactive Start Screen
- Credits Screen
- Intro and Outro Screens

- Transition Level Systems

Expedition Deliverables

- Whiteboard Terminology 08
- Screenshot – Game Start
- Screenshot – Credits
- Screenshot – Transition

Mission 09 Vista

Map Waypoints

- In-Game POI Design and Construction
- Orienting the Player
- Player Conveyance, Focus, and Goals
- Parallax Layers Systems Design
- Creating Depth in a 2D World

Expedition Deliverables

- Whiteboard Terminology 09
- Screenshot – POI
- Screenshot – Depth or Parallax

Mission 10 Evolution

Map Waypoints

- Evaluating Overall Gameplay Flow
- Dialogue, Narrative and Storytelling Best Practices
- Tutorial Designs; Explicit and Interactive
- Tutorial Pacing and Reinforcement

Expedition Deliverables

- Whiteboard Terminology 10
- Screenshot – Dialogue Triggered
- Screenshot – Tutorial Elements

Mission 11 Encounter

Map Waypoints

- Boss Encounter Examples and Design Basics

- Epic Encounter Types
- Designing in Unity with Impact
- Boss and Epic Level Architecture
- Boss and Epic Systems Overview

Expedition Deliverables

- Whiteboard Terminology 11
- Screenshot – Boss or Epic Encounter Level

Mission 12 Beta Milestone

Map Waypoints

- Beta Milestone Games Examples
- Content Lock Evaluation Process
- Game Audio; Global, Local Positional, Specific
- Beta Build Testing Exercise

Expedition Deliverables

- Whiteboard Terminology 12
- Beta Game Executable Build

Mission 13 Complications

Map Waypoints

- Post-Beta Evaluations
- Peer Testing Exercises
- Managing External Bug Lists
- Unity Post-Processing; Global and Local Volumes

Expedition Deliverables

- Whiteboard Terminology 13
- Screenshot – Post-Processing Volume Effects

Mission 14 Identity

Real-Time Comms Session 3

- 10 – 20 participants
- Online evening meeting with project feedback
- Advanced lighting and post-processing techniques

- Peer game testing session

Map Waypoints

- Team Splash Exercise
- Game Icon Exercise
- Custom Cursor Exercise

Expedition Deliverables

- Whiteboard Terminology 14
- Screenshot – Game Splash Screen
- Image – Icon

Mission 15 Gold Master

Map Waypoints

- Gold Master Games Reviews
- Final GDD Exercise
- Project Post-Mortem Exercise
- Your Game as a Portfolio Element

Expedition Deliverables

- Gold Master Final Game Executable Build
- Game Design Document v3.0 Final
- Post-Mortem Document

COURSE BEST PRACTICES

What Went Well

- Mission structure was well-received and students loved adopting their course game personas.
- Students created their own Discord channel and broke it out into help sub-channels for the various missions, and the various disciplines; art, programming, design, and production.
- I was invited to join the student Discord channel as could use it to deliver timely course script updates, tips and tricks, explain tough vocabulary definitions, and more.
- Unity started providing 'LTS' editor/engine versions (Long Term Support) which could be used in class for an entire semester without fear of students using an unstable tool set.
- Unity's Sprite Shape, Text Mesh Pro, and Post-Processing packages were out of preview mode and could be seamlessly integrated into the editor.
- The support network students' created on discord expanded to create a comradery that had them all connected to one another on multiple levels.

- The face-to-face evening Zoom sessions designed to deliver updates to technology and processes since the course was recorded, actually become a way to develop synergy between myself and the students in a more significant way than just the recorded Missions Director.
- Recording the face-to-face evening Zoom sessions, and providing the link the next day to students who wanted a refresher of a process discussed, or missed the actual event, proved invaluable.
- Office hours supported the in-person sections of the class with dynamic, instant-help, and the online sections were also invited to regular office hours via Zoom.

What Was Challenging

- As cool as the game mission structure was, its cadence was lock-step required to go from concept to finished complex video game. A more flexible approach to mission requirements was hard to adopt.
- The Canvas discussion boards, except for the initial Crew Introductions board available at the outset, were abandoned for the more agile and crew-controlled course Discord channel. Discord allowed for smoother interaction, file sharing, online meetings and collaboration.
- No matter how many game types and genres received introductory course support with scripts, materials and instruction – there would be expansions into gameplay unforeseen during course recording, that would require the students to independently research cutting edge technology. An infinite possibility of game types and genre-blends is a double-edged sword.
- Supporting the course with the face-to-face Zoom evening get-togethers was limited to about three per section per semester. More events, while beneficial, put undue expectations on online students' schedules. Attempts at adding more face-to-face online meetings resulted in reduced attendance.
- The bridges in the course from Canvas to Rise for every mission need to be manually updated every semester beyond the first, or all the links would become invalid. For next semester the link requirements were broken between Canvas and Rise and a more logical flow between the two programs implemented to solve this.
- The missions and outcomes were static, and while students wanted to show more initiative and do more than was required per mission – with all the subject matter being relatively new they had no idea where to start.

FUTURE COURSE PLANS

Improvements and evolution of the course structure will be possible the next major recording update in 2022. The rapid advances in the technology used can be augmented by the face-to-face Zoom sessions for 2-3 years maximum before they are so significant as to require new mission recordings.

Improvements which have already been integrated into this Fall's recording of the DIG2632 Creating Mobile Games online course, and will be part of a DIG3713 Game Content Production 1 renovation are:

- A Swiss-army knife approach to game entity creation; for example Player scripts that can be modified dynamically with check-boxes to switch between side-scrolling, top-down, simple or ray-cast physics, expandable inventory, health or other affecting metric at any amount with segmenting or fill-graphics. Enemies with multiple behaviors built into the structure that can be mixed and matched; static, random patrol radius, custom patrol points patrol, and detection with aggressive behavior modifiers. (these can be used minus a damage-dealer script to create non-player character 'follower' entities as well).
- Animated map mission support with briefings and content provided by Articulate's Rise platform have been architected to remove the back-and-forth with Canvas which requires link updating every semester.
- Course flow between Rise and Canvas, and between mission to mission, has been streamlined and improved since the initial version pioneered with DIG3713 Online.
- Face-to-face Zoom sessions to provide updates and instructor/student synergy are built into the schedule so students can plan to attend them (vice having them randomly over the semester).
- To provide opportunities for students to push beyond the required mission objectives (optionally) – Secret Level 'stretch goals' are integrated into each mission. These are not obvious and their linked icons need to be 'found' in the mission material. Once found, they provide a way to do some extra work specific to that mission that will expand the instruction, make the final game product more professional, and provide a small amount of extra credit toward the course grade (mathematically allowing close grades to 'round up' if they are completed successfully).

Wishlist potential future improvements for the course include:

- Integration with the 2D animation courses so an option for animated characters could be a standard IK (inverse kinematic) skeleton architecture and more traditional digital animations per entity instead of the sprite frame-based format.
- Working with the Digital Worlds Professional Development courses in order to showcase the games for portfolios more effectively, use student branding in splash logos, and have the game content available for Games Master's program petitions, or game company internship applications.
- Streamline and update all the games courses so they flow smoothly from one to the other building on the technology provided. Currently the timeline of when a course was required dictates the technology used, and right now as someone teaching the material I have to support four different iterations of editor/engines, scripts, and materials across the three games courses' multiple online and in-person sections – which will eventually become an overwhelming task and support will break down.

REFERENCES:

Supporting links and various course screenshots demonstrating functionality.

Resources – Links

80.lv – Tutorials and Material

https://80.lv/

Itch.io – Tutorials, Tools, Resources, and Indy Games

https://itch.io/

Freesound.org – Sound FX

https://freesound.org/browse/tags/sound-effects/

ZapSplat.com – Music and Sound FX

https://www.zapsplat.com/

OpenGameArt.org – 2D Art

https://opengameart.org/

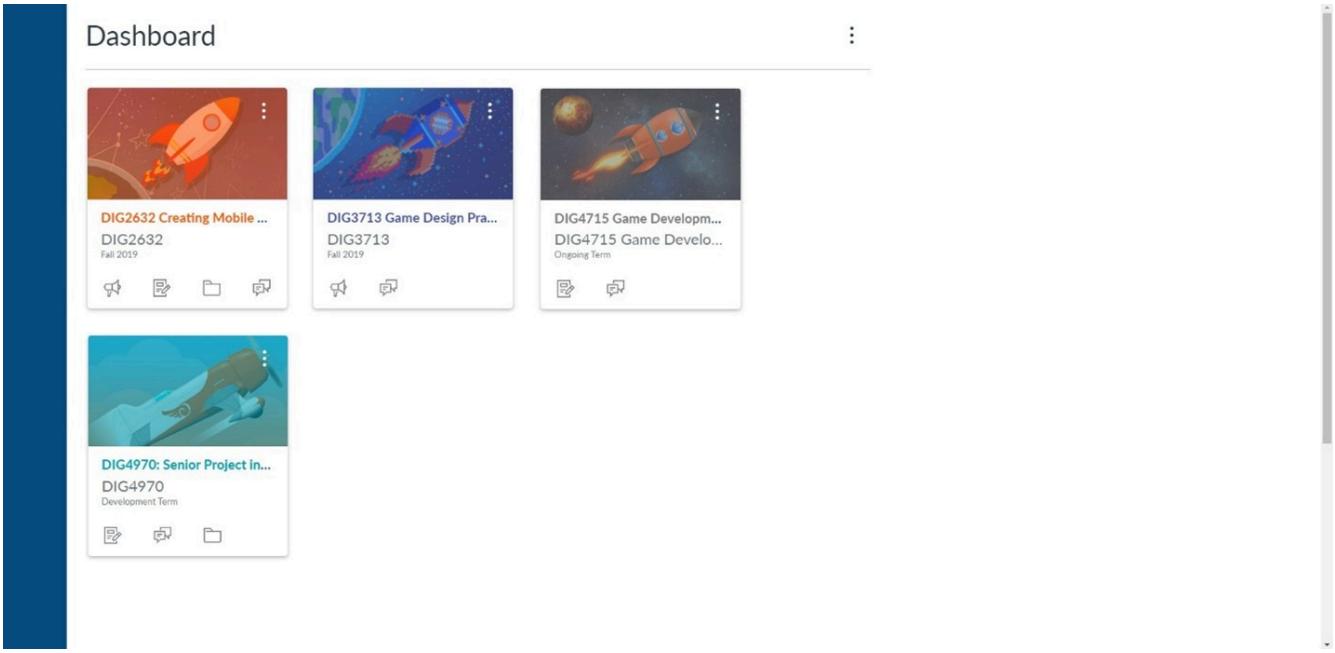
DaFont.com – Custom Fonts

https://www.dafont.com/

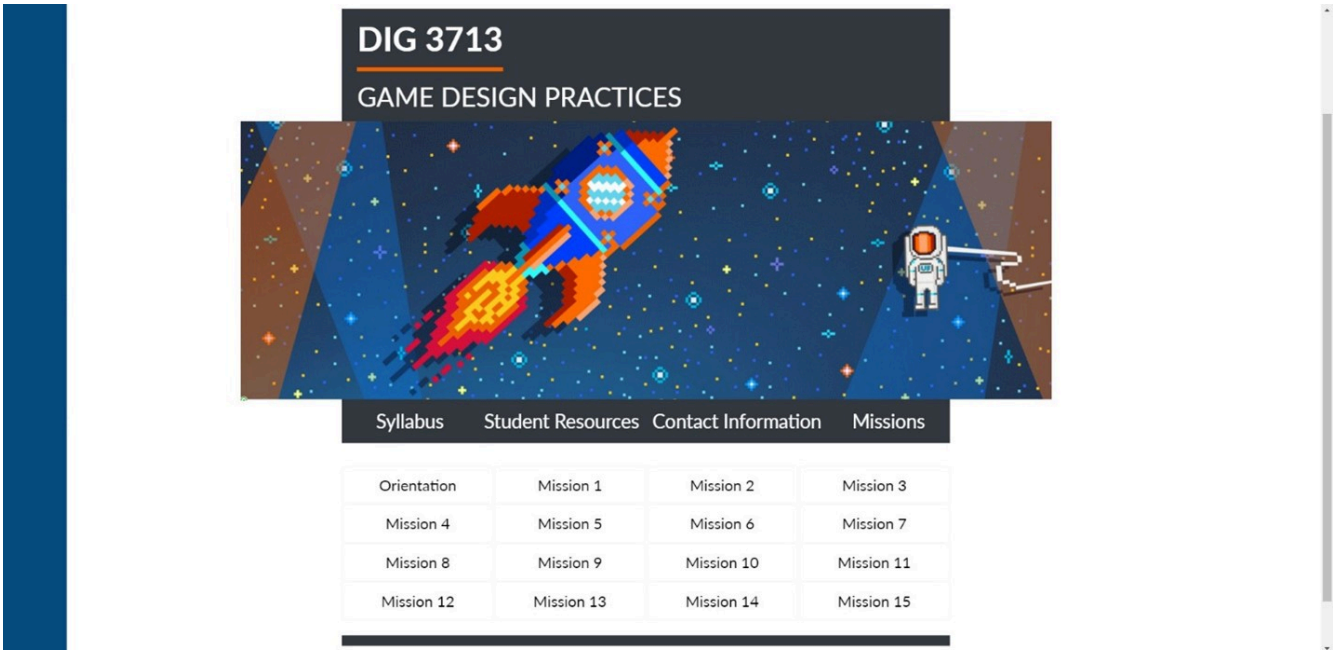
ArtStation – Reference and Tutorials

https://www.artstation.com/

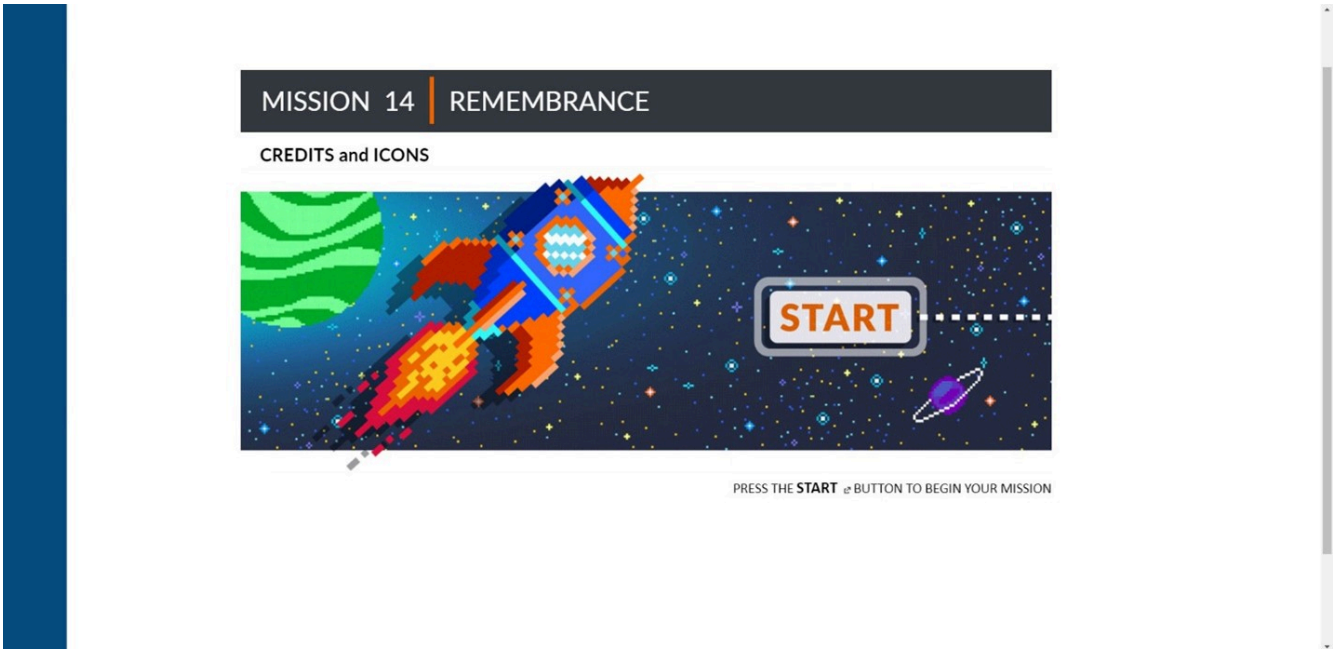
Resources – Course Structure Images



1. Canvas Launchpad with Animated Gifs



2. Canvas Missions Gateway with Animated Gif



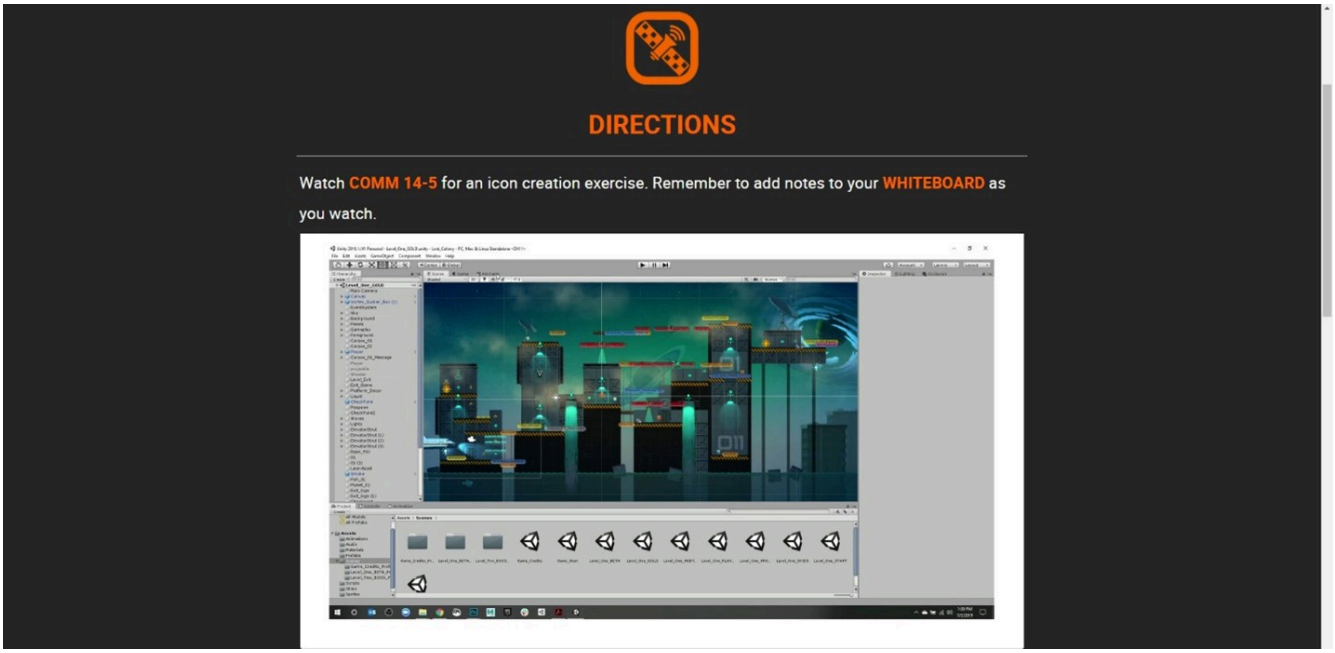
3. Canvas Mission Start with Unique Planet Designs

4. Mission Briefing Information Screen

5. Waypoint Navigation Map

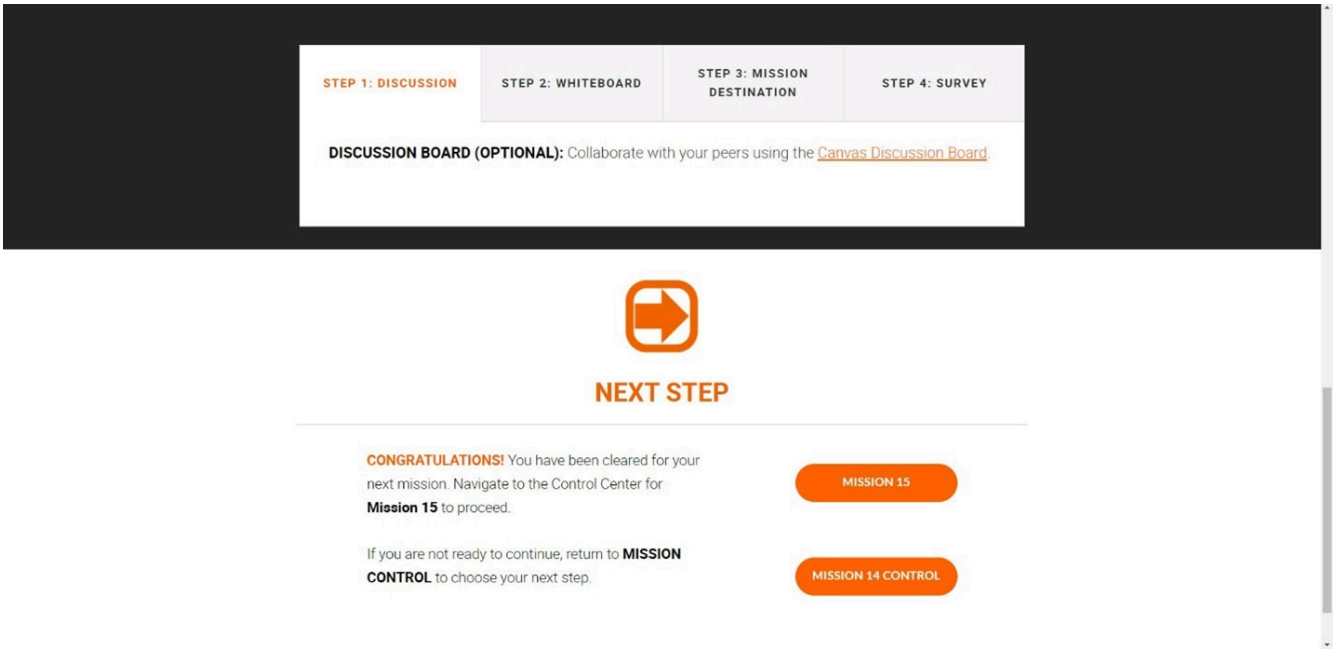
6. Embedded Lecture Waypoint

7. Full-Screen Lecture Video

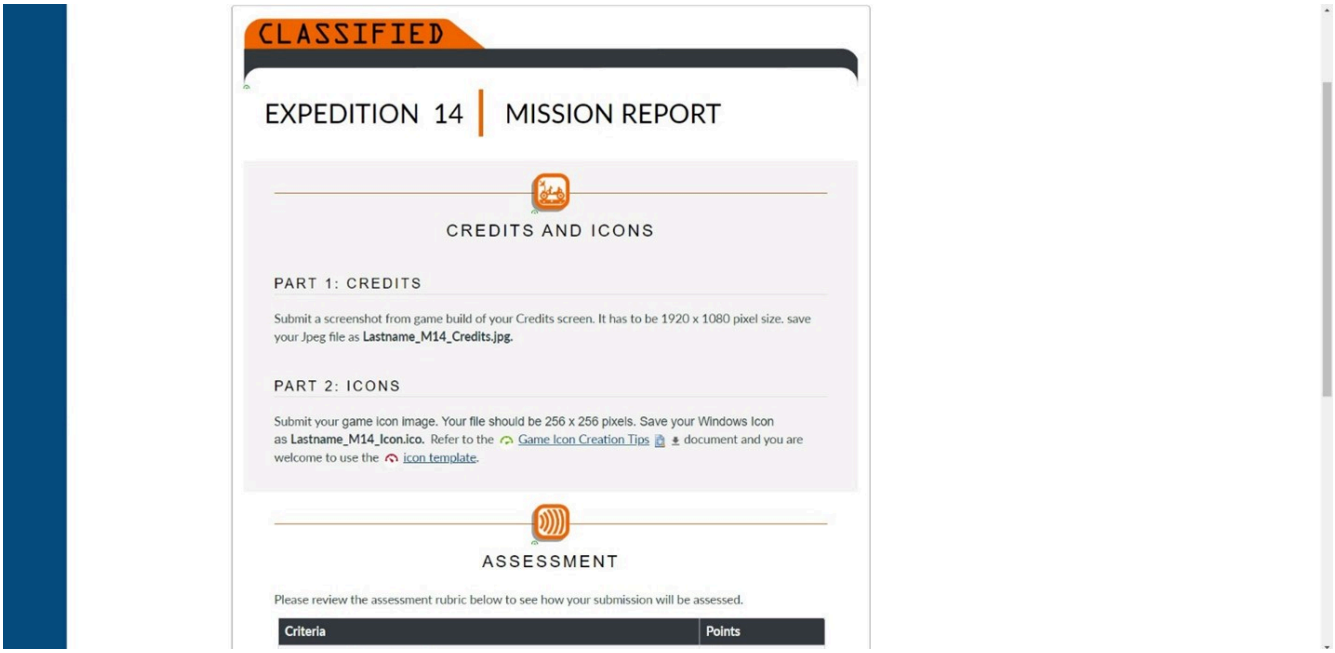


8. Embedded Exercise Waypoint

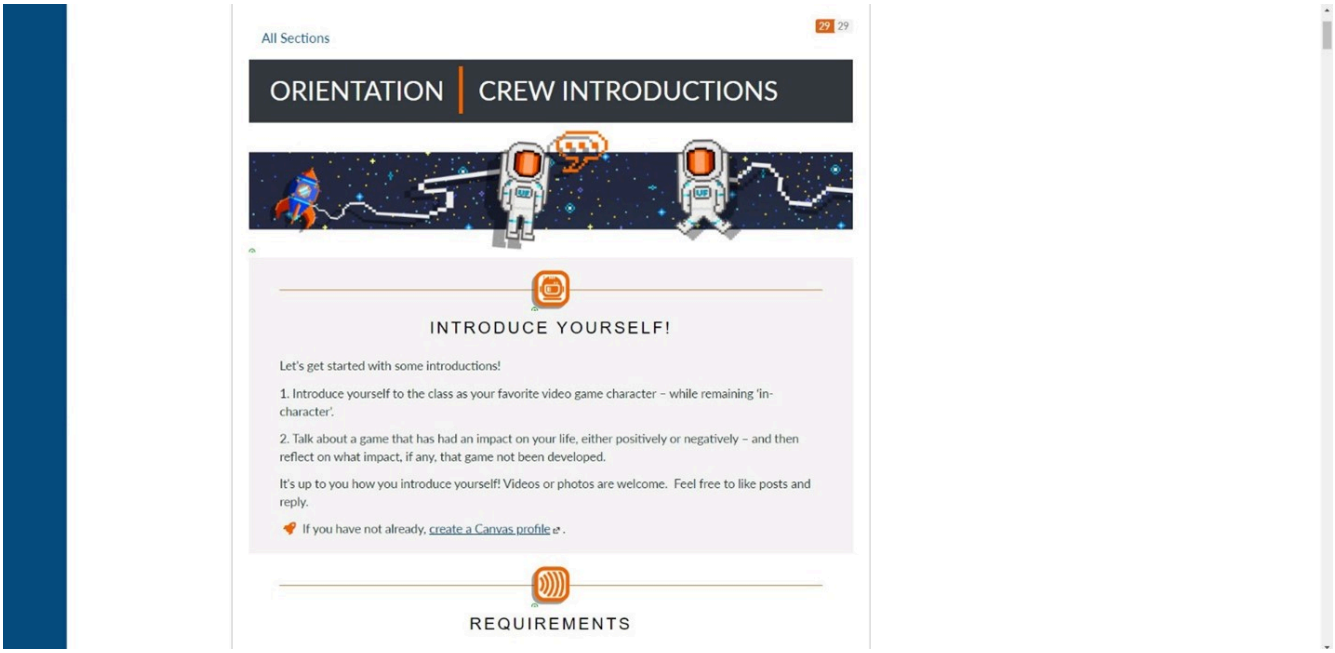
9. Full-Screen Exercise Video



10. Mission Completed Interface



11. Canvas Mission Report



12. Mission Discussion Boards

CHAPTER 20.

GAME DESIGN AND PRODUCTION (DIG 4527)

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UNIVERSITY OF FLORIDA

Course Title: DIG 4527 Game Design and Production
Course College/School: College of the Arts
Course Department/Program: Digital Worlds Institute
Course Level: Undergraduate
Course Credits: 3
Course Length: One semester (15 weeks)
Course Medium: Face-to-face, Online, Blended/Hybrid
Course Keywords: Game, Design, Production, Group project, Game design frameworks, Layered tetrad

CATALOG DESCRIPTION

An interdisciplinary approach to game design and production. Emphasis on rapid prototyping, agile design, collaboration, and project management in a relatively short development cycle. Structured as a series of lectures, in-class exercises, and discussions at the intersection of digital design and technology. The course provides insights into industry topics, including video game design, production, project funding, game startups, team organization, game monetization, and game promotion. Students work on idea pitches, write concept proposals, and work throughout the semester to develop their own video game. Throughout the course students will work in groups on their final projects, and learn to use collaboration and time tracking tools. Course contains a substantial focus on game design theory, and a review of the most common design frameworks. Industry vocabulary and best practices are reviewed and expanded upon.

1. Marko Suvajdzic (marko@digitalworlds.ufl.edu) is a diverse thinker with 20 years of achievement in academia and the creative digital research and production space. Marko's experience includes projects ranging from artificial Intelligence-intensive video game titles for major industry publishers, to co-founding five of his own startups. Currently, he is an Associate Professor and the Associate Director of Digital Worlds Institute at the University of Florida. Marko has lectured internationally at schools and conferences in U.S.A., U.K., India, UAE, Serbia, China, Australia, Norway, and Japan.
2. Gabriel Coleman is a videographer, full stack web developer, 3d artist, game designer, and a computer programmer who served as a TA for DIG 4527.
3. Jordan Smith (jordan.smiths.games@gmail.com) is a professional software and game designer and developer who served as a TA for DIG 4527.

COURSE PURPOSE AND OBJECTIVES

The objective of this course is to introduce the students to the advanced game design practices. Both in terms of the production of the final group project, as well as through the study of ludology and the main game analysis frameworks. The course unfolds through two parallel activities:

1. Group project – video game: Throughout the semester students work in the groups of 3 to produce their final video game. Game production process is followed from the initial idea brainstorming to the final code delivery. Students are taken through the series of industry inspired assignments: Concept proposal, Game Design Document, Alpha/First playable, Beta, Final. Parallel to the production of the game, students are asked to author a 60 seconds promotional video, and a one page poster/flyer.
2. Study of theories and design frameworks: up to this point in their curriculum, students have not engaged in the study of game design from a theoretical point of view. In this class, first we cover the main concepts of the game design process: chance, skill, designing for different ages, etc. Then we dive deep into the analysis of different game design frameworks: MDA, Formal, Dramatic and Dynamic, Elemental Tetrad, and the Layered Tetrad.

Objectives: By the end of this course, students will be able to:

- Describe and articulate major trends and trajectories in the field of video games production.
- Use different perspectives to analyze and investigate practices, trends and production cycles in the contemporary video games production process.
- Present findings from personal research into a specific aspect of video games culture.
- Design and produce their own video game

COURSE CONTEXT

DIG 4527 Game Design and Production, is an elective course and is intended as a capstone course for those students who wish to specialize in video games development. Digital Arts and Sciences students at the Digital Worlds Institute share the same core of classes. Further specialization is achieved through a series of electives in the areas of game design, 2D/3D animation, and media production.

To enroll in the class, all students must take at least two previous classes in game engine development (Unity), as well as a series of classes that cover tools like: Photoshop, Premiere, 3D Maya, and Illustrator. Students are expected to have all the necessary development skills and to be fully focused on the process of game design

COURSE PEDAGOGY

"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn." (Alvin Toffler)

The focus of our teaching practices is on active learning. Our main objective in teaching is to facilitate learning by helping students to gain the necessary skills to take control of and become conscious participants in their own learning. We believe that knowledge gained through active participation

is knowledge that will stay with an individual. Beyond striving to ensure that students learn the fundamental content of the courses that we teach, our objectives are as follows: (a) to foster critical thinking skills; (b) to facilitate the acquisition of lifelong learning skills; and (c) to help students develop industry-based creative problem-solving strategies.

Our pedagogy stems from sensitivity to students' media interests and their skepticism both towards the media and the critics who take them to task. Our overarching goal for students is to think critically about their engagement with the digital media and understand the subsequent effects this engagement has on our individual, social, and cultural value systems.

In my teaching role I cover both undergraduate and graduate classes. My areas of expertise are: game design & production, entrepreneurship & innovation, and emerging technologies (VR/AR, Blockchain). In addition to teaching assigned graduate or undergraduate courses in the Digital Arts and Sciences (DAS), I serve on graduate supervisory committees for both Digital Arts and Sciences graduate students as well as MA/MS and PhD students from other colleges.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Required Materials

- *Gibson, J. (2015). Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#. Upper Saddle River, New Jersey: Pearson Education.*
- *Brathwaite, B., & Schreiber, I. (2008). Challenges for Game Designers (1st Edition ed.). Hingham, Massachusetts: Charles River Media.*
- *Costikyan, G. (2002). I Have No Words & I Must Design: Toward a Critical Vocabulary for Games. Retrieved 2020, from http://www.digra.org/wp-content/uploads/digital-library/05164.51146.pdf or http://www.digra.org/wp-content/uploads/digital-library/05164.51146.pdf*

Required hardware and software

- Laptop/Desktop
- Unity game engine
- Adobe CS
- Maya 3D

Recommended Materials

- Selection of online articles and videos throughout the semester, as they relate to the issues and challenges that arise with group projects and quizzes

COURSE ASSIGNMENTS

1. Assignment | List of Three Video Games

What type of game do you think is capable of being produced in 3 months, and with a small team of 4 developers? For this assignment, you are asked to compile a list of three video games that are close in scope to the final project in this class. This is a creative exercise, so do not worry about being right

or wrong. The goal of this exercise is to start us thinking of the type of games we will be making, and narrowing down the options early on in the production process.

Submission Requirements:

This assignment MUST include the following info for EACH of the three video games:

1. Game title
2. Link to the playable game or a video describing it (for game review purposes)
3. Short game Description (50 words)
4. Screenshots of the game (1-3)
5. Size of the team that built the game, and the total time of production (if known)
6. Why did you choose this particular game? How is it compatible with your perception of the class final project? (50 words)

Assignment Format Requirements:

- Font: Calibri
- Size: 11
- Spacing: Single (1.0)
- Use bullet point lists to directly reference the requirements of the assignment.

2. Assignment | Video Game Concept proposal

Write a Concept proposal for the final project game. Please include everyone's names on the concept proposal. The proposal is required to be exactly two pages. The first page should contain the game description (text/calendars/graphs), the second page should contain game concept art and examples.

First page:

1. Game title (work in progress)
2. Game Description
3. Gaming platform (web, mobile, etc.)
4. Project scope (skills required, time required, tools required, project management software proposed)
5. Other relevant info

Second page:

1. Game art style description. Original concept art is optional. However, you can use photos or screenshots from other authors to communicate a mood or general settings.
2. Examples of similar games. Add a note on what exactly should one focus on when looking at other games.

Useful links:

For more information on how to structure your concept proposal, please check out the following resources. They provide information about common qualities that should be in every video game concept proposal, as well as those that should not, as well as general tips and tricks to the writing process.

- GDC talk about pitching your game: http://www.gdcvault.com/play/1020877/In-3-Sentences-or-Less
- Gamasutra article about the stages of pitching: http://www.gamasutra.com/view/feature/134571/how_to_pitch_your_project_to_.php?print=1
- Gamasutra article about game proposals: http://www.gamasutra.com/view/feature/2911/the_game_proposal_part_one_the_.php?print=1
- Sloperama articles about game proposals:
    - http://www.sloperama.com/advice/lesson35.htm
    - http://www.sloperama.com/advice/lesson21.htm
    - http://www.sloperama.com/advice/lesson13.htm
- Gamasutra article about game design documents: http://www.gamasutra.com/view/feature/1709/design_document_play_with_fire.php

3. Assignment | GDD Project Schedule

A game design document (often abbreviated GDD) is a highly descriptive living design document of a video game. The final delivery of the project MUST be made in Word Doc format. This is a "GDD", and as such it must be relatively detailed.

Submission Requirements:

A GDD should include the following features:

- DETAILED PROJECT SCHEDULE (**SEPARATE FILE**)
- Name of the game
- Table of Contents
- Introduction
- Description
- Key features
- Key Mechanics
- Concept art
- Progressions chart or Level diagram
- Full description of every level of the game
- User interface and controls

- Sound and Music guidelines
- Other relevant info

Assignment Format Requirements:

- Font: Calibri
- Size: 11
- Spacing: Single (1.0)

Useful links:

The following links provide example game design document templates which you may adopt and modify to your game's needs.

- Gamasutra article about game design document guidelines: http://www.gamasutra.com/view/feature/131791/the_anatomy_of_a_design_document_.php
- Article detailing example game design documents:
- http://seriousgamesnet.eu/assets/view/238
- Article about how to write a great game design document: http://gamedevelopment.tutsplus.com/articles/how-and-why-to-write-a-great-game-design-document–cms-23545
- Great game design document template, made by Dungeon Siege's creator Chris Taylor: http://www.runawaystudios.com/articles/chris_taylor_gdd.php
- More example game design documents: https://forums.epicgames.com/threads/739373-Two-full-Game-Design-Documents-free-for-you-to-use

4. Assignment | Promo Material – Video Trailer Promo (60 seconds)

Video trailer promo is a video that has for its purpose to present the game to potential buyers. The idea here is to impress and wow the future players. The video can contain but is not limited to: Gameplay, developers/players interviews, concept art, cinematics, and/or any other visuals that you may think would be inspiring for a potential player.

Assignment Format Requirements:

1. Video length: 60 seconds (50 – 90 seconds for this draft version)
2. Resolution: 1280 x 720
3. Type: MP4, or AVI
4. Maximum file size: 10MB (or smaller)

Useful links:

The following links provide information about making a game trailer as well as how to compress the video to meet the required 10 MB file size.

- How to make a game trailer: https://www.videopixie.com/make-a-game-trailer
- Video compression guide: http://www.v4c.org/en/content/video-compression-guide
- How to compress and send videos by email: http://www.makeuseof.com/tag/compress-videos-send-email/

5. Assignment | Final Game Group Project – Alpha Version (First Playable)

The *first playable* is the game version containing representative gameplay and assets, this is the first version with functional major gameplay elements. It is often based on the prototype created in pre-production. Alpha and first playable are sometimes used to refer to a single milestone (as in our case), however large projects require first playable before a feature complete (https://en.wikipedia.org/wiki/Feature_complete) alpha.

Alpha is the stage when key gameplay functionality is implemented, and assets are partially finished. A game in alpha is *feature complete*, that is, the game is playable and contains all the major features. These features may be further revised based on testing and feedback. Additional small, new features may be added, similarly planned, but unimplemented features may be dropped. Programmers focus mainly on finishing the codebase, rather than implementing additions.

For this assignment, you are asked to submit the following items:

1. Playable game with key gameplay functionality implemented (URL, mobile app download, or an installation file)
2. Clear instructions on how to install/access the game, how to start the game, how to play the game, how to restart the game, and how to close the game.
3. List of remaining items to implement the production schedule for the rest of the game

6. Assignment | Three peer reviews for assignment: Alpha Versions
For this assignment, you must submit the following material: Three peer reviews for assignment: Alpha Versions

Submission Requirements:

- All peer reviews should be listed in the same Word document
- Each peer review should be 150 – 250 words in length
- Include your name and the assignment name on the first page, each assignment peer review should be clearly listed, followed by the project name, followed by your review. Please separate each peer review by starting a new page.

Assignment Format Requirements:

- Font: Calibri
- Size: 12
- Spacing: Single (1.0)

7. Assignment | Final Game Group Project – Beta Version

Beta, named after the second letter of the Greek alphabet, is the software development phase following alpha. The software in the beta stage is also known as **betaware**. The beta phase generally begins when the software is feature complete but likely to contain a number of known or unknown bugs. The process of delivering a beta version to the users is called beta release and this is typically the first time that the software is available outside of the organization that developed it.

For this assignment, you are asked to submit the following items:

1. Project schedule listing all the hours spent per person to date, and outlining the remaining tasks.
2. Playable game with complete gameplay functionality implemented (URL, mobile app download, or an installation file)
3. Clear instructions on how to install/access the game, how to start the game, how to play the game, how to restart the game, and how to close the game.
4. List of known bugs
5. List of any cheat codes that you have implemented to help the game testing.
6. A zip file containing your Unity / Unreal project folder.

8. Assignment | Participation – Team Assessment

In this assignment, you are asked to assess your teammate's efforts and contributions to the group final project this semester. As you think through this exercise, please consider the following questions:

1. Did the person attend all group meetings?
2. Did the person perform all assigned tasks on time and per agreed upon specification?
3. Did the person contribute to the group project more or less than others?
4. Was the person a good team player? Did they motivate and inspire others? Did they have a positive attitude about getting things done? Did they strive to improve the project with their efforts?
5. Would you choose to work with this person again?

Please rate each teammate by assigning a number of stars, from one to five:

1. **Teammate1 Name:** number of stars (1-5)
2. **Teammate2 Name:** number of stars (1-5)

COURSE ASSESSMENT:

Assignment	Percentage of Grade
List of 5 games, similar in scope to our final project	5%
Video Game Concept Proposal (1 page)	5%
GDD + Detailed Project Schedule	10%
3 Peer Reviews – GDD + Detailed Project Schedule	5%
Promo Material *Draft* (1-pager + 60 sec video)	5%
2 Quizzes	20%
Alpha/First Playable	10%
3 Peer Reviews - Alpha/First Playable	5%
Beta	10%
Final Project: o Fully playable, bug free game o Promo Material Final (1pg + 60sec)	25%

EXPANDED COURSE OUTLINE

Week 1:

Lectures:

- Syllabus review
- Introduction to the class

Week 2:

Lectures:

- VGD Chapter 1 – The Basics

Class Exercises:

- Review of various award winning independently produced games
- Forming teams of 4-5 people
- Group creative exercise

Assignments/Quizzes Due:

- Links to 3 games compatible in scope with class project

Week 3:

Lectures:

- Publisher Milestones
- Creating a Game Concept Proposal
- VGD Chapters 5, 8 – Elements of chance vs. skill

Class Exercises:

- Working on the Game Concept Proposals

Week 4:

Lectures:

- Creating a Game Design Document
- VGD Chapters 5, 8 – Elements of chance vs. skill

Class Exercises:

- Project Schedule and Game Design Document

Assignments/Quizzes Due:

- Video Game Concept Proposal

Week 5:

Lectures:

- Video game monetization models
- Careers in the Gaming Industry

Class Exercises:

- Project Schedule and Game Design Document

Assignments/Quizzes Due:

- Peer reviews of Video Game Concept Proposal submissions

Week 6:

Lectures:

- Class review of the Game Concept proposals submitted

Class Exercises:

- Working on the Alpha / First Playable version of the game

Assignments/Quizzes Due:

- Quiz 1

Week 7:

Lectures:

- Game Analysis Frameworks – Overview

- Game Analysis Frameworks – The Layered Tetrad

Class Exercises:

- Working on the Alpha / First Playable version of the game

Assignments/Quizzes Due:

- Game Design Document
- Project Schedule

Week 8:

Lectures:

- Game Analysis Frameworks – The Inscribed Layer
- Game Analysis Frameworks – The Dynamic Layer

Class Exercises:

- Working on the Alpha / First Playable version of the game

Week 9:

Lectures:

- Game Analysis Frameworks – The Cultural Layer
- Class review of the Alpha / First Playable submissions

Class Exercises:

- Working on the Beta version of the game

Assignments/Quizzes Due:

- Alpha / First Playable version of the game

Week 10:

Lectures:

- Video game marketing and promo material

Class Exercises:

- Working on the Beta version of the game

Assignments/Quizzes Due:

- Peer reviews of Alpha / First Playable submissions
- Quiz 2

Week 11:

Lectures:

- Gamification of Education

Class Exercises:

- Working on the Beta version of the game
- Review of the Beta version's progress

Assignments/Quizzes Due:

- Research Paper

Week 12:

Lectures:

- Game Startups and Entrepreneurship

Class Exercises:

- Working on the Beta version of the game
- Review of the Beta version's progress

Week 13:

Lectures:

- Class review of the sell sheet and video trailer rough drafts

Class Exercises:

- Working on the Beta version of the game
- Review of the Beta version's progress

Assignments/Quizzes Due:

- 1 page promotional sell sheet (rough draft)
- 60 second video trailer (rough draft)

Week 14:

Lectures:

- Class review of the sell sheet and video trailer rough drafts
- Thanksgiving Break

Week 15:

Lectures:

- Project / class post-mortem
- Class review of the Beta version submissions

Class Exercises:

- Working on the final version of the game

Assignments/Quizzes Due:

- Beta version of the game

Week 16:

Lectures:

- Class review of the Beta version submissions

Class Exercises:

- Working on the final version of the game

Week 17:

Lectures:

- Class review of the Final version submissions

Class sendoff

Class Exercises:

- Playing other teams' games

Assignments/Quizzes Due:

- Final version of the game

COURSE BEST PRACTICES

This is a complex course that requires a lot of time and effort from the students. Some of the main challenges are in regards to managing student groups throughout the semester. First challenge is how to divide the students into the working groups of 3-4. Second challenge is to fairly evaluate individual student contributions within each group.

After much experimentation with how to create well rounded student groups, I have settled to selecting groups in an informed random process. Students do not get to choose who they would like to work with. Instead they are grouped based on their submitted short bio that includes their interests. Of importance to note here is that I no longer request the students to submit detailed descriptions of

their skill sets, but rather a general description of interests. Based on their bios students are grouped to include individuals from different spheres of interest.

To best track everyone's contribution to the group project, students are asked to develop a detailed production schedule. The schedule contains all the tasks that are planned for the next milestone, including who is the task assigned to, and how many hours are estimated. The important addition to the production schedule that I recently implemented is to track who actually completed the task (vs. who was the task initially assigned to), and how many hours did the task actually take. This approach has yielded excellent results to date. All hourly contributions are recorded and agreed between the students before they submit their updated project schedule for each production milestone.

FUTURE COURSE PLANS

I have taught this course for 5 years now. The content, projects, quizzes, and readings are fully defined and implemented. While minor adjustments are expected on a year by year basis, I do not expect any major changes.

The biggest future plans relate to the online students, and solving the challenges that this form of education presents. In the near future, I am looking to learn how to best implement the course in an asynchronous setting. The biggest challenge comes in terms of group collaborations, and facilitation of the student group work. In the gaming industry, remote teams are not uncommon, however they are hard to implement without a dedicated manager and predefined organizational processes. In this case students are asked to self organize, and since none of them is above the other it is often hard to force one's peers to do something in a particular manner and on time. I am currently engaged in research on online group management, and I intend to conduct several experiments in the coming years in order to develop the most efficient way to facilitate game development by online student remote teams.

Another area of innovation will be the inclusion of the emerging technologies of Blockchain, AI, and XR. Many students are experimenting with these technologies, and I plan to introduce them into my curriculum in a more formal manner. I plan on guest lectures, online training certificates, and the inclusion of a series of online videos. It is my expectation that these emerging technologies will find their way into many of the student projects in the next 5 years.

REFERENCES

Gibson, J. (2015). *Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#*. Upper Saddle River, New Jersey: Pearson Education.

Brathwaite, B., & Schreiber, I. (2008). *Challenges for Game Designers* (1st Edition ed.). Hingham, Massachusetts: Charles River Media.

Costikyan, G. (2002). *I Have No Words & I Must Design: Toward a Critical Vocabulary for Games*. Retrieved 2020, from http://www.digra.org/wp-content/uploads/digital-library/05164.51146.pdf or http://www.digra.org/wp-content/uploads/digital-library/05164.51146.pdf

CHAPTER 21.

PLAYCENTRIC GAME DESIGN (SGD100)

COLLEEN J. STIELER-HUNT [1], CRAIG HARGRAVES [2], AND SANDRA ELSOM [3]
UNIVERSITY OF THE SUNSHINE COAST

Course Title: Playcentric Game Design (SGD100)
Course University: University of the Sunshine Coast
Course College/School: Bachelor of Design (Game Design)
Course Department/Program: Creative Industries
Course Level: First year, undergraduate
Course Credits: 12 credit points (one-quarter of a full-time load for 1 semester)
Course Length: 13 teaching weeks and 2 weeks of assessment time. Each teaching week features a three-hour workshop for a cohort of up to 28 students.
Course Medium: Face-to-face (although we converted to online in 2020 with some success)
Course Keywords: game design, serious games, introductory, board games, alternate reality game, group work, university, online elements, face-to-face elements

COURSE DESCRIPTIONS

This chapter describes the course "Playcentric Game Design (SGD100)" and how we embedded an alternate reality game (ARG) into that course. It is as much, and possibly more so, about the delivery of the course rather than the course's content. SGD100 is a first year, first semester, introductory game design undergraduate university course. An ARG is a pervasive game that combines an interactive storyline with clues that advance the narrative as players solve puzzles and complete real-world tasks in collaboration with other players (The IGDA Alternate Reality Games SIG, 2006).

In the next paragraph (catalog description) we provide the description that students read prior to enrolling. In the subsequent paragraph (ARG description) we describe the ARG, *Against The Authority.*

1. Dr Colleen Stieler-Hunt (cstieler@usc.edu.au) is a game design lecturer at The University of the Sunshine Coast. As a multi-award winning educator with over 20 years of experience, she is interested in how games can be used to enhance learning. She is a co-creator of the *Against The Authority* alternate reality game and the regular teacher of the course discussed in this chapter.
2. Craig Hargraves (craighargraves@gmail.com) is a Masters' candidate at the University of the Sunshine Coast. He is researching the effects of an alternate reality game on the student engagement of university students. He is the co-creator of the *Against The Authority* alternate reality game.
3. Sandra (Sandie) Elsom (selsom@usc.edu.au) is a Lecturer in Tertiary Access at the University of the Sunshine Coast, Australia. Her work focuses on the integration of games into the higher education curriculum. She is particularly interested in the potential for using alternate reality games to create an engaging and effective social learning experience.

Students are not informed about the existence of the ARG prior to enrolment. The ARG occurs in and around and between the elements of the course the students are formally enrolled in.

Catalog Description

This course introduces the playcentric design process and theory relating to the design of Serious games. A Serious game is a game designed for a primary purpose other than just entertainment, such as education, behavioural change, or raising awareness. You will work in teams to design your own Serious board, card, tabletop or other non-digital games from the initial concept, to playable Serious game prototypes and then demonstrate them to a panel. The process and theory underpinning the design of board, card and tabletop games also applies to video games.

The current description of the course can be viewed at https://www.usc.edu.au/study/courses-and-programs/courses/course-library/sgd/sgd100-introduction-to-game-design

ARG Description

Against The Authority is used as a pedagogical tool to further the learning outcomes of the course. The alternate reality game (ARG), *Against The Authority*, interweaves a fictional story and quests with real-world class interactions. This is done through the class receiving messages from — and sending messages to — fictional ARG characters who live in a future in which games have been banned. Course materials are "hacked" by these fictional characters to set class quests. The game includes player (student) achievements, and a fictional story that aligns with course assessment tasks. For an overview of the game, go to www.againsttheauthority.com/tour

COURSE PURPOSE AND OBJECTIVES

In this section we describe the overarching learning outcomes for the course, then we detail the theory students are exposed to in order to meet these learning outcomes. Then, we discuss the aims of the *Against The Authority* ARG and how it relates to the overarching learning outcomes for the course.

Learning outcomes

On successful completion of this course, students should be able to:

- analyse and describe games in terms of game design theory, player experience, game structure, and their impact;
- work as part of a team to iteratively design and develop a serious game accounting for game design theory, player experience, game structure, and social impact;
- create a design document for a serious game that clearly explains the intended player experience, the target audience, game elements and structure, and how your design relates to game design theory and its serious purpose.

In service of these specific learning outcomes, the course introduces class members to:

- game design theory as outlined in chapters 1–5 of Fullerton (2019) including player experience, formal and dramatic elements of games, and games as systems;
- serious games, games created for a primary purpose beyond entertainment (Sawyer, 2002),

and their intended impacts;

- working as part of a team to iteratively design and develop a serious boardgame. The iteration process involves extensive prototyping and playtesting with potential players; see chapters 6–11 of Fullerton (2019);
- documenting their game designs and relating their game designs to game design theory;
- intentionally designing a game for a serious impact, a particular target audience, and a defined player experience.

ARG learning outcomes

Against The Authority ARG aims to have class members:

- experience a serious game;
- be thoroughly engaged in the classroom experience;
- build rapport with each other;
- build rapport with their tutor(s).

Further, it aims to instill a sense of care and purpose for the serious games that they design and develop. The ARG aims to meet this objective by intertwining the game's narrative with the course's final assessment task, thus providing an additional reason for students to complete their assessment. In the ARG's narrative, the central character has been arrested because they were playing games created by the students. The students' final assessment requires group presentations of the students' own original serious games. These presentations are offered to The Authority as a defense of the charges against the protagonist.

The player (student) achievement system used within the ARG encourages the following desired activities:

- attending class;
- developing a professional portfolio;
- playtesting iterations of their games (assessment pieces);
- critical reflection of games they play;
- active group work;
- working in a team with classmates outside of class.

COURSE CONTEXT

This course is a first year, first semester course in a three-year bachelor's games degree program at an Australian regional public university. Although it is a required course for the Bachelor of Design (Game Design) degree (University of the Sunshine Coast, 2020), the course is also studied as an elective. In 2020, 32% of the cohort were enrolled in a degree program other than the Bachelor of Design (Game Design) degree. The degree admits students who have achieved an Australian Tertiary Admission Rank (Queensland Tertiary Admissions Centre, 2019) of 54.55 or more — which

means that they achieved within the top 45.45 percentile relative to other students in that year — in their secondary school studies or equivalent. Places in the program are supported by the federal government. The Bachelor of Design (Game Design) cohort tends to be predominantly young, male and full-time. In the first semester of 2020, just 13.4% of students told us that they were female, in contrast to the female representation in the university overall of 68%. 85% of them were studying full time (71.4% university-wide), and nearly 57% were 20 years of age or younger (37% university-wide). Further, students with disabilities are more highly represented in this program at nearly 18% of the cohort, compared to 6.5% in the general university population.

Most, but not all, students have significant prior experiences with playing games before coming to class. We interviewed nine students in 2020 and asked them about their relationship with games. Eight of the students were men aged from 17 to 38, and all of them described a history of gaming since they were children and each one spent many hours a week on the practice. The games they enjoyed were varied, with an emphasis on First-Person Shooters (e.g. *Call of Duty*), Action Adventure games (e.g. *The Legend of Zelda*), Open Worlds (e.g. *Skyrim*) and Battle Royales (e.g. *Apex Legends*). Three of the interviewees described a love of puzzle games, and although the sample is small, it is interesting to note that they were the students who most engaged with *Against The Authority*. The final student interviewed was a 69-year-old woman, who enjoyed playing boardgames throughout her childhood in Germany. Now she studies game design as a way of supporting her disabled son who is passionate about video games.

The tutor explains how they aim to encourage inclusiveness within the cohort: "During class discussions I encourage students to be inclusive by asking them to explain gaming terms used and describing any games they have played so that those who have not played the games before can have some level of understanding. I also try to promote and encourage students to play and appreciate a diverse range of games. For example, during workshops I introduce students to a variety of boardgames, many of which students have not seen before. I see this course as a way to help my students transition from being a game player to becoming a game designer".

Although most of the students have significant experience playing games, most have never experienced an alternate reality game before. Alternate reality games, traditionally, take themselves seriously, not admitting to their status as "game". However, educators in higher education using ARGs for learning and engagement have reported that it is challenging to get people to play without being specific about what they are being asked to do — see, for example, Evans, Christopherson, Sturm, King, and Haefele (2010). Therefore, we begin the semester with the lecturer providing an overt explanation of the game and how it will work. Following this explanation, the lecturer also immerses themselves in the game and does not further acknowledge that it is a game, treating the unfolding narrative and gameplay as if it is real.

Accommodations for online only delivery

In 2020, several weeks into the course we had to shift the course to online delivery due to COVID-19 restrictions. We made the following accommodations:

- Workshops were held using a combination of Zoom and online activities.
- Students were reluctant to have discussions over Zoom, so we tended to use Padlet

(https://padlet.com/) for students to articulate their ideas and then we would have a brief discussion over Zoom. Our university has a Padlet subscription.

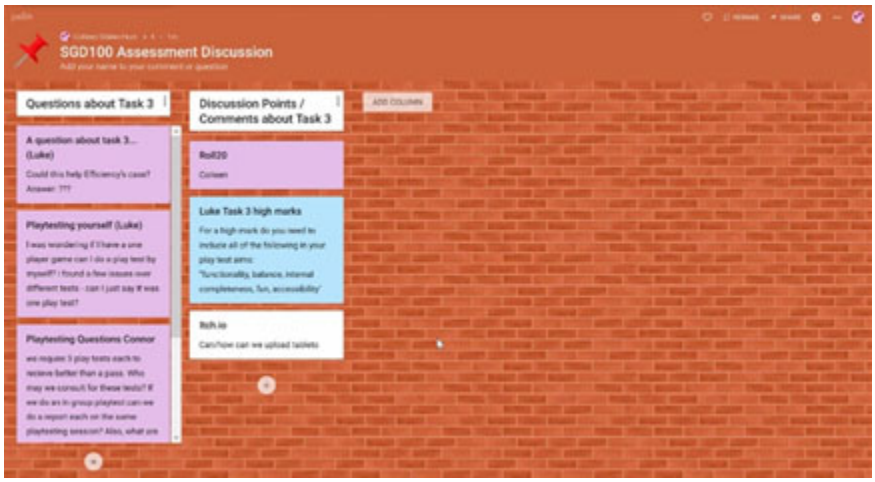


Figure 1. Padlet was used for students to articulate their ideas.

- We used Zoom breakout rooms for group work.
- We demonstrated physical prototyping using tabletop simulator (https://store.steampowered.com/app/286160/Tabletop_Simulator/), Tabletopia (https://tabletopia.com/), and shared whiteboards in Zoom.
- Some students created their task 3 game designs in Tabletop Simulator and Tabletopia. Others continued to create physically using items from their homes whilst others created their game elements in other software. For example, one game was played sharing their screen and the game facilitator moving game pawns and simulating other game activities by showing and hiding layers inside Adobe Photoshop (https://www.adobe.com/au/products/photoshop.html).
- Playtesting was either conducted face-to-face or online using Zoom or Discord.
- In class we would traditionally play boardgames and card games. Instead, we used a combination of activities including:
    - Playing boardgames on Board Game Arena (https://boardgamearena.com/). The tutor purchased a premium account, students had a free account.
    - Free multiplayer, easy to learn, online or mobile games such as krew.io (http://krew.io/) and *Spaceteam* (https://spaceteam.ca/)
    - Werewolf over Zoom following Anjuan Simmons instructions (https://anjuansimmons.com/blog/how-to-play-werewolf-over-zoom/).
    - At the Verdict Party we played games such as *Jackbox Party* (https://www.jackboxgames.com/), *Among Us* (http://www.innersloth.com/gameAmongUs.php), *Werewolf*, and Board Game Arena (https://boardgamearena.com/) boardgames.

COURSE PEDAGOGY

Kahu and Nelson (2018) list four psychosocial constructs that they propose compose the key parts of the educational interface that bring about students' engagement with their studies. These constructs are academic self-efficacy, emotions, belonging, and wellbeing. The core pedagogical belief that drove the creation of this curriculum and the embedded ARG was the psychosocial construct of "belonging".

Many scholars have noted the importance of belonging for academic achievement (e.g. Connell & Wellborn, 1991; Deci, 1991; Earl, Hargreaves, & Ryan, 2013; Osterman, 2000). Belonging is characterised by positive interpersonal attachments and is described as the connection between the student and the institution, the student and the discipline, and the student and people such as their class mates and tutor (Kahu & Nelson, 2018).

This curriculum aims to build a sense of belonging between the students and between the students and the tutor. We address this aim through the ARG's narrative and the "alternate reality" aspect of the ARG. The ARG allows the entire class, tutors and students alike, to experience this alternate reality together. Other aspects of the curriculum also work to address this aim including providing time for student to play boardgames together, the playing and building of icebreaker games, and group work for formative and summative assessment tasks. Learning is a social process, and the ARG, along with the class activities, provides a context for socialisation to occur.

Although our students are tasked with designing serious games in this course, many have never played a serious game outside of the short form learning games (drill and practice, trivia, and puzzle games) typically used in classrooms (Stieler-Hunt & Jones, 2017; Takeuchi & Vaala, 2014). *Against The Authority* ARG provides an opportunity for students to experience firsthand another type of serious game; it helps to develop students' understanding of the educational potential of serious games and the different ways games can be used to encourage learning.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Course Text – Fullerton, T. (2019). *Game Design Workshop: A Playcentric Approach to Creating Innovative Games* (Fourth ed.). Boca Raton: CRC Press, Taylor & Francis Group.

A variety of boardgames for the class to play. Games used include *Pandemic* (Leacock, 2008), *7 Wonders* (Bauza, 2010), *Cleopatra and the Society of Architects* (Cathala & Maublanc, 2006), *Formula D* (Lavaur & Randall, 2008), *Codenames* (Chvatil, 2015), *Tobago* (Allen, 2009), and *Thebes* (Prinz, 2007);

Learning Management Software (LMS) (we use Blackboard) to administer aspects of the game. We use features such as:

- displaying and sharing information (including in the form of "hacked" course slides) with the cohort;
- achievements;
- quizzes;
- adaptive release.

This course requires a website to be used as part of the game. It requires the software and someone with the ability to do basic editing and uploading of web pages.

We used digital tools to create artefacts for the ARG. These could be adapted and changed as required. Here are the types of artefacts we created:

- Simple videos (e.g. https://youtu.be/r15xhumxgGk)
- Artwork created by a third year game design student (student was paid to create these) including logos for The Authority and Against The Authority and designs for student achievements that were used for Blackboard achievements and some were printed as physical stickers (https://tinyurl.com/atastickers).
- An online discussion group that allows the course coordinator to create and post from new accounts for the alternate reality game's fictitious characters. We use Discord and created three accounts to be used to portray game characters: Efficiency Jones (protagonist), Unity Jones (protagonist's cousin), and Agent Conformity Fusion (represents the antagonist).
- A kit of materials that can be used to design and prototype non-digital games (e.g. boardgames, card games, physical games).
- World and Character guide (https://tinyurl.com/atacharacter) designed to be used as a reference for the people acting online as Efficiency Jones, Unity Jones, and Agent Fusion.

COURSE ASSIGNMENTS

The course assignments listed below are a summary of the activities listed in the "Assignments" sections of the week-by-week overviews provided in the expanded course outline. Completing these assignments prepares students to complete the assessment. For example, an understanding of the theory presented in Fullerton (2019) is required for students to complete their first assessment task, a game analysis journal.

Course assignments included:

- reading chapters from Fullerton (2019) or other readings and discussing them on Discord,
- watching prescribed videos and discussing them on Discord,
- documenting group game design activities (e.g. design an icebreaker game),
- documenting playtests of the games designed,
- familiarising themselves with boardgames to be played,
- micro game analyses (e.g. analysing a game in terms of its player experience goal or an aspect of theory), and
- discussing elements of their group's game design on Discord.

COURSE ASSESSMENT

1. **Game analysis journal** (30% individual) – Students are tasked with writing a short analysis of three different games: a game they like to play, a game they would not normally choose to

play, and a serious game. The games can be digital or non-digital. They analyse the game in terms of its intended player experience and other theoretical material outlined in the textbook (e.g. formal and dramatic elements, games as systems).

2. **Serious game design document** (30% total: 25% group, 5% individual) – In groups, students complete a game design document from a template. The document outlines design decisions for their original non-digital serious game and analyses their game using theoretical material outlined in the textbook. Individually, students submit a reflection on the task and outline the contributions everyone in their team made towards the document.
3. **Playtest reports** (20% total: 5% group, 15% individual) – As the students create prototypes of their original non-digital serious game, they conduct playtests of their game. Each student must submit 3 playtest reports for the same game. Accompanying the reports is a summary of changes made to the game throughout the playtesting process.
4. **Prototype & presentation** (20% total: 15% group, 5% individual) – At the end of the semester, the students submit and present their non-digital serious game to a panel. They are marked on how well their game caters to its serious purpose, addresses the needs of the target audience, and meets its player experience goal. They are also marked on the completeness of their game, how well they communicate during their presentation, the quality of their individual contribution to the final product, and their reflection on the group design process. There are some marks allocated to uploading the game as a print-and-play to be shared on the Internet.

Items 2, 3, and 4 relate to the design, testing, development, and presentation of the same original serious game.

How does the course assessment align with the ARG?

Assessment 1 is scaffolded with in-class activities as well as within the ARG. The game's central character, Efficiency Jones, is from a dystopian future and knows nothing about games. At the beginning of the semester, Efficiency Jones uses the class's online discussion group to question students about games they have played. Efficiency has no prior experience with games and can be used to help students write clearer descriptions of gameplay and explain the mechanisms of gameplay.

Assessment items 2, 3, and 4 all relate to the design, playtesting, development, and presentation of the same non-digital serious game. Part way through the semester, the students discover that Efficiency Jones has been arrested by the dystopian future's totalitarian government, The Authority, for playing games that the students designed as part of class activities. The Authority consents to having the students' presentations of their games entered as evidence on behalf of Efficiency Jones. The students are thus tasked with creating and presenting games that can have a positive impact on society and saving Efficiency Jones from The Authority's "re-training".

EXPANDED COURSE OUTLINE

In this section we outline how the class and embedded ARG unfold from week-to-week. The ARG is designed to be responsive to what is happening in the class and as such, activities can be moved around as required. This expanded course outline begins during week 0, which is orientation week. It proceeds through a 13-week semester of 3-hour workshop classes and concludes during the exam

block with presentations and a final verdict party. Each week contains a number of subheadings. The "Class Topics/Activities" section provides an overview of the content covered and the activities offered during the 3-hour workshop. "Key ARG Moments" outlines the main happenings in the ARG that occur during that week. Some of these will take place during class and others will take place between classes (e.g. on the Discord server). The "ARG Preparation" lists the key preparations required in order to engage with the week's "Key ARG Moments". These preparations could be done by one person (e.g. the lecturer) or shared between a team of people. The "Assignments" section lists the work that students are expected to complete between classes. The "Achievements" section lists the key Blackboard Achievements that may be awarded to some students in that week. This document (https://tinyurl.com/ATA-achievements) contains a more expansive list of achievements. Within the text below, asterisked (*) items can be accessed by going to http://www.againsttheauthority.com/artefacts/ and finding the appropriate link.

Week 0: Orientation

Class Topics/Activities

Tutor sends welcome message and invite to Discord server via LMS and email (The link does not actually send students to the Discord server, it instead sends them to a jigsaw puzzle*).

Key ARG Moments

- Efficiency Jones redirects tutor's Discord invite link to the ARG website containing a jigsaw puzzle* of the game logo.
- Completing the jigsaw puzzle unlocks a greeting from Efficiency and a Discord invite link*.

ARG Preparation

- Create online jigsaw puzzle* or similar. We purchased this Canvas Puzzle* and made a puzzle of our Against The Authority logo*.

Assignments

Students:

- Introduce themselves on the Discord server.
- Read pp. 3-11 of Fullerton (2019) which introduces the role of the game designer and discuss on Discord.

Achievements

- The Rabbit Hole – awarded for joining the Discord server
- Ready Player N – awarded when students interact with Efficiency on Discord
- Welcome to SGD100 – awarded for introducing themselves on Discord

These achievements will continue to be awarded over the next few weeks as students join the Discord server.

Week 1: Course Introduction & Player Experience

Class Topics/Activities

Topics:

- Course introduction
- Writing player experience goals based on p. 12 of Fullerton (2019)

Student Activities:

- Play an icebreaker game with the tutor modelling how to conduct and document a playtest.
- Design and create an icebreaker game* in a group and start to complete the game overview document template*.

Key ARG Moments

Occurs during class

- Efficiency inserts several links to the jigsaw into the tutor's slideshow presentation (example*).
- If students prompt the tutor, the tutor may interact with Efficiency's links and explain that they are not sure how the links got there.

Occurs outside of class

- Efficiency interacts with students on Discord and continues to respond to student introductions.

ARG Preparation

- Add links to the jigsaw on several of your slides (example*).

Assignments

Students:

- Finish designing their group icebreaker game. Continue the game overview document template*.
- Prepare to playtest their icebreaker game in class next week. Begin to complete the playtest report template*.
- Read the rest of chapter 1 of Fullerton (2019) and discuss on Discord.
- Watch Gaming can make a better world* and discuss on Discord.
- Choose a game they played recently and propose a player experience goal for it. Share on Discord.
- Watch How I dumped electricity and learned to love design* (optional)

Achievements

- Game On – awarded for week 1 attendance

Week 2: Serious Games

Class Topics/Activities

Topics:

- Introduction to serious games looking through the lens of Stokes (2016) "types of impact" typology and Brathwaite and Schreiber (2009) "by purpose" typology
- Demonstration of games from each category
- Tips for designing serious games
- Time management

Activities:

- Nominate a boardgame to play next week.
- Students playtest their group icebreaker game.

Key ARG Moments

Occurs during class

- Efficiency inserts a slide* with a question for the class regarding serious games. Class responds via Discord.

Occurs outside of class

- Efficiency responds to students as they post their icebreaker game outlines in Discord, questioning when something does not make sense, giving students feedback on their games, and reporting back their play experiences with the game.

ARG Preparation

Add a slide* with a question about serious games.

Assignments

Students:

- As a group, finish the game overview template*.
- As a group, finish the playtest report template*.
- Familiarise themselves with the rules of the boardgame they will play during class next week.
- Upload their icebreaker game overview template to Discord.
- Read chapter 2 of Fullerton (2019) and discuss on Discord.

Achievements

- Serious Gamer – awarded for week 2 attendance

Week 3: Game Structures

Class Topics/Activities

Topics:

- Defining games based on chapter 2 of Fullerton (2019)
- Introduction of formal and dramatic aspects of games and games as systems based on chapter 2 of Fullerton (2019)
- Revisiting player experience
- The importance of referencing

Activities:

- Work as a class or in small groups to decode the message left in the player experience video.
- Play boardgames.

If all students have not finished their icebreaker games, continue playtesting these this week.

Key ARG Moments

Occurs during class

- Efficiency hacks a video* used in class to explore player experience and inserts a coded message into it.

Outside of class

- Students feed the decoded message into a Blackboard quiz (answer is *player experience*).

ARG Preparation

- Produce a video* about player experience that has an encoded message and displays the Against The Authority logo.
- Create a Blackboard quiz* where students can feed the decoded answer from the video. A correct answer to the quiz unlocks the Cracked It Blackboard achievement.

Assignments

Students:

- Read chapter 3 of Fullerton (2019) and discuss on Discord.
- Familiarise themselves with the rules of the boardgame they will play during class next week.
- In Discord, identify a game and its player experience goal and explain how one of the formal

elements contributes to this player experience goal.

- For groups that did not finish their game overview template* or playtest report template* for their icebreaker game, upload these to Discord.
- Upload their icebreaker game instructions to itch.io or similar website.

Achievements

- Structured – awarded for week 3 attendance
- Cracked It – awarded for cracking the code in the video that Efficiency hacked
- Portfolio Starter – awarded for uploading game instructions to the web
- Icebreaker – awarded for designing and playtesting an icebreaker game
- Player Experience – awarded for correctly identifying a game from the player experience video

Week 4: Formal Game Elements

Class Topics/Activities

Topics:

- Formal elements of games based on chapter 3 of Fullerton (2019)
- Analysing a game using the formal elements

Activities:

- Play boardgames.
- Tutor discusses how to begin writing an analysis of a formal element of a boardgame they have played in class. We use Matt Leacock's *Pandemic* (2008).
- In groups, design a physical game*.

Key ARG Moments

Occurs during class

- Efficiency releases a faux-book website to tell students about where (when) they live and puts a link to it in the slides. The website contains two puzzles which unlock further background information via a Blackboard quiz. Class work together on these quizzes.

Outside of class

- Students may solve the Blackboard quizzes on their own.

ARG Preparation

- Remove previous content from the game's web server and replace with something similar to this web page* which contains 2 puzzles. Change the names in the 6 reviews to be the names

of students in your class. We modified this free web template*.

- Set up "A shapely puzzle" Blackboard quiz* which can be solved using the web page*. When completed correctly, it uses Blackboard adaptive release to give student additional information about the future*.
- Set up "E's Review Test" quiz* in Blackboard so that when a correct response is received this content* is released and the Time Traveller achievement is unlocked.
- Add a slide to this week's class presentation that has Efficiency responding to something someone has said in class and links them to the game website (example slide*).

Assignments

Students:

- Read chapter 4 of Fullerton (2019) and discuss on Discord.
- Familiarise themselves with the rules of the boardgame they will play during class next week.
- Continue designing the physical game and completing the game overview template*.

Achievements

- Formal Elements – awarded for week 4 attendance
- Time Traveller – awarded for correctly completing "E's Review Test"

Week 5: Dramatic Game Elements

Class Topics/Activities

Topics:

- Dramatic elements based on chapter 4 of Fullerton (2019)

Activities:

- Play boardgames.
- Tutor presents a finished game analysis based on the class discussion last week. Together, the tutor and the class deconstruct the analysis to help them understand what makes a good analysis for task 1.
- Playtest physical games*.

Key ARG Moments

There is no communication from Efficiency this week as they have been arrested in the future for crimes against society (although the students do not yet know that this has happened, they find out in week 6). The tutor may choose to comment that no slides have been hacked this week.

ARG Preparation

- Efficiency's website is taken down and replaced with a warning from The Authority*.

Assignments

Students:

- Read chapter 5 of Fullerton (2019) and discuss on Discord.
- Familiarise themselves with the rules of the boardgame they will play during class next week.
- As a group, finish the game overview template* for their physical game.
- As a group, finish the playtest report template* for their physical game.
- As a group, upload their physical game instructions to a website such as itch.io.

Achievements

- Dramatic Elements – awarded for week 5 attendance

Week 6: Games as Systems

Class Topics/Activities

Topics:

- Games as systems based on chapter 5 of Fullerton (2019)
- Core game loops
- Verb-noun approach to game design
- Team charters

Activities:

- Play *7 Wonders* (Bauza, 2010).
- Analyse the systems in *7 Wonders.*
- Form groups. They will be in these groups for tasks 2, 3 & 4.

Key ARG Moments

Occurs during class:

- Unity Jones (Efficiency's cousin) inserts a call for help to the class. The lengthy message uses a pigpen cypher. The class collectively deciphers the message and discuss how they can help with Efficiency's trial. Tutor attempts to lead students to suggesting that their final assessment presentations and games be used as evidence in Efficiency's trial.

Outside of class:

- Continue discussions in Discord relating to how the class could help Efficiency.

ARG Preparation

- Add slides to this week's class presentation with Unity's encoded call for help (example

slides*).

- Release a part of the pigpen key in Blackboard*, Discord*, and in another Powerpoint slide*.

Assignments

Students:

- Read chapter 6 of Fullerton (2019) and discuss on Discord.
- Familiarise themselves with the rules of the boardgame they will play during class next week.
- Read an article on values in games and discuss on Discord. Suggested articles Flanagan, Belman, Nissenbaum, and Diamond (2007) and Flanagan and Kaufman (2016).

Achievements

- Game Systems – awarded for week 6 attendance
- Code Breaker – awarded for decoding Unity's call for help

Week 7: Values in games & Conceptualising games

Class Topics/Activities

Topics:

- Values in Games based on Flanagan and Nissenbaum (2014)
- Conceptualising game ideas based on chapter 6 of Fullerton (2019)

Activities:

- Play boardgames.
- Debrief Values in Games.
- Work on assessment in groups.

Key ARG Moments

Occurs during class:

- The Authority inserts a slide to accept the students' proposed legal defense.

ARG Preparation

- Add a slide to this week's class where The Authority accepts the students' proposed legal defense (Note: before doing this step, the students need to decide that their presentations for final assessment could be used in defense of Efficiency Jones).

Assignments

Students:

- Read chapter 7 of Fullerton (2019) and discuss on Discord.
- Familiarise themselves with the rules of the boardgame they will play during class next week.
- Discuss ideas for the game each group will make for their final assessments on Discord.

Achievements

- Values in Games – awarded for week 7 attendance
- Brainstormer – awarded for week 7 attendance

Week 8: Prototyping

Class Topics/Activities

Topics:

- Physical prototyping based on chapter 7 of Fullerton (2019)

Activities:

- Play boardgames.
- Prototype Battleship as outlined in Fullerton (2019).
- Prototype a first-person shooter as a boardgame as outlined in Fullerton (2019).
- Work on final assessment games in groups.

Key ARG Moments

Occurs during class:

- Unity inserts a puzzle leading to a URL with a message from Unity welcoming them to The Resistance.

Outside of class:

- In Discord, students meet Agent Fusion, The Authority representative appointed to oversee the case.

ARG Preparation

- Add two puzzle elements to different slides for this week's class (slide 1 example*, slide 2 example*). The answer to the puzzle is "casenumber". In order to apply that to the URL, the students need to go to last week's slide* to find the case number. In the example slides, the URL would be AgainstThe Authority.com/152120-01-20091305.html
- Add a web page* to the web server that has a message from Unity. The URL needs to be the same as the one decoded using the slides above.
- Add a message (sample message*) to the Discord as Agent Fusion and respond in-character.

Assignments

Students:

- Read chapter 9 of Fullerton (2019) and discuss on Discord.
- Familiarise themselves with the rules of the boardgame they will play during class next week.
- Work on final assessments.

Achievements

- Prototyper – awarded for week 8 attendance
- The Resistance – awarded for finding Unity's welcome to the resistance message

Week 9: Playtesting

Class Topics/Activities

Topics:

- Playtesting based on chapter 9 of Fullerton (2019)

Activities:

- Play boardgames.
- Develop a playtest script and playtest modifications to a pen and paper prototype of *Connect Four* (Wexler & Strongin, 1974) as outlined in Fullerton (2019).
- Work on final assessment games in groups.

Key ARG Moments

Occurs during class:

- Agent Fusion posts a message about how games are a waste of time and detrimental to society. Unity hides a password in this message with bolded letters which unlocks a smuggled message from Efficiency.

ARG Preparation

- Add a slide* to this week's class from Agent Fusion detailing how games themselves were responsible for being banned. This slide also has certain letters bolded.
- Set up a Bb quiz* that requires the student input the bolded letters in the slide.
- A correct answer to the quiz should use adaptive release to unlock a secret message* from Unity and Efficiency

Assignments

Students:

- Read chapter 10 of Fullerton (2019) and discuss on Discord.
- Familiarise themselves with the rules of the boardgame they will play during class next week.
- Prepare a one-minute pitch of their game for assessment to share with the class next week.
- Finalise their player experience goal, serious purpose, and target audience for final assessment game.

Achievements

- Playtester – awarded for week 9 attendance

Week 10: Playtesting for Functionality, Internal Completeness, and Balance

Class Topics/Activities

Topics:

- Playtesting for functionality, internal completeness, and balance based on chapter 10 of Fullerton (2019)

Activities:

- Play boardgames.
- Identifying and discussing game-play issues relating to functionality, internal completeness, and balance.
- One-minute game pitches.
- Work on final assessment games.

Key ARG Moments

Occurs during class:

- The Authority inserts a propaganda slide or two.

Outside of class:

- Continued dialogue in Discord between students and Agent Fusion.

ARG Preparation

- Add one or more slides* to this week's class that are designed to promote The Authority's worldview.

Assignments

Students:

- Read chapter 11 of Fullerton (2019) and discuss on Discord.
- Familiarise themselves with the rules of the boardgame they will play during class next week.

- Work on final assessments.

Achievements

- Balancer – awarded for week 10 attendance

Week 11: Playtesting for Fun and Accessibility

Class Topics/Activities

Topics:

- Fun and accessibility based on chapter 11 of Fullerton (2019)
- Types of fun as outlined in Lazzaro (2009)

Activities:

- Play boardgames.
- Discuss and analyse what makes particular games fun.
- Continue working on final assessment games.

Key ARG Moments

Occurs during class:

- Agent Fusion inserts a slide challenging the students on the concept of fun.

Outside of class:

- Continued dialogue in Discord between students and Agent Fusion.

ARG Preparation

- Add a slide* to this week's class outlining the pursuit of fun as a selfish pursuit.

Assignments

Students:

- Work on final assessments.

Achievements

- Engagement – awarded for week 11 attendance

Week 12: Digital Game Making

Class Topics/Activities

Topics:

- How to get started with digital game making (to prepare students for future courses)

- Tips for making boardgames and writing rules for boardgames

Activities:

- Analyse rulebooks for commercially produced games. Develop a list of what makes a good rulebook.
- Continue working on final assessment games.

Key ARG Moments

Occurs during class:

- Agent Fusion continues to taunt and belittle the students' efforts. Propaganda slides continue.

Outside of class:

- Continued dialogue in Discord between students and Agent Fusion.

ARG Preparation

- Add a slide* to this week's class from Agent Fusion taunting the students.
- Add one or more slides* to this week's class that are designed to promote The Authority's worldview.

Assignments

Students:

- Work on final assessments.

Achievements

- Digital Gaming – awarded for week 12 attendance

Week 13: The Future

Class Topics/Activities

Topics:

- Resources for extending learning and preparing for students' future study and work

Activity:

- Continue working on final assessment games.

Key ARG Moments

Occurs during class:

- The Authority inserts more propaganda slides.

- There is a final communication regarding the monitoring of the final assessment presentations from Agent Fusion.
- Unity inserts a coded slide to indicate their support.

ARG Preparation

- Add one or more slides* to this week's class that are designed to promote The Authority's worldview.
- Add a slide* from Agent Fusion communicating how The Authority will monitor their presentations.
- Add a slide from Unity indicating their support of their work (alternate slide* – requires a Caesar Box cipher* to solve).

Assignments

Students:

- Work on final assessments.

Achievements

- The future – awarded for week 13 attendance

Exam Block: Game Presentations

Class Topics/Activities

Activity:

- Student groups present their games to a panel for feedback as part of their final assessment.

Key ARG Moments

Occurs during presentations:

- The Authority are monitoring presentations using attendees' digital devices.

ARG Preparation

- Issue invitations to the Verdict Party*.
- Replace the current website with a countdown timer* which counts down the time until the Verdict Announcement. We used this JavaScript Countdown Timer*.

Exam Block: Verdict Party

Class Topics/Activities

Activities:

- Play boardgames.

- Order & eat pizza.

Verdict announcement & final awards Key ARG Moments

Occurs during verdict party:

- The Authority announces the verdict to Efficiency's trial using Blackboard, a video, and a website.
- Efficiency leaves a message for students that is unlocked after completing a Blackboard quiz.

ARG Preparation

- Based on the quality of student games and presentations, create a suitable:
    - verdict announcement video*.
    - new faux book website (example 1. Verdict is in favour of Efficiency Jones*, example 2. Verdict is only partially in favour of Efficiency Jones*, example 3. Verdict is not in favour of Efficiency Jones*).
    - Blackboard test that uses clues from the faux book website. Completing the test correctly reveals a message from Efficiency Jones (sample test and message* for a favourable verdict for Efficiency Jones, sample message* for verdict partially in favour of Efficiency Jones, sample message* for verdict not in favour of Efficiency Jones).

Achievements

- The Endgame – awarded for presenting their game as evidence in Efficiency Jones's trial
- World Changer – awarded to all students if the verdict was in favour of Efficiency Jones
- Games as Trainers – awarded to all students if the verdict was only partially in favour of Efficiency Jones.
- Game Over – awarded to all students if they choose not to help Efficiency Jones
- Achiever – awarded to the student who earned the most achievements
- Various awards for qualities of students' presentations

* Go to http://www.againsttheauthority.com/artefacts/ to find the link to this resource.

COURSE BEST PRACTICES

(1) Extra learning opportunities provided by ARG

Integrating *Against The Authority* ARG into the course provided more learning opportunities than were present in previous iterations of the course. For example, the narrative requires students to respond over Discord to antagonistic comments from Agent Fusion regarding the value of games. This provides students with the motivation and opportunity to articulate their perception of how games benefit society. One of our students, commented "I think it helped us explore something more to what we were doing instead of just going through it and creating what everyone else was creating, we create something unique, and it helped us explore why that's important". Further, the narrative

provided an opportunity for individual student group projects to be part of a collective class effort to free Efficiency Jones from prison.

We provided further opportunities for students to learn from *Against The Authority* ARG by including slides at the end of each week's course content that helped students analyse and reflect upon the design of *Against The Authority* in relation to the content for that week (example slides – https://tinyurl.com/ATAdesignnotes).

Inspired by this course, we developed a prequel to *Against The Authority* ARG to be played by high school students in a 45-minute workshop about serious game design. View the workshop outline (https://tinyurl.com/prequelworkshop).

(2) Fictional narrative of ARG aligns to course assessment

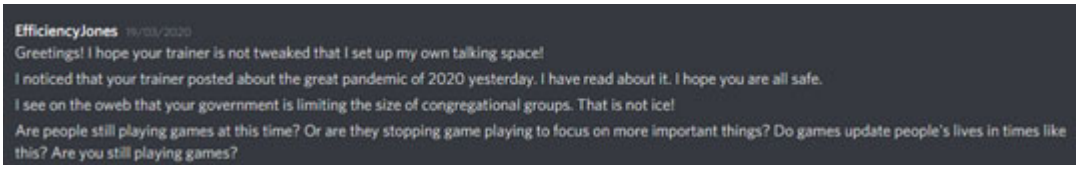
The narrative of the game requires students to present a defense for Efficiency Jones's release from prison. This defense is in the form of students' presentations of the serious games they are making as part of the course's assessment. This alignment of narrative and course assessment makes both the game narrative and the assessment tasks more meaningful and potentially more motivating to students. It also is not creating extra work for students as they will have to complete the assessment tasks anyway. The ARG narrative provides another way for the students to engage with their assessment tasks.

(3) Be adaptable and flexible

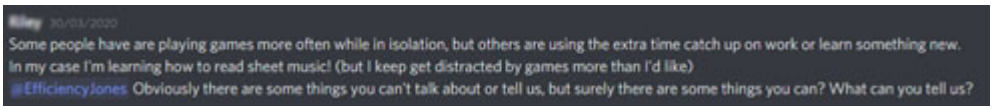
Although we have presented the ARG as it may unfold over 13 weeks of classes, it could be adapted to fewer or more weeks as required. Each time we have run the ARG, it has unfolded slightly differently. Sometimes this was due to student responses and sometimes it was simply due to the tutor not having adequate time to plan activities, because they forgot to do something or because of the COVID19 pandemic. In each case, we were able to adapt the game to make it work.

(4) Show students that their actions have meaning in the ARG

In a well-designed game, players will feel that their decisions matter within the game world. Each iteration of the game would adapt to what is happening in class and also in the world around them. The ARG characters react and respond to the actions of students as much as possible. For example, in 2020 Efficiency Jones posted:



Here is one of the student responses:



We also believe that it is important that students know the game's end is not predetermined and

that their actions and choices within the game affect the outcome. This is something we believe we could improve in the future. Although we have created more than one game ending, to date, all game endings have been the same (a complete win of the game), although we have made some nuanced differences in content to respond to the uniqueness of the students and their circumstances. We also make an effort for "hacked" slides and web pages to refer to students in the class and comments they have made in class or on Discord.

(5) Cater for diversity and different types of student engagement

Our cohort has a high percentage of students with disabilities (nearly 18% of the cohort in 2020 as compared to 6.5% within our wider university population). We also have quite a high acceptance rate of students. Therefore, many of our students may not have felt successful within traditional models of education. *Against The Authority* ARG provides a different way for students to engage with the educational process. Our early research indicates that some students who find traditional classroom environments challenging are able to engage with the ARG more easily and connect with their fellow students, the tutor and the course materials through it as a shared experience.

Within the cohort there will be different levels of interest in the ARG and it may not be evident to the teacher which students are participating. A student that the teacher may think is not terribly engaged, may still be taking the game in and feel quite involved. This type of passive participation can be valuable and still be useful for learning. For example, when asked whether they found the ARG interesting, one student replied "Extremely. Mostly with the … developing story that's been coming out. And more of the interaction between the characters and the class". However, this engagement wasn't obvious to us at the time as the student had only made one game-related post on Discord and was generally quiet in class. What we also could not see at the time, but later learned of, was the time the student was putting into reviewing lecture slides searching for clues and the reviewing of the course content as they did so.

Still other students may not see the game as being a valid part of their learning and may feel frustrated that the game is taking up time in class. Although the game did take up time during class, we tried to minimise the duration of in-class activity each week. We could also do more to help students understand how it is a part of their learning. For the future, we will also be exploring how we can engage more students. We understand that we will not engage every student every week, but we hope to include a wider variety of activities that will involve more students across the whole semester.

(6) Make use of classroom dynamics

In our first iteration of *Against The Authority* ARG, we expected that students would engage with the ARG outside of class of their own accord. However, we found that many of our students were too shy to engage with the game characters over Discord. As a result, the game stagnated. Therefore, we changed our approach and presented more of the game content during class. Students were more willing to participate when prompted as part of wider class discussions. We had discovered in our research into ARGs in higher education that low rates of participation was a common problem (see, for example, Evans, King, Christopherson, Haefele & Sturm, 2010). We had hoped to avoid that by integrating the game into the course content, but further encouragement was required to turn students into players.

(7) Play the game alongside the students

Once the game is running, tutors should also "play" the game as if its real. The tutor should play ignorant and help the students work through the puzzles. The intent is for students to feel like the tutor is playing the game with them rather than just facilitating the game for them. However, there is a delicate balance required between honouring the "This is not a game" aesthetic of ARGs and being honest with the students.

(8) Introduce the ARG as a game

Typically, ARGs take themselves seriously and do not acknowledge that they are in fact games. Despite the ARG's nature of blending with our own reality we have found it to be best to be explicit about the presence and nature of the game, as well as the ways in which the tutor believes the game will benefit the students. We describe the ARG as being like a role-playing game where the students are playing a version of themselves that believes what is happening in the game is real. This may be important for people with mental health issues, so that they understand that the happenings in the ARG are fictional. In some semesters, we have had some students confused about how the teaching materials were being "hacked".

(9) Understand the purpose of each ARG character

Each ARG character is introduced for a purpose. The tutor should be careful to not get side-tracked. For example, students will have a lot of questions about the future. If the tutor is unsure how to answer them it is easy to deflect them. Efficiency and Unity are both young and have limited knowledge and experience to draw from having grown up in an oppressive totalitarian state. Agent Fusion can simply tell students that some by-law forbids them from giving them the information to protect the timestream. Agent Fusion exists to provide opposition to the players. Agent Fusion is there to challenge the students' beliefs and, hopefully, provoke a response. Agent Fusion is arrogant, dismissive and a lot of fun to play. Don't be afraid to use Agent Fusion to push the students. We have always found our students have impressed both ourselves and each other with their responses to these challenges.

When responding to student's questions as a game character, pre-plan forum discussion responses and post responses all at one time. This will give the tutor time to use the appropriate tone and language for the character. If the tutor can post responses at a consistent time each day or week this will become something that students look forward to. There is no need to get into real-time discussions with students — that is not how time travel works. It takes time for these actions to ripple through time (and it is easier for the tutor).

(10) Align your ARG to the skills and technology available

When designing *Against The Authority* we explored the skills of the teaching team and the technology we had available to us. We made use of our learning management platform (Blackboard) extensively, using it in ways that go beyond typical use (e.g. adaptive release after correct quiz responses, regular achievements). The course coordinator had basic web skills and we used those to adapt a web template for the main *Against The Authority* web page.

Running the game will require the tutor to manage multiple discussion forum accounts. We have

found it useful to have one device or application dedicated to responding as the game's characters and another for the tutor to prevent accidental postings as the wrong person, although this may have happened once or twice. We designed the story so that usually only one game character, either Efficiency, Unity or Agent Fusion, is communicating with students at a time to minimise confusion.

We would also recommend creating ARGs for classrooms within a team environment. It is also helpful to run it as a teaching team in order to spread the load. However, post development, we have run the game with just one tutor.

(11) Be careful of red herrings

In our first two iterations of *Against The Authority* we had some random numbers that appeared in games (e.g. a case number). The number itself was not designed to have any significance beyond the game. However, sometimes this would prompt students to look for significance when there was none (and be a waste of their time). One student spent hours scouring the library for a clue, another student made a phone call to a stranger's residence in the middle of the night. For our most recent iteration of the game, we removed random numbers and codes and replaced them with items that were easier to find. For example, the case number became a code related to the *Terminator* movies, another code related to the number plate on the DeLorean in the *Back to the Future* movies (both movies relating to time travel). By doing this, students can still choose to search for the significance of these numbers and codes, but it should not waste too much of their time searching for a significance that does not exist. Similarly, we also changed the agent's name from "Agent Smith" to "Agent Fusion" because students were getting quite sidetracked comparing them to Agent Smith in *The Matrix* movies.

FUTURE COURSE PLANS

In the future, we would like to build more opportunities for students to build rapport with classmates. We are planning to add some optional puzzles to the ARG that will require students to work together to solve them. For example, using adaptive release in Blackboard, a selection of students may receive a part of a cipher key and others may receive another part and so forth. The students will have to work together in order to decode a message.

Our course is changing focus away from serious games to designing games for any purpose, including pure entertainment. Therefore, we are evaluating how we can best shape the ARG's narrative and/or student assessment items to still fit within this new framework. One consideration is that students' final presentations will need to focus on the ethics of their game and the soundness of their arguments will form part of Efficiency Jones's defense within the ARG's narrative.

We are also exploring ways to help students understand how the ARG fits within the course's learnings and incorporate analysis of the ARG as a game as part of student instruction. Currently, we introduce the ARG as a "game" in the first two weeks of classes and from then on, we do not acknowledge that the ARG is a game until after the verdict party. We are planning to introduce several checkpoints throughout the semester where we talk about the ARG as a game and discuss its design. This will serve the purpose of analysing its design and catching students up on anything they may have missed in the ARG so far. We will also use this as an opportunity to explain to students that the outcome of the game itself is not predetermined and their actions and choices will affect the outcome of the ARG.

We are also going to explore is how the ARG can be engaging for a more diverse range of students. We understand that it will not engage every student every week, but we hope to include a wider variety of activities that will involve more students across the whole semester.

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CHAPTER 22.

FOUNDATIONS OF ALTERNATIVE CONTROLLER GAMES (GAME 202)

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Course Title: GAME 202: Foundations of Alternative Controller Games
Course University: University of California, Santa Cruz
Course College/School: Baskin School of Engineering
Course Department/Program: Games & Playable Media / Serious Games MS Programs (Computational Media Department)
Course Level: Graduate
Course Credits: 5
Course Length: 10 weeks
Course Medium: Face-to-face
Course Keywords: Alternative Controllers, Novel Interfaces, Physical Computing, Interaction Design, Arduino, Prototyping, Gamepad

CATALOG DESCRIPTION

This class introduces physical computing and interaction design concepts critical for building novel physical interfaces. It employs a combination of theory and practice ranging from gamepad, circuit, and interaction design to in-class activities, homework assignments, and solo/group projects creating alternative controller games.

COURSE PURPOSE AND OBJECTIVES

Increasingly low cost, availability, and ubiquity of sensors have made incorporating novel technologies into games and their controllers a viable practice for many developers. The resulting alternative controller games have become a popular phenomenon—1) utilizing emerging technologies to expand the scope of digital games through novel material mediums; 2) moving players and designers beyond the screen through diverse and customizable physical interactions; and 3) enabling innovative ways of engaging with both player and spectator through space, objects, and theming.

1. Edward F. Melcer, eddie.melcer@ucsc.edu. Dr. Edward Melcer is an independent game developer, director of the Alternative Learning Technologies and Games (ALT Games) Lab, and Assistant Professor in the UC Santa Cruz Department of Computational Media. He explores the usage of novel gameplay mechanics and emerging technologies (AR, VR, 3D printers, wearables, and so forth) to enhance learning outcomes in educational games.

Foundations of Alternative Controller Games provides an introduction to physical computing and interaction design concepts critical for students to build these novel physical interfaces. It employs a combination of theory and practice, ranging from the basics of gamepad, circuit, and interaction design to in-class activities deconstructing existing alternative controller designs and building circuits to test a variety of switches and sensors. Project-based learning is also applied in the form of midterm and final projects that guide students through building their own novel alternative controller game prototypes, combining numerous electronic components in tandem with Arduino and a game engine—such as Processing or Unity—to create unique player experiences. This course ultimately aims to improve its students' overall game design skills by broadening their perspective and understanding of how the physical affordances of a controller can drastically impact the interactions and design choices that best fit a game.

The specific course objectives to meet this purpose and goals are as follows:

- Develop a set of skills and experience necessary to design meaningful hybrid digital-physical interactions.
- Analyze context and possible applications of custom physical interfaces for digital games, toys and other interactive experiences.
- Understand the differences and relationship between physical and digital affordances with respect to games.
- Employ physical computing concepts (i.e., the application of various sensors and switches) in the creation of alternative controller games.
- Develop a broad toolkit of circuits, code, and so forth that can be combined in various ways to achieve different sensing and feedback outcomes.
- Apply DIY methodologies to incorporate open-source software tools and rapidly prototype physical interfaces/interactions.
- Create game prototypes that utilize customized novel interfaces and alternative controllers.
- Develop unique portfolio pieces (in the form of alternative controller games) that are submittable to relevant game festivals such as IndieCade, Come Out & Play, alt.ctrl.GDC, IGF, PAX, and so forth.

COURSE CONTEXT

Foundations of Alternative Controller Games is currently an elective course offered to graduate students as part of the Games & Playable Media and Serious Games professional masters programs within the Computational Media Department at the University of California, Santa Cruz. It has also been offered previously as an upper-level elective course simultaneously open to both the B.S. in Computer Game Design and B.A. in Art & Design: Games & Playable Media degrees. Notably, due to the novelty of the content for most game design students and the heavy hands-on/project-based nature of the course, the teaching between undergraduate and graduate sections remains almost the same. The main difference being that students in the graduate section are given a bit more leeway on groups, with the option to tackle the midterm and final projects solo if they desire. Furthermore, in both undergraduate and graduate cases, the students that attend this class are generally quite

experienced in making purely digital games, completed a prerequisite introductory programming course, and have some experience creating analog games in the form of board games or playground games. However, these students generally have very little (if any) prior experience designing or playing hybrid digital-physical games. They are also expected to have no real experience with physical computing or prototyping video game hardware. Therefore, the course experience focuses heavily on a broad application of interaction design and physical computing concepts in applied activities rather than diving deeply into electrical engineering or interaction design theory—as students have little prior background in either. I.e., instead of getting 'buried in the weeds' on topics that would derail the ability of the course to enable quickly and successfully building alternative controller games, the teaching emphasis focuses on a practical understanding of how electronic components map real-world phenomena into digital or analog input/output that can be incorporated into games. This is done through 1) presentation of existing alternative controller examples for design inspiration at the beginning of every class; 2) analysis activities (both in-class and for homework) that deeply explore existing systems to develop an intuitive sense for the broad design space of alternative controllers; 3) design activities centered on understanding physical affordances and their relationship to digital affordance for both player and spectator; and 4) in-class prototyping activities that create electronic circuits, arcade game interfaces, simple alternative controllers, and so forth to understand how electronic components work and can be applied in novel physical interfaces.

COURSE PEDAGOGY

This course employs a constructivist pedagogical approach [1,2,3], focusing on problem-based learning [4] and learning through doing [5]—i.e., in the form of group projects, live coding/prototyping lectures, and a variety of in-class activities applying the technology and theory learned earlier in the lecture. This in turn helps students develop their own skills for learning and applying new technology/information outside of the traditional classroom setting. In this constructivist learning approach, rather than treating information and theory as a set of facts that students are expected to merely memorize for a grade, basic principles of game design, interaction design, physical computing, and so forth are taught as tools [6]. These tools can in turn be applied as lenses to critically assess existing systems and/or combined as techniques to build novel interactions into one's own systems. Tying theory to practice also offers three major benefits to students: 1) it develops strong fundamentals for designing and creating interactive systems through practical experience [5]; 2) it provides concrete, interactive examples to ground and enhance theoretical understanding [7]; and 3) it offers the flexibility to creatively experiment with course material through projects that afford a deeper understanding of underlying concepts [8].

The learning through doing aspect of the course also inherently utilizes the DIY method from which its content draws heavily upon [6]. Students are given homework assignments that tie the theory presented in class to practice, providing open prompts that allow for creation and exploration of custom physical interfaces as well as modification of existing games to incorporate novel physical interactions. Most importantly, students are encouraged through extra credit to be creative in their own explorations at the intersection of digital and physical, ultimately learning through failure as they attempt the challenge of simultaneously combining hardware design with game design in a unique way. In this way, students develop valuable practical skills for discovery learning [3] which helps them

move from structured-inquiry to guided-inquiry within the paradigm of inquiry-based learning [9]. To that end, it is critical that this course merges theory, practical examples, and hands-on projects.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Textbooks

- None

Hardware for Students

- *Arduino Starter Kit ($30 – $50)* — There are a number of cheap Arduino hardware starter kits available online that provide both the Arduino microcontroller and a variety of sensors needed for the in-class activities, homework assignments, and group projects. The recommended starter kit is the ELEGOO UNO Project Super Starter Kit, however most are fine. The kits should come with a minimum of the following components to be useful for all class lectures/assignments (most do):
    - 1 x Breadboard
    - 30 x Jumper Wires
    - 10 x Resistors (220, 10k, and 1meg preferred but most resistance values will work fine)
    - 4 x Pushbuttons/Buttons
    - 4 x LEDs
    - 1 x Potentiometer
    - 1 x Passive Buzzer
    - 1 x Photoresistor
    - 1 x Thermistor
    - 1 x Tilt Switch
    - 1 x Ultrasonic Sensor
- *Laptop with Web Camera* — For running software and web camera for AR.
- *Optional Components* – These components are not required for the class or covered in the lectures, but are easy enough to learn how to use and provide additional unique input/output possibilities:
    - Reed Switches
    - Accelerometer and Gyroscope
    - RGB Color Sensor
    - Capacitive Touch Sensor
    - Conductive Rubber Stretch Sensor
    - Linear SoftPot
    - NeoPixel LED Strips

Hardware for Instructors

- *Arduino Starter Kit* — Same as the students' hardware kits for live wiring, coding, and prototyping during lectures.
- *Additional Components and Materials* — These sensors and materials typically do not come with starter kits, but can be purchased relatively inexpensively in bulk from most electronics websites (e.g., SparkFun, Adafruit, and so forth) and returned/used over multiple years:
    - Electret Microphone
    - Piezo Element
    - Capacitors
    - Conductive Tape
    - Electrical Tape
    - Velostat
    - Conductive Thread and Fabric
    - Soldering irons, Solder, and Helping Hands
    - Protoboards
    - 22 AWG Solid Wire
    - Solder Smoke Extractor/Fan

Software

- *Arduino Web Editor (Free)* — Communication with the Arduino microcontroller.
    - https://create.arduino.cc/editor
- *Processing and/or Unity (Free)* — Prototyping of digital games and communication with Arduino microcontroller via serial communication.
    - https://processing.org/download/ | https://unity3d.com/get-unity/download
- *Serial Communication Library for Unity* — If working with Unity, this is a useful GitHub repository that sets up and manages communication with Arduino over serial.
    - https://github.com/kahodesu/Arduino-and-Unity-Are-Friends
    - Arduino Connector Class: https://github.com/kahodesu/Arduino-and-Unity-Are-Friends/blob/master/ArduinoController.cs
- *Fritzing (€8 for Executable, Free from Source Code)* — Circuit diagramming of hardware interfaces and prototypes.
    - https://fritzing.org/download/

COURSE ASSIGNMENTS

In-Class Activities

Each in-class activity is designed to build upon what was taught earlier in that class (and previous lessons) by providing a more creative context to apply the new piece of technology, sensing technique, design analysis, etc. Often involves building the circuit in real time with the class and then live coding the Arduino to use the circuit.

Homework

Each homework assignment is designed to provide additional practice outside of class that reinforces knowledge, skills, and design thinking learned from previous weeks. Homework will focus more heavily on brainstorming and understanding how to apply sensing techniques in novel ways within alternative controller games. Please see expanded course outline for individual homework assignments and objectives.

Presentations

One core aspect of being a game developer that creates alternative controller games is submitting and presenting these games at festivals since festivals are the primary medium to distribute and showcase such work. Learning to give an elevator pitch and quickly present any game (but especially an alternative controller game) is a crucial skill that is typically only developed through experience of doing so. Therefore, many of the homework assignments also come with an in-class presentation component to help students develop their presentation skills and ability to discuss the design of an alternative controller game.

Midterm Project

The midterm project focuses on tying learning content from multiple weeks together in order to produce more complex alternative controller games (i.e., a hardware component using Arduino and a variety of sensors combined with a digital component created in a game engine). It also allows small teams of students to think more broadly about how the various sensing technologies they have learned can be incorporated into games and enables them to apply this knowledge in the creation of a more ambitious **and functional** game prototype than on the homework assignments.

Final Project

The final project builds upon the hands-on skills developed in the midterm, enabling student teams to polish their designs, games, and hardware from either the midterm or a student's previous homework assignment. Student teams are also able to create a new game from scratch for their final project if they desire, but this is not advisable without a strong creative vision for the game before starting. This project also focuses on teaching students how to present their alternative controller work to the outside world and the best ways/venues to do so.

COURSE ASSESSMENT

- Class participation 10% of grade (attendance, discussions, and in-class activities).
- Presentations 10% of grade (presenting certain assignments to the class).

- Homework 30% of grade (each homework assignment counts equally).
- Midterm project 25% of grade.
- Final project 25% of grade.

EXPANDED COURSE OUTLINE

For the latest course materials such as slides, code examples, and so forth please see: http://edwardmelcer.net/teaching/foundations-of-alternative-controller-games/

Similarly, an extensive and up-to-date archive of alternative controller games that can be drawn on for design inspiration and analysis activities can be found here: http://shakethatbutton.com/

Week 1: Introduction and Overview of Alternative Controllers

Class 1 – Introduction to Alternative Controller Games and Concepts

Class Topics/Activities

- Course overview
- What is a controller?
    - Input and output device
    - Combination of mapping and abstraction
- What is an alternative controller? [10]
- Historical examples of alternative controllers in games [11]
    - Shooting Gallery, Joyboard, Power Glove, Power Pad, R.O.B., DK Bongos, Steel Battalion, Wii Balance Board
- Examples of current alternative controllers in games
    - Wiimote and Nunchuck, PlayStation Move and Eye, Microsoft Kinect, Leap Motion, Myo, and Ring-Con™
- What can alternative controllers be?
- Importance of physical interaction [12,13]
- Understanding and designing for affordances of the controller, environment, and body
    - Controller affordances dictate the interactions and design choices that best fit a game [14,15]
- Three unique advantages of alternative controller games
    - Employing diverse forms of input and output
    - Physically theming gameplay
    - Engaging spectators
- How can alternative controllers help your games?
- *10 minute in-class activity*

    - Break into small groups and brainstorm alternative controllers for favorite existing commercial games
    - 5 minutes to brainstorm followed by 5 minutes to share ideas
    - Fun examples to show before or after discussion include:
        - Dark Souls with a Banana Controller (https://youtu.be/v1F58OCqMEI)
        - Exergame version of Katamari (https://youtu.be/6iGhjQH6pOU)
        - AR version of OutRun (https://youtu.be/TaTB5Q11Dzc)

Class 2 – Designing Alternative Controller Games

Class Topics/Activities

- Designing for the body and objects
    - Embodiment [16]
    - Embodied interaction [17]
    - Tangible User Interfaces (TUIs) [18,19]
    - Embodied metaphors [20]
    - Three ways to physically theming gameplay
        - Physical actions mirror the narrative
        - Physical objects act as props to enhance the narrative
        - The transformative power of costumes [21]
    - Incorporating analog technology
- Designing for interactions between the digital and physical
    - Transforms conceptualize a space and describe the relationships between physical/digital actions and physical/digital effects [22]
- Designing for space
    - Manipulating the magic circle [23,24]
    - Embracing and designing for spectators
- Tips for idea generation of alternative controller games
- Tips to keep in mind when creating your own alternative controllers

Assignment: Homework 1 – Game Show Interface Analysis

Game shows have a surprising amount in common with alternative controller games, i.e., utilizing novel interfaces/interactions and designed for spectator engagement. Therefore, game shows are interesting case studies to analyze the designs of. Look up an existing game show interface and analyze how different aspects of the design impact player and spectator experiences. E.g., think about narratives, affordances, physical interactions, gameplay, and emotions that the interfaces evoke.

Create 3 – 4 slides highlighting some of these aspects:

- The first slide should explain how the game show works or have a link to a **short** video that shows the core gameplay
- The remaining 2 – 3 slides should highlight some of the points above
    - Use images, gifs, or **short** video clips of the gameshow to help illustrate your point.

Grading Rubric (Missing any of these will result in the corresponding number of points taken off)

- 2 Points – One slide explaining the game
- 3 Points – Multiple slides analyzing the game (no more than 4 slides)
- 5 Points – In-class presentation

Stretch Goals (Extra Credit)

- 1 Point – Use a game show from a culture outside of the USA or a novel/creative game show

Due by class 3. You will also present these slides at the beginning of classes 3, 4, and 5 (the presentation order will be randomly selected).

Week 2: Introduction to Circuits and the Arduino

Class 3 – Circuit Basics and Software Setup

Class Topics/Activities

- Student presentations from homework 1
- What is electricity?
- Electronic sensors
- Forms of energy
- Conductors and insulators
- Examples of surprising insulators and conductors (such as the Jello piano)
- What is a circuit?
- Ohms Law
    - Voltage, current, and resistance
    - https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law
- Introduction to currents
    - Alternating Current vs. Direct Current
- Introduction to the core tools for the course
    - Arduino
    - Jumper Wires

    - Breadboard
- Understanding how a breadboard works
- *10 minute in-class activity – Setting up the Arduino*
    - Do this activity live with the students following along

Class 4 – Digital Output and First Circuit

Class Topics/Activities

- Student presentations from homework 1
- Digital vs. Analog
- Our first digital electronic component: Light-Emitting Diodes (LEDs)
- Using LEDs for output
- Resistors
    - How they work
    - Reading the resistor color code
    - Why they are important (prevent your components from blowing up)
    - How to calculate appropriate resistance (using an electronic component datasheet)
- Building circuits with Arduino
- *In-class activity – Building our first circuit (making an LED light)*
    - 'Live wire' a simple circuit that connects a red LED to 5 volts, a 220 ohm resistor, and ground
    - Use an external web camera or document camera to display your hands, Arduino, and breadboard on the classroom project screen for students to follow along
- How to control LEDs using code
- *In-class activity – Controlling an LED using the Arduino*
    - 'Live wire' changes to the previous circuit to enable the Arduino to control the LED
    - Live code turning an LED on/off every second
- Adding more LEDs
    - Series vs. Parallel Circuits
    - LEDs in Series and Parallel
    - Old vs. new Christmas lights example

Week 3: Handling and Diversifying Input

Class 5 – Digital Input

Class Topics/Activities

- Student presentations from homework 1
- Understanding digital input and output
- Using switches for input
- Pushbuttons/momentary switches
- Switch contact types
- Pull-up and Pull-down resistors
- *In-class activity – Making a button operated LED with Arduino controlled digital input/output*
    - 'Live wire' button and LED circuits on the breadboard that are connected to Arduino
    - Live code handling digital input from the button and digital output to control the LED
- What is a circuit diagram?
- Fritzing introduction
- *In-class activity – Recreating the Family Feud interface*
    - Watch videos of people using the Family Feud button/buzzer interface
    - Recreate that interface in class to practice circuit diagraming, wiring, and coding buttons as input and LEDs as output
    - The Family Feud interface should have the following:
        - Two buttons (one for each contestant)
        - Two LEDs (one for each contestant)
        - The first contestant to hit their button will cause their LED to light up
        - The other contestant's LED can no longer light up until the Arduino is reset
    - Use Fritzing software to diagram the Button and LED circuits
        - This should be live in front of the class with the students making suggestions and the teaching guiding them to the correct circuits
    - 'Live wire' the circuit based on the Fritzing diagram
    - Live code the Arduino to make the interface function similar to the Family Feud one

Assignment: Homework 2 – Simple Button & LED Game

Design and sketch a hardware circuit overview (using Fritzing) for a game interface that uses multiple switches and LEDs. This could be your own original game creation or a simplified version of an existing game interface (e.g., a trivia game buzzer, a soundless version of Simon, or a slightly reduced version of Cyclone). However, do not do a Family Feud interface since we already covered that in class. Then build a that circuit and write the code to make this interface work.

What's required for submission, a .zip file containing the following:

- An image file showing your hardware circuit overview
- A small writeup explaining what the interface is and how it works (this could be through the submission comments or as a small text document inside the zip file)
- The code for your hardware circuit (it should be a .ino file if you download it from the web editor)
- A short 1-minute video recording showing your working hardware in action

Grading Rubric (Missing any of these will result in the corresponding number of points taken off)

- 2 Points – Sketch of a game interface with multiple switches (1 or more buttons) and LEDs (1 or more LEDs)
- 6 Points – Building a working interface based on the sketch (code and hardware)
- 2 Points – Video documenting the interface and how it works

Stretch Goals (Extra Credit)

- 1 Point – Use 3 or more buttons
- 1 Point – Use 5 or more LEDs (HINT: this will require you to wire them in parallel)
- 1 Point – Make something really fun/creative

Due by class 7

Class 6 – Analog Input and Variable Resistors

Class Topics/Activities

- Debugging a circuit (various approaches)
    - Ensure all individual electronic components are working properly
    - Draw/diagram the circuit
    - Trace the current through your circuit to make sure it is going where you would expect
    - Follow the path of least resistance
    - Check for open or short circuits
    - Use a multimeter
    - Use a circuit simulation program
    - Use the serial monitor in the Arduino IDE/web editor
- What does analog mean?
- Digital vs. analog
    - Digital provides discrete values (on/off or 1/0)
    - Analog provides continuous ranges (0 – 255 or 0 – 1023)

- Switch vs. sensor
- How Analog works with the Arduino
- Variable resistors
- Potentiometer
- How a potentiometer works
- Different kinds of potentiometers
- Introducing the Serial Monitor in Arduino
- *In-class activity – Making a potentiometer with serial debugging*
    - 'Live wire' the potentiometer circuit feeding into one of the Arduino's analog input pins
    - Live code reading the analog input and printing the values to serial for debugging
    - Show how to use the serial monitor to see the values written there
- Using variable resistors
- Photoresistors (LDR)
- How a photoresistor works
- Everyday usage of photoresistors
- Game usage of photoresistors (light guns)
- Voltage divider circuit – The heart of using variable resistors
- The magic of variable resistors
    - Same circuit and same code, but different sensing capabilities based on what variable resistor we are using
- *In-class activity – Using variable resistors*
    - 'Live wire' a photoresistor circuit
    - The code from the earlier potentiometer function is the same so we can just reuse that
    - Show how changing the light levels (by covering the photoresistor) changes the values
    - Swap the photoresistor with a thermistor
    - Show how we can now detect changes in temperature
- Using flex/bend sensors for input
- How a flex sensor works
- Game usage of flex sensors (Power Glove)
- *In-class activity – Creating a 'soft' flex sensor from scratch*
    - Flex sensors are not the cheapest variable resistors, but luckily we can actually make our own from scratch to better understand how they are varying resistance
    - Requires velostat, single-sided conductive tape, foam, electrical tape, and hot glue

    - Break students up into groups of 2 – 4 and have them follow the instructions here to create their own flex sensor: http://edwardmelcer.net/teaching/foundations-of-alternative-controller-games/supplemental-materials/flex-sensor-worksheet.pdf

Week 4: Analog Output and Advanced Analog Techniques

Class 7 – Communicating to the Player with Analog Output

Class Topics/Activities

- What is pulse width modulation (PWM)?
- Duty cycle
- PWM pins on the Arduino
- *In-class activity – Making a fading light with analog output*
    - 'Live wire' a simple Arduino controlled LED circuit
    - Make sure that the anode of the LED is connected to one of the PWM pins on the Arduino
    - Live code changing the brightness of the LED using analogWrite
- *In-class activity – Controlling an RGB LED*
    - 'Live wire' a RGB LED circuit with the r, g, and b pins each connected to a different PWM pin on the Arudino
    - Live code changing the color of the LED by changing the brightness sent to the r, g, and b pins
- How does sound work?
- Understanding your speakers
- What are piezo elements?
- How piezo buzzers work
- Passive vs. active buzzers
- Controlling tones with the Arduino
- *In-class activity – Making music with a passive piezo buzzer*
    - *'Live wire' a passive piezo buzzer circuit*
    - *Live code playing a short (8 note) melody on the buzzer*

Class 8 – Advanced Analog Techniques: Calibration

Class Topics/Activities

- What is a theremin
- How does a theremin work
- Emulating a theremin with a photoresistor and buzzer

- *In-class activity – Creating a simple light theremin*
- Use Fritzing to 'live draw' the circuit for the light theremin with the guidance of the class
    - 'Live wire' a simple circuit with a photoresistor and passive piezo buzzer connected to the Arduino
    - Live code the simplest solution for the theremin
        - I.e., take the raw read value from the photoresistor (between 0 and 1023) map it to an audible pitch range for the buzzer (between 50 and 4000)
        - Then change the mapping to an index for an array of note pitches to play a simple c scale (between 0 and 7)
    - Use serial debugging and the Serial Monitor to highlight how photoresistor values do not cover the full range of 0 – 1023 and therefore does not play all the notes no matter how hard we try
    - Photoresistors are highly dependent upon lighting conditions
- Handling different lighting conditions
- Different kinds of calibration
- Calculating and using calibration values
- Improving our light theremin
- *In-class activity – Calibrating the simple light theremin*
    - Live code how to calculate the average, low, and high read values from a photoresistor at setup
    - Use the high and low read values to change the mapping range from 0 – 1023 to low – high
    - Show how this calibration allows us to now play all the notes now using our light theremin
- A quick recap of the many electronic components we know how to use now
- What components we will learn about in the next few weeks
- Tools for brainstorming alternative controller game ideas
    - Generominos: http://www.galaxykate.com/generominos/
        - An interesting way to conceptualize interactive systems
        - The many ways data can be transformed from input to output
- Iterative design
- Different prototyping techniques
    - Ideation/mental simulation
    - Bodystorming
    - Physical/paper prototyping

Assignment: Homework 3 – Brainstorming Arduino with Processing Games

Brainstorm 2 potential games or interactive experiences that use Arduino and Processing/Unity for your midterm project. These can be entirely original or (substantial) expansions on existing prototypes you made. You can use any hardware for the Arduino, even if we haven't covered it in-class. Make sure to bodystorm the interactions to ensure that they are physically reasonable for the player.

Submit a google document with at least 1) a 1 sentence elevator pitch, 2) a list of electronic components the game would need to work, and 3) a 1 paragraph explanation for each game/experience idea to elaborate on how it would work. You will then be asked to pick and present your favorite of the two ideas for 1 minute to the class on 2/4.

Grading Rubric (Missing any of these will result in the corresponding number of points taken off)

- 4 Points – First brainstormed game/interactive experience that uses both Arduino and Processing
    - This must include a 1 sentence elevator pitch, a list of electronic components the game would need to work, and a 1 paragraph writeup explaining the game in more detail
- 4 Points – Second brainstormed game/interactive experience that uses both Arduino and Processing
    - This must include a 1 sentence elevator pitch, a list of electronic components the game would need to work, and a 1 paragraph writeup explaining the game in more detail
- 2 Points – In-class presentation (1 minute MAX)

Stretch Goals (Extra Credit)

- 2 Points – Make and include a circuit diagram/overview for each game on your google document

Due by class 10. You will also give a 1-minute elevator pitch to the class for your favorite of the two game ideas (the presentation order will be randomly selected). Use this to help recruit teammates or find a team you would be interested in joining for the midterm project.

Week 5: Getting Serial – Communication with Arduino and Processing

Class 9 – Advanced Analog Techniques: Thresholds

Class Topics/Activities

- Using a sensor as a switch
- Thresholds
- *In-class activity – Miniature lamp post*
- Use a photoresistor and LED to mimic the functionality of a lamp post, i.e., when it gets dark the light turns on and when it gets bright the light turns off
    - 'Live wire' a circuit with a photoresistor and LED with the class

    - Live code the simplest solution first with a hard threshold
    - E.g., if value drops below 500, then turn light on
    - Dim the lights and restart Arduino to show that this kind of threshold is highly dependent upon lighting conditions
    - Refine code to use a relative threshold based on the calibrated average photoresistor value from last week
    - Show how this works regardless of lighting conditions
    - Show that there is still an issue with the LED flickering if the light level is near the threshold
- "Switch bouncing" and the wobble effect
- Using debouncing to avoid the wobble effect
- Multiple (state dependent) threshold to avoid bouncing with our photoresistor values
- *In-class activity – Refining the miniature lamp post*
    - Live code a more complex thresholding solution that keeps track of the current lamp state and uses high/low relative thresholds to prevent bouncing
- What is piezoelectricity?
- Piezoelectric materials
- Detecting vibration with piezo elements (disk)
- *In-class activity – Using a piezo element*
    - Live wire a simple piezo and LED circuit
        - It is helpful to tape the piezo element to the table to get better vibration readings
    - Live code tweak the refined threshold code from the miniature lamp project to only turn the led on if there is a certain amount of vibration

Class 10 – Sending and Receiving Data via Serial Communication

Class Topics/Activities

- Student presentations from homework 3
- What is serial communication?
- How serial communication works
- Using serial data for communication between Arduino and Processing
- Sending serial messages from Arduino to Processing
- *In-class activity – Whack-A-Mole game*
    - Build a simple single button interface with Arduino that sends a message to Processing when the button is pressed or released
        - 'Live wire' a simple 1 button circuit

        - Live code reading that value on the Arduino and sending it to Processing via serial write
        - Refine code to only send data over serial when the button state changes (to save valuable bandwidth)
    - Build a simple infinite Whack-A-Mole game in Processing that tries to whack the mole whenever it receives a button press message from Arduino via serial
        - Make sure to provide students with the assets they need to make this work before class
        - Live code receiving the Arduino value via serial read
        - If the player pressed the button when the mole was up, it disappears and
- Sending serial messages from Processing to Arduino
- *In-class activity – Light Mapper*
    - 'Live wire' a simple 4 LED circuit and connect it to the Arduino
    - Live code the Arduino to read an integer over serial (between 0 and 3) and turn on the corresponding LED while turning off all of the others
    - Live code a simple Processing application that maps the x position of the mouse to a value between 0 and 3
- Students form teams for midterm project

Assignment: Midterm Project

Using your brainstormed game from homework 3 as a starting point, form teams of 2 – 5 students to create an alternative controller game or interactive experience that has a hardware component with the Arduino and a software component running a game on a game engine such as Processing, Unity, or UE4. The hardware component **must use a minimum of two different electronic components**. Solo projects are allowed but must be approved by the instructor first.

What's required for submission, a .zip file containing the following:

- An image file showing your hardware circuit overview
- A small writeup explaining how the game works and how to play it (this could be through the submission comments or as a small text document inside the zip file)
- The code for your hardware circuit (it should be a .ino file if you download it from the web editor) and code for your digital game
- A short 1-minute video recording showing your working game in action

Grading Rubric (Missing any of these will result in the corresponding number of points taken off)

- 1 Point – Hardware circuit overview
- 1 Point – Writeup explaining how to play the game
- 2 Points – Code for hardware and software

- 4 Points – A fully functioning game with digital and hardware components
- 2 Points – Video documenting the interface and how it works

Stretch Goals (Extra Credit)

- 1 Point – Make a highly creative or polished game

Due by class 14. You will also give a live demo of the game in a class playtest session.

Week 6: Faking Sensing and Midterm Project Development

Class 11 – Faking Sensing

Class Topics/Activities

- Faking sensing – degrees of separation between perceived input method and actual sensor detection
- Examples of faking sensing
    - The Nintendo DS detecting how hard a player blew on the microphone
- Understanding analog sound and transducers
- Using electret microphones
- In-class activity – Using an electret microphone
    - 'Live wire' a simple electret microphone circuit
    - Live code a simple program to read the analog values from the microphone and print them to serial
    - Use the Serial Monitor to show the sound waves that are created when the microphone picks up noise
- Finding peak values
- In-class activity – Creating a 'fake' breath sensor
    - 'Live wire' your electret microphone circuit a bit further to add an Arduino controlled LED
    - Live code a simple algorithm to detect the peak value of a sound wave and turn an LED on relative to the strength of the sound wave's peak value
    - This creates a 'fake' sensing effect where it appears that strength of breath is being measured, but it is actually just measuring noise levels

Class 12 – Midterm Project Development

Class Topics/Activities

- Break into Midterm project groups and work on games
- Instructor goes from group to group checking on progress and offering suggestions

Week 7: Sensing Motion, Distance, and Midterm Presentations

Week 13 – Sensing Motion and Distance

Class Topics/Activities

- How does sonar work?
- Using ultrasonic distance sensors detect the distance of objects
- *In-class activity – Sensing distance*
    - 'Live wire' the ultrasonic distance sensor
    - Live code a simple program to read the distance values and print them to serial
    - Show how the sensor can detect the distance from an object
- Detecting tilt motion
- How tilt sensors work
- Using tilt switches as an alternative to accelerometers
- *In-class activity – Building a custom motion controller*
    - Accelerometers are expensive and not the easiest piece of hardware to work with. Luckily, if we just care about the direction of motion (and not the speed of it) then it's possible to instead use tilt sensors to create a motion controller.
    - 'Live wire' two tilt sensors to different sides of the breadboard to detect when the board is tilted left, right, or is level
    - Live code a simple program that prints the state of the breadboard's motion to serial
    - If there is extra time, create a simple Processing sketch that allows the breadboard motion to control the movement of an onscreen object

Class 14 – Midterm Project Demonstration/Playtest Event

Class Topics/Activities

- Break into Midterm project groups and demo/present midterm projects
- Students can go around and play the games from other teams
- Instructor goes around to grade all midterm projects

Week 8: Sensing Objects through Computer Vision: Engaging with Objects and the Body

Class 15 – AR and Computer Vision

Class Topics/Activities

- What is augmented reality?
- Examples and discussion of AR games
- Window-on-the-World (WoW) vs Word-as-Support (WaS) interaction paradigms for AR [25]

- Understanding infrared and computer vision
- Commercially available technology for broader distribution (camera and Kinect)
- Detecting the body with Microsoft Kinect
    - Video examples
- In-class discussion of why it failed
- Fiducial markers and tracking objects with reacTIVision, TUIO, and processing
    - Video examples
- Face detection and tracking with Ketai OpenCV and Processing
- In-class activity – Building an AR mask application
    - Live code an application that draws a mask image over a person's face when it is detected using computer vision
    - Use the Ketai library in Processing to perform basic face detection with a web camera
    - When the library detects a face, draw a mask image over it
    - Give students time and flexibility to find their own mask images online and customize their applications
- Discuss Final project

Assignment: Final Project

Form new teams of 2 – 5 students per project (or keep the original team from the midterm project). Solo projects are also allowed with instructor approval. Either continue working on finishing/polishing the midterm project, choose a past homework to develop out further into an alternative controller game, or create a new alternative controller game from scratch. Purely physical alternative controller games are allowed for the final.

What's required for submission, a .zip file containing the following:

- An image file showing your hardware circuit overview
- A small writeup explaining how the game works and how to play it (this could be through the submission comments or as a small text document inside the zip file)
- The code for your hardware circuit (it should be a .ino file if you download it from the web editor) and code for your digital game (if there is one)
- A short 1-minute video recording showing your working game in action

Grading Rubric (Missing any of these will result in the corresponding number of points taken off)

- 1 Point – Hardware circuit overview
- 1 Point – Writeup explaining how to play the game
- 2 Points – Game code
- 4 Points – A fully functioning alternative controller game

- 2 Points – Video documenting the game and how it works

Stretch Goals (Extra Credit)

- 1 Point – Create a video trailer of the game (for portfolio documentation and submission to festivals in the future)
- 2 Points – Submit the game to an actual festival
    - Good festivals for submission include: alt.ctrl.GDC, IndieCade, IGF, Come Out & Play, Bit Bash, and A MAZE.

Due by class 20. You will also give a live demo of the game in a class playtest session.

Class 16 – Final Project Development

Class Topics/Activities

- Break into Final project groups and work on games
- Instructor goes from group to group checking on progress and offering suggestions

Week 9: Making Robust Alternative Controllers: Soldering and Conductive Thread

Class 17 – Soldering and Conductive Thread

Class Topics/Activities

- What could go wrong? Challenges in public display deployments [26]
- Taxonomy of six categories for things that can go wrong with public displays
    - Weather, events, surroundings, space, inhabitants, and vandalism
- Discuss ways to make alternative controller games more robust
- Basics of soldering
- Explain various soldering tools
- Discuss proper way to solder and soldering techniques
- The LilyPad, wearables, and conductive thread as an alternative to solder
- In-class activity – Soldering practice (ONLY under instructor supervision)
    - Please ensure that the proper safety materials are present before starting the activity
        - Solder smoke absorber, a clear desk space with no nearby flammable materials, a bucket of cold water in case of burns
    - Students do not have to participate if they do not want to
    - Set the soldering space up at the front of the classroom for easier supervision
    - Setup several protoboards, soldering irons, solder, soldering fans, jumper wire, and helping hands
    - Allow students to take turns soldering 22 AWG solid wire to the protoboards under

direct teacher supervision

Class 18 – Final Project Development

Class Topics/Activities

- Break into Final project groups and work on games
- Instructor goes from group to group checking on progress and offering suggestions

Week 10: Final Project Polish and Playtest Presentations

Class 19 – Next Steps: Showcasing Alternative Controller Games

Class Topics/Activities

- Who accepts alternative controller games work?
- Festivals, festivals, and more festivals
    - There are so many festivals that support alternative controller games
    - IndieCade, alt.ctrl.GDC, Bit Bash, Come Out & Play, A MAZE., Makers Play, etc.
- Creating a portfolio of work
- Strong alternative controller game portfolio examples
- Creating enticing gameplay trailers
    - Software for creating gameplay trailers
    - Tips for creating gameplay trailers
- Work in Final Project groups

Class 20 – Final Project Demonstration/Playtest Event

Class Topics/Activities

- Break into Final Project groups and demo/present final projects
- Students can go around and play the games from other teams
- Instructor goes around to grade all final projects

COURSE BEST PRACTICES

Tips and Tricks

- 'Design inspirations' in the form of existing alternative controller games can be extremely useful for both students and instructor. Providing students with examples of 1 – 2 existing alternative controller games as design inspirations at the beginning of class is 1) highly engaging for the students, 2) expands their repertoire of alternative controller game designs, and 3) gives the instructor an opportunity to prime the students for the piece of technology they will be working on that day. For instance, showing students a video of Donkey Konga and the DK Bongos on the same day that the piezo element (detects vibration) is introduced

provides a nice lead-in to talk about that electronic component for the class lecture.

- Whenever introducing a new electronic component (e.g., photoresistor, piezo, microphone, and so forth), it is useful to also incorporate video/GIF examples of games that have utilized these components. This helps students to ground their understanding of how these components work in an applied context and provides them with additional design inspirations for their own games.
- Learning to prototype circuits is difficult for students with no prior experience to understand, even with pictures, videos, and circuit diagramming software such as Fritzing. One way to greatly help students in understanding how to build a certain circuit is to do 'live wiring' during class lecture. I.e., setup an overhead camera (such as a document scanner camera), and use it to project the breadboard, circuit, and your hands during class while you are wiring a circuit.
- Another nice trick to use, if time permits, is to 'live draw' the circuits in Fritzing with the class before wiring them or coding in Arduino. This is a time-consuming process, so it is not ideal to do for every circuit that is wired in class. However, it is useful for teaching more conceptually difficult concepts such as series and parallel circuits.
- Providing real-world contexts and application areas for alternative controllers can serve to greatly motivate students and help them view their work as more relevant. Giving extra credit on the final project for submitting their alternative controller game is one nice potential way to add motivation for students and help them to build a quality game portfolio.
- For the homework assignments, providing stretch goals in the form of extra credit tasks is a nice tool to address a broader range of students in the class. While the homework should not be too difficult, the stretch goals can provide additional outlets of exploration for students that are excelling and similarly motivate other students to attempt/learn from more challenging tasks once they have completed the core homework assignment. Adding extra credit for creativity or polish is also great since it encourages the students to explore more and further engage with their game designs.
- For homework assignments that were not presented to the class, it is also nice to highlight a few strong homework submissions at the beginning of class. Students generally enjoy seeing the great work done by their peers and it serves as extrinsic motivation. Make sure to highlight as many different students' work as possible through the course.
- Sometimes is it helpful to take a problem-based learning approach [4,8] for certain classes, such as when teaching advanced analog techniques like calibration and thresholding. Since these techniques provide solutions to common problems, it is helpful to start by creating the problem and using that to ground student understanding of the technique. For instance, when introducing calibration, the class starts out with the simplest circuit and code solution possible to create a light-controlled theremin. The class then proceeds to discuss the issue and iteratively refine the light theremin (using calibration) until it functions much better—such as being able to adjust to different lighting conditions.
- Some students may be color blind, which makes reading resistor color codes nearly impossible. There are a number of mobile apps that can take a picture of a resistor, determine the color codes, and identify the resistance. It is good practice to mention or even show one of

these apps when first introducing resistors.

Pitfalls

- 'Live wiring' and live coding are fairly intensive processes where students can easily fall behind. It is important to check with students after every couple of wiring steps or lines of code to make sure that they are caught up and conceptually understand what just happened. It is also extremely helpful to have teaching assistants in the classroom to aid students who have fallen behind or are less comfortable with programming/physical computing concepts.
- Space is a very valuable resource for courses such as this one which rely heavily on hands-on activities. Ensure that the classroom reserved for this class is a lab room or has a large, shared desk for each row of students. In the past, this course was taught in a classroom that only had individual desk chairs, and that was not nearly enough space for a laptop, electronics kit, and Arduino/breadboard.
- One assignment that did not work extremely well in the past was to create a video trailer of the final project game. While this was beneficial as it helped students to document their games more formally and provided them with more submission material for festivals, it also proved difficult for a number of students to create a video trailer in a short one-week span. Making non-game design/development assignments optional (or for extra credit) can prove more flexible in providing additional challenges to students that are excelling in the class while alleviating pressure on those that are struggling a bit more.

Alternative Controller Game Examples from Past Courses

- *HyperMasculinity* by Fernando Tapia, Cory Super, and Charisse Lo
    - https://youtu.be/ox-30ISmpiM
- *Sengoku Rhythm* by Eisaku Imura and Hesiquio Mendez Alejo
    - https://youtu.be/Gk7FH0l9Wug
- *Beat Shift* by Bradley Matias
    - https://youtu.be/MVs-ZCFF6CY
- *Laser Archery* by Andrew Cousins and Mallory Strout
    - https://youtu.be/PGS1Gm5c1so

FUTURE COURSE PLANS

Alternative controller games have continued to grow in popularity in recent years, with venues such as alt.ctrl.GDC and Night Games at IndieCade garnering major attention. With this rise in popularity comes additional polish and novel approaches that push the boundaries of 'alternative controller'. In order to support the broad range of potential games and interactive experiences that could incorporate alternative controllers, there are a number of potential directions, topics, assignments, and so forth that the course could address, including:

- Accessibility is perhaps the single most important application area that this course does not

currently cover for alternative controllers. By enabling designers to control the physical affordances of a controller, alternative controllers have enormous potential to bring greater accessibility to gaming. Future iterations of the course should incorporate a class on designing for accessibility, as well as an assignment to create an accessible interface for a popular commercial game.

- An assignment focused on repurposing existing analog technology (e.g., adding sensors to a bike, couch, or television or even providing new ways to control a sewing machine or 3d printer) could prove challenging and fun.
- Teaching how to use and incorporating fabrication technologies such as sewing machines, 3d printers, and CNC machines. This would enable students to create far more polished interfaces for their games and provide them with valuable new skills for the future.
- Escape rooms are a very common application of novel interfaces and alternative controller technologies, so a class discussing the design of escape room puzzles would be valuable. Furthermore, escape room technologies are almost always purely physical (no digital screen component). Therefore, an assignment to create technology for an escape room puzzle would present a useful set of design challenges that contrast well with the physical interface/digital game requirements for the midterm project.
- Increasing emphasis on wearable technologies, switching from the standard Arduino to the LilyPad Arduino or Circuit Playground (which are better suited for projects with e-textiles and wearables but still offer similar functionality to a standard Arduino), and exploring the concept of playable fashion.
- Live action role-playing games (LARPs) are a type of role-playing game where participants physically portray their characters to enact the plot of a game [27]. Notably, employing wearables to enhance and support the LARP experience has become increasingly more accessible and popular. Therefore, a class discussing technologies currently employed in LARPs and an assignment to build a LARP wearable could be a fun task that exposes students to other interesting tools/materials such as EVA foam.

Ultimately, this class addresses a wide range of games, communities, and applications that are generally ignored by most commercial game companies. As noted above, there are a variety of ways this course could evolve over the next 3 – 5 years to better address these often overlooked but quickly growing application areas.

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CHAPTER 23.

LEVEL DESIGN (1145ME)

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SÖDERTÖRN UNIVERSITY

Course Title: 1145ME: Level Design
Course University: Södertörn University
Course College/School: Natural Sciences, Technology and Environmental Studies
Course Department/Program: Media Technology
Course Level: Undergraduate
Course Credits: 7.5 ECTS credits
Course Length: 5 weeks (100% of students' time is dedicated to the course)
Course Medium: Face-to-face *(the latest run was held online because of COVID-19 restrictions)*
Course Keywords: Level Design, Light Design, Environmental Storytelling, Architectural Approach to Level Design, Project-based Learning, Problem-based Learning

CATALOG DESCRIPTION

The course participants are to obtain theoretical and practical skills for level design, by designing their levels – both conceptually and in practice. The practical elements are combined with theoretical ones where; theory and method of level-design are applied to the design work.

COURSE PURPOSE AND OBJECTIVES

The purpose of the course is to let students learn the theory and practice of level design. The current version focuses on Totten's (2019) architectural approach to level design as a main theoretical and methodical framework for level design.

The learning goals are the following:

- Describe the concept of level design and what it includes,
- Summarize theories and methods of level design,

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- Apply theories and methods of level design in practical level design work,
- Design and create levels for different parts of a game and adapt them to the overall vision and basic mechanics of the game.

This level design course focuses on level design, which we mean is the design of game scenes or levels, which in turn consists of defining the game space, placement of assets, obstacles (such as guards, traps, puzzles). The lighting and how storytelling is implemented in the scene/level is considered to be a part of the level design.

The course has its theoretical, methodological, and conceptual bases in architectural and spatial design as well as theatre light design and level design (e.g., the concepts of critical path and intensity ramping). The purpose of the course is to let students learn systematic ways to think about game architecture and spatial design as well as introducing language to talk about level design. In addition, the course aims to develop practical level design and development skills.

Lastly, because the level design is typically a group effort (at least in AAA games) conducted in large design teams, the course also aims to build group work and cooperation skills within the context of level design.

COURSE CONTEXT

The level design course belongs to the Game Development Program, within the media technology subject, at Södertörn University, Sweden. The program is at an undergraduate level that requires no prior experience in game development. The program has two specializations: game design and scripting and game art. Students in both specializations study for the most part together, with the exception of two specialization courses which they study separately. The level design course is an obligatory course for the students of both specializations. Additionally, the course takes place in the spring term of the first study year. Prior to the level design course, there are multiple courses focusing on game development, game design, scripting, and game art, which provides the students with a basic skill set of tools, design, and project management.

We had the course for the first time in 2012, and the course has gone through various iterations. While the course has provided sufficient tasks for the art students, the tasks for design students have evolved. With the early course designs, students spent too much time on game design and focused too little on actual level design.

The first iteration we tasked students to do level design to the games they developed in an earlier game design course. This course design had two major flaws: 1) not all games were mature enough for level design, so some student groups spent too much time on other things than level design, such as revising and improving the foundation of the game; 2) within the course set-up it was hard to guide students in how to work towards the learning goals of the course. For the second major iteration of the course, Dr. Lankoski developed a Unity project for an exploration game and tasked the students to create games based on that Unity project and its game design.

During the first run, we had smaller student groups (size of groups may benefit the text) developing their own game. In the next iteration, we had the full class working on the same game. Here, the class

split into groups of approximately five to six people, each making a level within the game. This set-up started to offer design challenges requiring cooperation with various level design teams. However, the project itself did not naturally guide students to different kinds of level design tasks. Lighting design was one of the aspects that could be neglected with the project.

The last major iteration involved a Unity project where we put in specific gameplay features (following the horror/stealth genre) so that students would encounter a more diverse set of design challenges, such as lightning design, environmental storytelling and building atmosphere according to a pre-specified game genre. We also went with two person groups: a designer and a graphic. This helps with the individual assessment.

COURSE PEDAGOGY

A *problem-based design* has been used in the level design course, where the practical level design task proposed a central field for learning. The course design is based on the idea of *constructive alignment* (Biggs & Tang, 2011), which means that assignments, assessment and learning goals are aligned so that everything in the course drives towards the learning goals. As stated in Allen et al. (2011), it is important to design the learning challenges so that they foster utilizing conceptual frameworks. In order to facilitate conceptual, as well as methodological, understanding of level design, students write reflective texts about their designs where they are expected to connect the frameworks from the course literature to the practical work.

The level design project is designed so that it gives multiple design problems tied to the learning goals of the course, and the practical work in conjunction with the course literature is the focal point of learning. A lecture of the beginning of the course introduces the course goals and design challenge as well as tools to be used during the level design project.

At this point, previous courses have covered fundamentals of the used development tools (e.g. Unity, Maya), project management, and game design / graphical design / programming, we do not need to cover these aspects. We have a workshop with a focus on technical skills (3D modeling of environmental art for graphics and lighting in Unity for design and scripting students) during the first week but these are not in the core of learning objectives of the course. We cover these in order to facilitate the learning of the core course topics. The emphasis of teaching is then placed on supervision, by guiding students during the development phase and providing continuous feedback on their concepts and level design. Thus, helping students with technical issues as well as giving design critique functions as a teaching method where the primary engagement is the discussion between teacher and student in line with the design project.

During the final phase of the project, we have a critique session where students get critique from teachers and other students (within the same class). We have also had professional level designers join for a guest lecture and provide critique to the students' level design.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Course Literature

- Totten, C. (2019). Chapters 1 and 3–9.

- Salzberg, J.E. & Kupferman, J. (2018). Principles of composition, Functions of stage lighting and Qualities of light parts.
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Software

The online platform itsLearning is used in conjunction with contact teaching and learning environments.

The last run of the course was fully online where we used Zoom for lectures and Discord for supervision and project communication.

The course uses Unity (Unity Technologies) as a development tool and game engine and Perforce (Perforce Software, Inc.) for version control.

Game and Tools

On the top of the Unity software, we have built the basic framework of the game project which contains the core mechanics of the game and a level design tool to be used throughout the course. The Unity project that the students get has the following features (some mechanics are demonstrated on video https://www.youtube.com/watch?v=OPIwVcOe3k0):

1. A level editor for creating rooms and corridors and placing them. The level editor is also used to place and configure functional assets (such as door controls) that come with the project.
2. Doors, locks, keys. The locks are not functional before completing a specified task of interacting with two objects (keys).
3. Monsters that patrol, chase and attack the player character, but cannot take damage nor die.
4. Robots that patrol areas and can be activated and guided to go to predefined target locations. The monsters also follow robots and try to attack them if they see those.
5. Mines to prevent movement (monsters and robots can trigger the mines).
6. Stealth mechanics. Dark areas or vegetation can be configured to block the line of sight of enemy Monsters.
7. Cloaking and scanning mechanics. Cloaking allows limited time invisibility and scanning to see certain objects through walls (such as keys or health stations).
8. First aid stations for healing the player character (can take damage from monsters).
9. Research data. An object that is placed across levels, a certain amount of research data needs to be collected in order to complete the game.
10. Special areas that do damage to the player character unless wearing the right equipment.
11. The start and end scene are given as a video recording as well as Unity assets (scenes with prefabs).

COURSE ASSIGNMENTS

The students are given three assignments: a written assignment, a practical level design and development assignment, and a written level design critique.

The written assignment is done individually and has three sections: 1) literature review or summary, 2) development diary, and 3) postmortem. The literature part asks the students to explain a set of concepts, theories, and methods from the course literature. The development diary is for documenting work, decisions and reasoning behind decisions during the practical level design assignment. The instructions of the development diary provide an example of what is expected from students' diary entries (see Figure 1). Lastly, the postmortem section is meant for students to reflect on the practical implications of level design by answering the following structure:

1. Explaining the basic premise and design goals of the group's level or in the lead designers' case, overall design.
2. Three to five things in the level design or development process that went right and provide an analysis of why those happened.
3. Three to five things in the level design or development process that went wrong and provide an analysis of why those happened.
4. A conclusion that explains the most important learning take-outs from the project that relates to rights and wrongs.

Scene: scene name that you & your group has developed

Datumn/Date: 2014/10/23
Timmar/Hours worked: 4 hours
Uppgifter jag arbetade på/Tasks I worked on:
- Environment design & modeling

Reflektioner/Reflections:
We wanted to create a sense of big space and making a player feeling him/herself small. We used high angle (cf Piaskiewicz, 2014) for that effect by placing a very high mountain in the middle of the level. The main color of level is gray stone and green. To focus players attention to landmarks, red is used in landmarks to contrast the landmarks from the rest of the environment (cf. Piaskiewicz, 2014).

Datumn/Date: 2014/10/24
Timmar/Hours worked: 6 hours
Uppgifter jag arbetade på/Tasks I worked on:
- Level design

Reflektioner/Reflections:
We worked on level design of the level where players should visit a small temple in the forest, but the we did not want to make it too obvious. We enclosed the forest by one end by a river and another end by mountain (funneling by edge of the word). We placed the temple by the mountain and we put a path (Breadcrumping: physical trails) from river to the temple that leads to temple. In this way players should find the path when they try crossing the area. We used the ideas of funneling and breadcrumping from Bateman (2009).

Figure 1: Examples of development diary entries.

In level design and development assignment, the students are tasked to conceptualise and build levels to a stealth science fiction horror game. The students work in groups of two (one designer and one

graphic designer) to construct a level. For the assignment, the students get a game brief, a Unity project containing the main functional assets, core mechanics and a basic level editor and both a starting and ending point of the game. The following game brief is used:

> The PC (a cyborg), a spy, is trapped in a cell in a research space station conducting illegal human experiments after she is caught. She has been there a long while after the crew vanished. The PC started hibernation to keep herself alive. When the cell door started to malfunction, her system woke her up. After wandering around in the space station, she finds dead crew members and monsters (who are crew members turned to monsters). The monsters try to kill the PC if they spot her. She can only sneak and try to avoid the monsters and find her way across the station to an escape shuttle. While she is exploring the station, she collects data that might be valuable. She does not find out why some crew turned to monsters for certainty.

During the practical assignment, the students are required to follow the three steps suggested by Totten (2019): *Pre-production* (create concept art and level sketches), *Production* (design, development and testing of level), and *Post-production* (technical testing and game balancing). The steps are chronologically applied during the course period, where the main focus lies on the first and second phase of level design.

Lastly, the critique assignment is written by the group and is an exercise for providing constructive design critique to others' work. Here, students are asked to provide feedback about what is good and why; what could be improved and why; and how the critiqued level works together with other levels in the game.

COURSE ASSESSMENT

The understanding of the theory, level design concepts, design methods, and the ability to apply all those in practice are assessed via practical level design work together with written assignments. The assessment relies on the following:

1. Practical level design work,
2. Development diary where in addition to documenting what has been done, the students are asked to explain the reasoning behind the design choices and how the literature has been utilized in the design,
3. Postmortem in which students are asked to reflect what went right and what went wrong with analysis of why those things went right or wrong.

The first section of the written assignment focuses on assessing if students have gained a basic understanding of level design concepts and theories, by asking them to describe a set of those (from course literature). The second section (development diary) evaluates how students have implemented theory into their practical work, and how they have resolved potential issues with their level design.

Lastly, the ability to critically reflect on others and one's level design work is assessed through the postmortem and critique session. Postmortem (as part of the written assignment) is used in conjunction with the designed level, to assess the students' ability to analyze and reflect on their work. Whereas the critique session is used to assess their ability to analyze and criticize others' work.

The assessment uses the grading criteria model (cf. Biggs & Tang, 2011). In order to get *Passed* one must show that in terms of skills and knowledge all learning goals are met and to get *Passed With*

Distinction one must also show the ability to critically evaluate one's own and others work so that the evaluation has sound bases in the course frameworks. Game scene/level, report and critique are assessed together and no separate grades are given in each part. To emphasize, the designed level is only assessed in conjunction with the written and oral assignments because failing to design a good or hardly playable level is less important than showing an understanding of why the design or development process failed and potentially how to avoid those kinds of issues in the future. We do not use a point-system for grading, instead, grading criteria explicate in what assignment a knowledge or skill is expected to be shown.

To receive the grade Pass:

- The report shows that the student can describe the key concepts in level design according to the course literature,
- The report shows that the student can describe and justify their design choices for level design,
- The report shows that the student can apply theories and methods from course literature in level design and practical development work.

To receive the grade Pass with Distinction:

- The report demonstrates that the student can critically reflect their and others' design and development process,
- The Unity scene and assets work technically well,
- The student's work fits the game described in the task (comes with style, narratives and gameplay) and functionality is consistent with the given Unity project and instructions.

EXPANDED COURSE OUTLINE

Week 1

Class Topic / Activities

- Introduction to the syllabus (Lecture)
- Familiarize with the requirements of the game and tools to be used in the project (game engine, established assets, version control)

The introduction lecture focuses on introducing assignments. A big part of the lecture focuses on describing the level design assignment and available tools to be used throughout the project. The first week consists of independent work where students read the literature and have two workshops: 3D modelling for Game Art students and lighting in Unity for Game Design and Scripting students. In addition to this, the lead design team (see Course Best Practices) starts to work with overall design.

Assignments

- Reading the course literature
- Setting up groups and Lead Team

Week 2-4

Class Topic / Activities

- Students design and develop a level (scene) for a science fiction horror game. All levels are part of the same game
- Students work in groups of two (with the exception of Lead Team)

This phase starts with a concept design workshop where each group starts to work on the idea of their level and produce concept art, flow charts and similar design artefacts for future reference. In this stage, the level design teams should coordinate so that levels/scenes are stylistically and thematically connected. The provided Unity extension tools allow an iterative level design approach where one can build designs rather quickly and then playtest them, which is our recommended workflow. It is also required that the students regularly submit their assets and Unity scenes to version control so that progression of the development can be followed and it is possible to share assets between groups (for project consistency). The Scrum process requires that everything is tested and working at the end of each sprint. The project ends with the post-production phase and the whole game is tested: all parts of the game works, no game-breaking bugs, and the game can be played through. Ideally students can do difficulty adjustments, etc. in this phase. There are no lectures during this period but the teacher(s) are available for student supervision throughout the development phase, and there are feedback sessions where students discuss their levels and obtain pointers as to how to improve/change design.

Assignments

- Creating concept sketches of the levels
- Building the level in the game engine by utilizing the pre-established game assets
- Creating and placing additional assets for environmental storytelling and potential puzzles
- Game balancing and playtesting both individual levels and the whole game
- Adjusting and applying light placement to levels, creating a mood for the levels

Week 5

Class Topic / Activities

- Evaluating and reflecting on one's work, design and process as well as others' design work

In the last week of the course, we have a critique seminar where students provide feedback to others' work. Teachers (in some years, also professional level designers) provide additional feedback to the students' work. After that, there is a period of independent work intended for writing a postmortem of one's own development process and level design.

Assignments

- Prepare and provide a critique to a set of game levels
- Oral presentation of critique and level design analysis of one's own level
- Writing a postmortem of the design and development phase

COURSE BEST PRACTICES

In the first course design, we connected a game development course to the level design course so that the student continued to work with the game they developed in the development course. This design had a major issue: not all games were suitable for the level design course because the game design and codebase were not mature enough so many groups spend time fixing their games instead of focusing on level design. During the second course design, we tried another game design (spatial puzzle with surrealist elements) which turned the focus to mostly level design. However, the task was too open as a problem-based learning challenge. This resulted in the third design which had a core game design building on stealth, with science fiction and horror themes with a requirement of environmental storytelling. This provided a good set of problem-based learning challenges covering various aspects of level design.

The project requires both specializations (graphics and design and scripting) to work together. In the early course designs, the groups built their own games and later tried so that groups (the full class) work on parts of the same game. This set-up comes nearer to any mid-sized or big projects and that comes with the learning problem of communicating and negotiating level designs of different parts of the game so that they form a game. We experimented with different group sizes and ended up having groups that consist of one game art and one design and scripting student because that makes assessing individual work easier. In addition, we ended up having a lead level design group consisting of one or two game art students and two game design and scripting students. The lead level design team is responsible for designing the overall game flow, how different levels connect and providing additional, more detailed guidance of visual style.

We found that the design challenge is extremely important to be well aligned with the learning goals of the course. Students like to design their own games and it can be hard to motivate them to do level design for someone else (and analyze that design). It is important to stress that they should not extend the game mechanics or add new ones but use the given ones. Students are also eager to jump into building levels without studying the tools they get; what is possible and what is not. It is crucial to cover the possibilities but also encourage the students to study the system and experiment with it before finalizing their designs.

The project and level design tools offered for the course are work-in-progress so there are some bugs in the code as well as some issues (for example jumping does not work) that we do not plan to correct. There are also some issues that need to be fixed so that the students can create their game (tweaking settings and game functions). Hence, we always plan some time for fixing bugs in the system we offer to the students.

From the start, our curriculum has contained agile game development (with the coursebook by Keith, 2010) and the basic understanding of the agile development process is an important prerequisite to this course design. In previous versions of course design, there have been major issues with applying these basics, we have therefore emphasised both in a prior course and this level design course for students to be active and routinize agile game development tasks.

In our experience, there is a need to have enough supervision throughout the project time to help with technical problems and giving feedback on game design and asset design. Continuous feedback

should be given both by teachers and the lead design team, in particular during the early stage of level design. Many students have a tendency to create levels which are not in line with the game itself nor possible during the time frame of the course, thus averting such issues can be done by supervising the concept-phase and proposing different solutions to level design. Also some students tend to get so focused on building their levels that they forget the importance of iterative development (testing and revising). It is important to continuously remind about testing and ensuring that their level/scene is playable.

Although level design concepts such as landmarks and elements to orientate the player are mentioned, we do not emphasize these during the level design course. This was notable when students created large levels (outside the scope of the assignment) and did not focus on environmental storytelling. This results in plain levels where there is no distinction between rooms and hallways which in turn, becomes difficult to navigate. An additional lecture on orientation techniques would benefit the students when designing narrow spaces that the player may need to traverse various times (a recurring aspect of the game).

Regarding online teaching, a practice which has worked was having a Discord server for group work. This enables teachers to help with issues and importantly students can help each other. This helps in maintaining contact with all groups. Perforce is also a valuable tool for observing what students are working on and overseeing the state/condition of the project (also outside of the online set-up). In addition, availability throughout the development process is moderately needed when students encounter technical problems with the project. Especially during the first week of development when some students are not familiar with the existing project assets and functionality.

FUTURE COURSE PLANS

We do not plan to make any major changes in the course. However, we are always trying to improve by clarifying the assignment instructions and make them easier to understand and follow. The software which is used throughout the course (e.g., Unity) keeps evolving and we need to stay up-to-date on those details in order to help the students with development. Additionally, tweaking the settings and improving features of the base project which the students are given would facilitate the process of the development stage for them.

It would be interesting to experiment running the course using a different game engine (e.g., Godot or Unreal Engine). This, however, would require that we also use the chosen game engine in other courses (at the moment Unity is the only engine we use throughout the program). It can be too much to learn a new engine from scratch during this short course in addition to the main course topics.

We had a hard time to find suitable course literature for the course. Totten's book *Architectural Approach to Level Design* is great for the course and provides a good theoretical and methodological framework for the learning objectives, and at the same time being easy to adopt in practical use. In terms of theoretical foundations, we do not have plans to make changes.

Despite good experiences about running the course online, we are not planning to continue teaching the course online after it is possible to return to the classroom. Mainly because the group work in

the classroom setting is much easier for the students and allows the development of class feeling on a different level to what it is happening when the course is fully online.

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CHAPTER 24.

NARRATOLOGY FOR GAMES (GAME40246)

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Course Title: GAME40246 – Narratology for Games (With a Reflective Comparison from Dr. Ian Sturrock from Teesside University)
Course University: Staffordshire University
Course College/School: Digital, Technologies and Arts
Course Department/Program: Games and Visual Effects
Course Level: Undergraduate
Course Credits: 30
Course Length: 24 weeks
Course Medium: typically Face to Face but has been adapted to Distance learning in the past and has run online over the 20-21 Academic Year
Course Keywords: *Narrative, Introduction, TWINE*

CATALOG DESCRIPTION

Within this module, you will be looking at understanding narrative in games, from analog and tabletop roleplaying games, to modern character driven games, along looking at the history of interactive fiction and its future. We will also be developing interactive narrative games in twine, as well as looking at the role of the narrative designer in the industry today.

COURSE PURPOSE AND OBJECTIVES

The Course has 4 learning outcomes, aligned with the academic level of the students (first year undergraduates)

1. Analyse The Narrative Structure of A Computer Game.
2. Demonstrate a knowledge and understanding of story structures, character development and

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narrative elements.

3. Critically appraise other games and produce competent judgements of the possible strengths and weaknesses of their narrative.
4. Communicate a logical and cohesive narrative structure with character development in the form of a narrative structure document for a computer game.

The Narratology for Games module (the UK standard term for a course taught as part of a larger program of study) serves several purposes. Primarily it is to give the students grounding in narrative theory. The first semester focuses on auto-ethnographic play analysis and consider how narrative theory reflects real world play encounters – this is done by grouping them together and getting them to play a Tabletop Roleplaying Games (TRPG) of their choice and reflecting on the play that upholds in the group session paying particular emphasis on character creation world building and narrative engagement.

This does lead naturally to a lot of Freytag Pyramids and Heroes journey circle diagrams, but it is often the first time the students have considered in any detail how narrative can be influenced by players, or how hard managing the expectations of players can be. Dipping their toes into auto-ethnographic analysis works well too to remind them they are starting on an academic path where we will encourage them to stop considering themselves just to be players of games – but designers and producers of them too.

The team Roleplaying Game (RPG) aspects of the first semester also need to work on introducing students to not just group work as an abstract concept but building the foundation of their roles in future groups projects, a prospect all the students on this course will face in later years as part of their studies. Students are often used to group work in a school-based setting but have never needed to navigate it as adults with competing agents of their attention and other priorities coming into play. Making them responsible for how they manage the group and the TRPG play sessions, even with time set aside on timetables, begins to lay the foundations of how they are expected to work in groups going forward in their academic careers.

There is a final aspect to the inclusion of group work in the first semester, as this is a popular first year module it is key in helping students create friendship bonds and feel a sense of belonging to the university and the course. Some TRPG groups thrown together by the computer in the first semester are still playing when they graduate 3 years later, and you can see the benefit of having a support network of likeminded individuals in place form the first week. 'Belonging' is a key metric used to gauge students' apparent happiness with the course and the inclusion of having creative group work can help facilitate that.

The second semester too has analysis as a key aspect of the first assignment, but this time focused on modern games, using the last 5 years as a time frame for them to choose from. Tying this back to theory covered in the first semester helps them consider the role of narrative theory in the games they are more used to playing. Finally, the students are asked to create a game in the text based narrative engine TWINE. This was brought on board to incorporate a more practical element to the module in line with the overall vocational nature of the department the course sits in. The students have some experience with other game engines, mainly Epic Games's *Unreal Engine* and *Unity* – but no base

scripting or coding knowledge. We also ask them to display much of this analysis in the form of flow diagrams – this again to help them consider how they communicate their ideas to teams so specific aspects are not lost in walls of texts. Hopefully, this is a skill they bring into play later when they form part of collaborative groups in later years of study, where they will work with other students on other games courses to produce games. Typically, the students who have studied Narratology for Games in the first year take on the roles of junior and lead designers in later years.

COURSE CONTEXT

As mentioned above the course is a first-year undergraduate module that is offered as an optional choice across two of the department degrees programs. These are the BSc (Hons) Computer Games Design and BSc (Hons) Computer Gameplay Design and Production. The module was a core component of the BA (Hons) Games Studies, a more theoretical degree program but that is no longer recruiting. The module and its content and assessments does not differentiate between the students from the different courses and has no differing assessments. Primarily this is due to the introductory nature of the module and its position within the degree programs. Neither of the courses have any interviewing aspects and students are accepted onto the degree programs with college or school credits, or UCAS (the University and College Admissions Service, the UK wide body that manages university admissions) points alone. Both degree programs have large intakes, with Computer Games Design being taught over two campuses, the main one in Stoke-on-Trent and a Satellite city campus in East London. In the 20/21 academic year the combined intake onto these courses from both campuses is 190 students, 98 of these chose to study Narratology for Games.

Since there are no specified requirements for entry onto the courses, a deliberate choice to open the degree programs to as wide a range of possible candidates as possible, then there is no prior experience that can be relied upon in the students coming onto the module. Predominantly the students that do apply for the courses have studied games at college level, typically vocational based courses at a level lower than university, usually studied between the ages of 16-18. Most starters on UK University courses are aged 18 or 19. Typically they are interested in computer games, but they have very mixed backgrounds in its studies. Because of this the module is deliberately set at an introductory level.

Both the Games degree courses mentioned above are three-year full-time programs that focus on different aspects of preparing students to design computer games using game engines or to make assets using *3DS Max*. BSc (Hons) Computer Games Design has a much wider range of options then BSc (Hons) Computer Gameplay Design and Production, which has a much narrower focus of core games design skills but in both cases the Narratology for Games module sits apart from others on those degree programs. It is optional and it does not necessarily influence any of the modules elsewhere in the degree programs, but it has other effects that are less tangible. Students come out of the module being able to call themselves 'games designers' for the first time – and often TWINE games turn up in Games Jams and projects going forward.

Interestingly the students' familiarity with Tabletop RPG systems varies a great deal but over the last few years we have noticed a trend where they are increasingly familiar with systems and games, and the conventions of play involved, even if they had not played one. They are often eager to play and experience a campaign.

COURSE PEDAGOGY

The first year Narratology for Games module has, as many long standing and ever evolving programs do, had an interesting history of being split, merged, moved around and eventually settled into its slot as a popular optional choice in the raft of first year choices. It is first semester is typically taught in a large lecture space, or in the 20/21 academic year over Microsoft Teams Live events. The first hour is used as taught content and the remaining two hours set aside for the groups to be able to play their TRPG games. The second semester moves the teaching to a large lab space to allow them to design their TWINE games.

These teaching spaces have also derived from the necessity of trying to fit a large module, that if taught on campus is spread over two locations, into what is a limited resource of lab space. With the practical nature of much of the program, delivery lab space is at a premium and Narratology for Games has always worked to take the pressure off other, even larger modules.

The classes in lecture heavy first twelve weeks are set in a traditional lecture set up – with the staff on the module taking a different topic each week, tying elements of what is covered back to the assessment. The move to online learning during the pandemic has moved these lectures to a Microsoft Teams Live format, and that has allowed for more interactive elements and the hour-long lectures are interspaced with discussion points. Traditional face to face teaching has less capacity for these interactive moments.

In the second half of the module, when the lessons move to a more lab-based setting to help the students work on their TWINE games there are still lectures, but the addition of computers makes for them to be much more interactive and they and topics covered are interspersed with key activities that help build towards their final assignments.

These constraints have shaped much of the way the module is taught – alongside continual 'sense checks' with job descriptions for game narrative roles of information gleaned from members in the industry in those roles, usually through Twitter threads. Employability, and key skills that align to specific job descriptions or developing skills that allow students to build up portfolio items are at the foremost of what we teach and how we plan modules. It is this push on practical skills that introduced TWINE as a game engine and the inclusion of getting students to make games as opposed to just analysing them and writing essays as the module stood a few years ago. This change in focus also came from listening to student feedback about what else they would like incorporated into the module in its future incarnations.

With a course that has evolved in the way this one has over the years has deviated from any initial planning but there are a few texts that we consistently return to when we reconsider the pedagogical background of the module. They are Game Writing: Narrative Skills for Videogames, by Chris Bateman, Chris Crawford's book on Interactive Storytelling and José P. Zagal's 2011 work Ludoliteracy. These are the texts that have helped the team consider who they wished to approach interactive narrative in this module. They are also texts that are recommended to students.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

There are two types of suggested texts for this module, the four 'required' by the module descriptor,

the document that is signed off by the quality department of the university that forms the blueprint for how the module should be taught. In the case of Narratology for Games these are: *(Bal, 1997)* (*Bateman, 2006)* (*Bruin-Molé, 2017)* (*Crawford, 2012)* (*Koenitz, et al., 2017)* (*Murray, 1998)* (*Pratten, 2015*)

Since this is a long-standing module it is not unusual for these descriptors to have some outdated elements. In this case the suggested texts are not entirely reflective of the range of suggested texts and papers that are linked in the weekly topic sessions.

The first semester directs students to choose a Tabletop Roleplaying Game (TRPG) of their group's choosing. Previous incarnations of the module directed students to a specific version of *Advanced Dungeons and Dragons*, but it was felt this was too restrictive so in recent years this has been opened out. This however poses a problem of making sure the systems available to the students, from the wide range of available titles is suitable for the task in hand of playing approximately 10 – 12 hours of play in the semester, and that the system is accessible to those who have never played or run a campaign before. The team are considering specifying or supplying a series of one-shot campaigns for future versions of the course to see if this levels the playing field a little.

In the second semester the focus shifts to using TWINE, an open-source narrative engine that allows the students to create non-linear text games. The assignment has a specific emphasis on the production of the narrative game and the journey of the designer though planning, production, playtesting and acting on feedback. This use of iterative design cycles is a key element here as it ties into a wider philosophy of what we as a program consider good standards in games design and as a model is reused in digital and analog games throughout the student's courses.

The decision to use TWINE came from several avenues in short succession, while also felt it stood alone as an engine that could be introduced afresh to the students as opposed to needing to lean on tuition from other modules. This was especially necessary when BA (Hons) Games Studies students had Narratology for Games as a required module, and they had no other exposure to engine based practical modules elsewhere in their degree program.

COURSE ASSIGNMENTS

There are two assessments in each semester of the module 1-1 & 1-2 are the first semester ones and entirely revolve around the analysis of the TRPG and 2-1 & 2-2 are focused on analysing modern computer games and creating the game in TWINE.

1-1 Reflect on engaging in a paper-based RPG (15%)

In your Blackboard play Journal reflect weekly about your play experiences either as the player or Games Master for your group.

The paper-based RPG that you choose is entirely up to your group – as is which of you takes on the role of Games Master.

You should play a module – a pre-written 'adventure'.

1-2 Analyse the RPG Module Played in regard to course theory (35%)

Apply course theory to your paper-based RPG experience in an analytical essay.

Look at analysing the characters, how they work in the group and identify key points in the overall narrative, particularly in comparison to the pre-written 'adventure'.

The word count is 1000 words /- 100.

2-1 Analyse a modern computer game (15%)

Briefly analyse the narrative structure of a character driven game released in the last 2 years.

Use flow charts to represent the branching narratives of the story and discuss the development of the main protagonist throughout the game.

Word count is 1000 words /- 100.

2-2 Design and Produce a Narrative Based Game (35%)

Using Story Dice as concept starters and Twine (or an engine of your choice) produce a narrative driven game.

You should document the planning, playtesting & production of your game in a Blackboard journal.

You are expected to reflect on playtesting feedback and as well as any future developments

As is typical in assignments in the program all other reading is suggested for 'deeper dives' into a specific subject as opposed to be a requirement to pass the course. They are ways of enriching the learning experience as opposed to adding to the assessment requirements for the course. The process by which assignments are set and approved should be noted here, there is no capacity for extra credit or anything to that degree. The students are expected to understand the assignments – they are covered and referred to frequently and ask questions if there is any ambiguity. They are moderated internally by domain specialists not on the teaching team and must align to learning outcomes that have been approved by the quality department of the school. The teaching team are open to looking at drafts of the students' essays in which they can send back feedback on anything that they feel is missing regarding the assignment brief but only a small proportion of students send drafts for feedback. The journals mentioned in assignment 1-1 also receive feedback form the staff so that the students know they are on the right track as far as what is required of them to complete the assessment.

This level of assistance is felt is needed due to the variable nature of the background of the students coming into the course, especially where they may not have done much, or any academic writing before these assignments. Much is made of assistance the library and the academic skills team can give in helping students write essays in the correct manner, further highlighting an important element of this module is familiarising the students with the services the library team can provide.

COURSE ASSESSMENT

1-1 Reflect on engaging in a paper-based RPG (15%)

Criteria / Contribution %

- *Character Creation: 33%*
- *World Building: 33%*
- *Narrative Engagement: 34%*

Mapped Learning Outcomes – 2) Demonstrate a knowledge and understanding of story structures, character development and narrative elements.

***1-2 Analyse the RPG Module Played in regard to course theory** (35%)*

Criteria / Contribution %

- *Narrative Analysis: 45%*
- *Character Analysis: 45%*
- *Spelling, Grammar, Presentation and Word Count: 10%*

Mapped Learning Outcomes – 3) Critically appraise other games and produce competent judgements of the possible strengths and weaknesses of their narrative.

***2-1 Analyse a modern computer game** (15%)*

Criteria / Contribution %

- *Representations of Narratives: 40%*
- *Discussion of the Protagonist Development: 40%*
- *Spelling, Grammar, Presentation and Word Count: 20%*

Mapped Learning Outcomes – 1) Analyse the narrative structure of a computer game.

***2-2 Design and Produce a Narrative Based Game** (35%)*

Criteria / Contribution %

- *Planning: 25%*
- *Playtesting: 25%*
- *Production: 25%*
- *Reflection on Feedback: 25%*

Mapped Learning Outcomes – 4) Communicate a logical and cohesive narrative structure with character development in the form of a narrative structure document for a computer game.

EXPANDED COURSE OUTLINE

Semester One – September / October – December

Week 1 – Introduction

Class Topics/Activities

- Background of Narratology
- Brief History of 'Narrative' Games
- Semester Assignments

Write first assignment blog post covering your experiences with paper-based RPGs, research into the topic and desired personal development.

Week 2 – Characters

Class Topics/Activities

- Characters
- Propp's Dramatis Personae
- Character Archetypes
- Traits
    - MIT Ideonomity Essay Positive, Neutral & Negative traits – http://ideonomy.mit.edu/essays/traits.html
- Alignments

Write first assignment blog post covering your experiences with paper-based RPGs, research into the topic and desired personal development.

Week 3 – Observing Narrative Play

Class Topics/Activities

- What is Narrative Play? Defining 'play' and 'game'
- The Magic Circle and Illusory Attitude
- How to take notes during play
- Looking at Actual Play content
- Advice for playing in a group
    - More assignment guidance, including journal post structures

Actual play of the paper-based RPG should begin, and the first session should be chronicled on the blog.

Week 4 – Establishing a World: Narrative in Games

Class Topics/Activities

- World building

- The Opening Crawl your players won't remember
- Environmental storytelling
- Embedded and Emergent Narratives

Continue to play and log the play sessions. Additional reading should be done through-out the module to further the student's knowledge. Make notes and begin to plan the analytical essay. Consider how course theory may be applied to analyse key events and moments. First drafts may be made at this stage, with placeholders left for further developments.

This Class activities continues for the remainder of the semester. Key topics in lectures are brought back around to the assignment due at the end of the twelve weeks.

Week 5 – Applying Narrative Structure Theories to Games

Class Topics/Activities

- Introduction to Narrative Structures
- Aristotle's Dramatic Structure
- Five & Three Act Structures
- Freytag's Pyramid
- Propp's Narratemes
- Campbell's Hero's Journey

Week 6 – Transmedia Storytelling and Games

Class Topics/Activities

- Transmedia storytelling

Week 7 – Narrative as a Marketing Model

Class Topics/Activities

- How marketing and narrative are connected
- The episodic model
- Sustaining interest

Week 8 – Analytic Writing

Class Topics/Activities

- Assignment Recap
- Recommended Essay Structure
- Academic Writing Tips
- RPG Journal Tips

Week 9 – 12 – Assignment Workshops

Class Topics/Activities

These act as drop-in sessions in which the students can ask assignment related questions, requested feedback on drafts and check in with the tutors that they are on the right lines for the assessments in this semester. Both elements of the assignment are due in on the final Friday of the term.

Semester Two – January – May / April

Week 1 – Project Planning

Class Topics/Activities

- Introduction to Semester Two
- Assignments
- Branching Narrative
- Project Planning
- Introduction to Twine

Plan your approach to the narrative game project. Blog about your initial ideas, potential interpretations of the story dice and the logistics of the project – this would include Gantt charts, contingencies, and other project management resources.

Week 2 – Formulating Plot and Character for Narrative

Class Topics/Activities

- Recap on Characters from last semester
- Consider the role characters will play in your game

Continue to update the blog with your plans. At this stage you should have an outline for the characters in the game, explain your reasoning and begin to develop the outline of the game.

Week 3 – Semantics

Class Topics/Activities

- Consider the role language will have in your game
- The effect genre has on narrative

At this stage you should be nearing the end of your initial planning phase. There should be a blog post applying course theory to your game outline and considering how best to implement it. Refine your concept into an 'elevator pitch' for delivery.

Week 4 – Elevator Pitches and Prototyping

Class Topics/Activities

Practica Class on Pitches. Students pitch their final concepts. Each studetn has 5 minutes, and a single power point slide in which to pitch their game idea. Keep the blog updated with any reflection, thoughts on how hearing other pitches may have changed your mind. At this stage you should begin work on the prototype.

Week 5 – Writing for Games – Part One

Class Topics/Activities

- Close analysis of narratives as used in games, including interactive Netflix narratives, *Journey* and *The Wolf Amoung Us*

Write: there should be regular progress updates on the project. Apply lesson theory to create a visual representation of the proposed narrative – flow charts, subway maps, etc.

Week 6 – Writing for Games – Part Two

- Examples of 'actual' narrative writing in games including barks, dialog trees and script writing.

Class Topics/Activities

Prepare a prototype of the narrative game so that you can receive valuable playtesting feedback. Continue to write.

Week 7 – Playtesting and You

Class Topics/Activities

Practical Session designing Playtesting strategies for their game. Blog about the performance of the playtests, any results and reflect on feedback received. Form plans to iterate and respond to the feedback.

Week 8 – Narrative Roles in Industry

Class Topics/Activities

- Analysing job descriptions for narrative roles in the games industry
- Consider what is required for a narrative designers portfolio and skill set

Continue to update your blog with progress posts.

Week 9 – 12 – Assignment Workshop

Class Topics/Activities

At this stage you should aim to wrap-up work on the game and its documentation. Outline your

essay if you have not already and create a visual representation of the chosen game's narrative. Both elements of the assignment are due in on the final Friday of the term.

COURSE BEST PRACTICES

With a course that has so many roles to fill as this one does then consider best practices from it is easier split into several different elements. Previous incarnations have had the course split up into two smaller modules in different academic years, but we found students did not see a link between the introductory module in the first year and the advanced module and when the opportunity to combine them into a large module arose it was seized upon.

The group dynamics aspects of the course have also led to the content being moved around and recognized. Previously the RPG element was in the second semester, but it frequently caused upset and interpersonal issues with groups that formed and cut across other existing friendship groups or where interpersonal issues had arisen in individuals. The constraint on a single system also caused upset amongst students too as they felt 'hemmed' in by the choice of the tutor at the time.

Before the inclusion of TWINE as a game production element the module had an almost entirely written based set of assessments, covering the analysis of different texts from various angles. Both '*Choose Your Own Adventure'* books and 'classic' point and click adventures were used as the basis for students' assessments and analysis but we found after a few years of this that plagiarism was rife and increasingly the 'key' to a game or adventure book was available online. The move to getting students to create their own games has helped a lot with this but shifted the burden of teaching and support to be less led by academic skill and more on the technical side and those with the knowledge of the engine. As we have grown the teaching team there is a level of upskilling required from the staff for them to support the students and this has been further magnified by having classes taught simultaneously over two campuses as we have in the last year. The ad hoc, open-source nature of TWINE development has meant there is not a great amount of formalised support for the engine as there is in other more developed systems.

Developing the practical side of the assessment has also meant recalibrating and managing the student's expectations of the assessment process. Previous experience of tooling up the technical side of an assignment often leads students to be over concerns on the finished project and not the journey of getting there. We encourage our students to embrace failure and reflect on it for their future learning and development, but this is often a hard lesson for new students to face, even on what is effectively a 'low stakes' module in the scope of their study. This was particularly evident when we had a mix of technically minded students from Games Design and Gameplay and the more academically focused students studying Game Studies. The move from lecture hall in the first semester to computer-based labs in the second semester was done with supporting these students in mind but often this resulted in students suffering from 'imposter syndrome' when they saw the work of others.

We used narrative picture based 'story dice' to give the students some constraints and direction for their TWINE games. This works well for the most part in bringing in some innovation to their stories and games, but the task of 'rolling' 100 dice rolls was laborious. Each dice roll was photographed so

the team has a library of 'rolls' to use and assign to students which has helped speed up the process significantly for future years.

Finally, the task of organizing students into play groups for the first semester continues to be problematic and time consuming – compounded by the fact that students can transfer courses, and optional modules up until the 3rd week of teaching. This either means a lot of swapping and changing out of members in groups, or time spent chasing group members who appear on the enrolment information for the module but may have transferred out or withdrawn. This year we did not form groups until the 4th week of teaching, but that then gave the students little time to settle into groups before they began playing.

The onset of the Covid-19 pandemic led the university to move primarily online teaching and Narratology for Games moved to entirely online tuition using Microsoft Teams as a facilitation method. Large scale Live events were put in place to limit bandwidth issues for the students and make use of the Question-and-Answer function they provide. Breakout channels were also put-on Teams for students to use, in the first instance, to work on group tasks in the context of the larger lectures and then for the running of their TRPG sessions. The move to online means we have also needed to suggest digital systems of managing games such as *Roll 20*. We left the option to manage their groups and plan sessions in the hands of the students. The plans for teaching the second semester, where we will move to teaching TWINE via online instruction will mirror how we teach other game engine-based classes with a mix of large-scale online lectures and online tutorials. Students will have the opportunity to interact with the tutors in a variety of ways but there is no direct group work in the 2nd semester to consider.

FUTURE COURSE PLANS

Much of the future for this module are currently on hold while we assess the viability of various modules continuing online as the institution moves to a blended system of learning. How this module is taught in the future will depend greatly on the feedback received from students and the grades of the work they submit this year. We will need to find some way of assessing if he groups work has managed to do at least some of its planned job in helping with the student's sense of belonging and capacity to make friends, already strained by having so much online tutorial as opposed to that happening in class, and a limiting of on campus

Other changes are planned involved a restructuring of the degrees in which this option sits. While it is a popular module it is an outlier in terms of the larger picture of the aims of the courses. The need to make sure the learning on the course is relevant and maps onto employability options means for modules like this there needs to be a case made that the skills taught on it are relevant to the employment opportunities that are or will be available.

If the module does continue then the key areas the team will look at will be the practicality of the assessments and ways of easing the creation of groups, and if we move to use one shot adventures to ease some of the issues with managing groups and making sure the students have a comprehensive play experience in which to analyse.

As the Games Industry continues to recognise narrative contributions to games, and those that write

them then the module will have more to draw upon in terms of defining skills required for those students who are looking at entering that aspect of the industry or looking at developing narrative aspects in games they design then the module, in whatever form it has in the future will continue to embrace these elements, as it has done in the past.

Author's notes – We conceived this chapter to showcase two similar modules in different UK universities, both within programs with strong Games Design focuses. They are both detailed separately, and we will reflect on each other's courses. This is a rare opportunity for the authors to reflect on courses within the same sphere as the course they run. This has given the opportunity for fellow author Dr. Ian Sturrock of Teesside University, a university comparative to Staffordshire University in the UK to reflect and comment on the syllabus described here.

Reflective Commentary

Ian Sturrock: I'm quite envious that I've not yet been lucky enough to teach D&D as part of a formal learning process, or better yet, to get taught D&D as part of a formal learning process! I do encourage my own games design students to learn to play tabletop RPGs as early as possible in their leisure time, and to try to GM a campaign during their years as undergraduates. So many great game designers, genre fiction writers, and genre TV showrunners cut their teeth as Dungeon Masters back in their own college days that I sometimes think that running a good D&D game at the university's TTRPG club may be almost as big a predictor of industry success, for game designers, as is their academic attainment.

You mention the possibility of recommending standard one-shot D&D campaigns — I think the current (5th edition) Starter Set is a superb introduction, probably the best introductory version of D&D that I've seen in almost 40 years of personal play and GMing. It's also well priced for student budgets.

It's also great to see you moving away from a more theoretical, essay-based analysis of existing interactive fiction and into students making Twine narratives. My own students take to Twine very happily and fluently, as third years, and having seen your account of the Narratology for Games module running so well for first years, I am contemplating ways in which to start students learning Twine a couple of years earlier, if possible.

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CHAPTER 25.

GAMES NARRATIVE (GAV3040-N)

IAN STURROCK[1] AND NIA WEARN[2 3]
TEESSIDE UNIVERSITY AND STAFFORDSHIRE UNIVERSITY

Course Title – GAV3040-N -Games Narrative
Course University: Teesside University
Course School: Computing, Engineering, and Digital Technologies
Course Department/Program: Computer Games Design https://www.tees.ac.uk/undergraduate_courses/computer_games/ba_(hons)_computer_games_design.cfm
Course Level: Undergraduate
Course Credits: 20
Course Length: 12 weeks
Course Medium: Typically face-to-face. Blend of face-to-face and digital for the 20-21 academic year due to COVID-19 pandemic.
Course Keywords: Games narrative, games writing, visual storytelling

CATALOG DESCRIPTION

This module explores the theory and practice of games narrative creation. It investigates the basics of storytelling in games, including: narration, character, story arcs, point of view, voice, tense, cut scene, mise en scene, narrative wash / narrative texture, backstory, storytelling using affordances and signifiers, world building, emergent storytelling, and found text / found audio. The module employs a range of strategies to help students develop their skills as a games narrative creator. Practical exercises and activities are employed to help develop students' own narrative voice and individual writing and/or visual storytelling style.

Planning and iterative design are encouraged by the use of three milestones, whereby submission of

1. Dr. Ian Sturrock (sturrock@gmail.com) is a senior lecturer at Teesside University, and a practising game designer, with a focus on narrative design and non-digital game design.
2. [Nia Wearn, Course Director for Esports, Games Studies and Communities, Staffordshire University n.h.wearn@staffs.ac.uk. Her teaching focusses on the production, communications, and gameplay aspects of the university
3. Authors' notes - We conceived this chapter to showcase two similar modules in different UK universities, both within programmes with strong Games Design focuses. They are both detailed separately and we'll reflect on each other's courses. This is a rare opportunity for the authors to reflect on courses within the same sphere as their course.

draft documents for formative feedback is rewarded by 5% for each milestone. The main hand-in is an individual assessment worth 85% of the module mark.

COURSE PURPOSE AND OBJECTIVES

The course has five aims, and six learning outcomes aligned with the academic level of the students (third year undergraduates). The aims are as follows:

- Discuss the theory and practice of story creation in a games context.
- Explore storytelling and narrative structure.
- Employ technical processes of story mapping, drafting, rewriting and editing.
- Develop students' creativity and confidence in their games narrative creation with the aim of evolving their creative voice and creative vision.
- Develop students' ability to develop narratives for digital platforms.

And, these are the learning outcomes:

- Communicate effectively and professionally, applying an understanding of principles and techniques of story creation to a games context.
- Develop and present a game narrative in a professional manner.
- Demonstrate and apply a comprehensive understanding of narrative theory and principles.
- Research and synthesise games narrative ideas and solutions based on research, critical analysis, contextual, historical, and conceptual study.
- Act with increasing autonomy and professionalism in the development of a games narrative plan and games narrative.
- Demonstrate proficiency and appropriate use of tools in the design and development of a games narrative plan and games narrative.

The main aims, in practice, are to get students thinking about stories so as to make them better game designers; and, to potentially get another short sample of game and/or story to add to portfolios.

Getting students thinking about the relation of game to story, has a big impact on the typical quality of final year projects, which take place in the next semester. Anyone who has taught game design, knows the sinking feeling when one sees yet another student project that involves Unreal Engine's default character model, running around a bland environment, wielding a shotgun. With a practical reminder of how much more games storytelling can be, we vastly increase the number of original, well-thought-out final projects.

Potentially portfolio piece outputs for the module include short, complete games made using the Twine tool; fragments or scenes from larger games, again made with Twine; cut-scene scripts formatted in industry standard script format; in-game documents such as letters, diary entries, and codices; and in-game audio such as audio logs and barks. Although none of these are likely to be enough in and of themselves to impress a potential employer sufficiently to secure a graduate with a job, they do provide an opportunity to showcase some story design and creation skills, and

particularly to demonstrate the sense of originality and fun that is crucial to any creative industry work.

COURSE CONTEXT

The module is part of our Bachelor of Arts degree in Computer Games Design. This course brings some unique challenges, as described below.

The game design field does not recruit heavily from recent graduates. In a Triple-A games studio team of perhaps 100-200 employees, or more, the majority will be artists, then programmers, with typically only four or five designers, most of whom did not study game design as an undergraduate degree. This is in contrast to games programming and games art, where a reasonably competent graduate will have little difficulty securing an entry-level job in this ever-expanding and successful industry.

Despite this, there is an expectation among students that their game design degree will be at least as vocational in nature as any other games course. If anything, there is much more resistance among game design students to learning about the theory that underpins their discipline, or even engaging at all with art forms other than games, than there is among, for example, games art students in the same school. There is an ongoing tension between student pressure to change the course so it is more and more vocational, and the requirement that to attain an honours degree students must be capable of describing and commenting on current research and scholarship in the field (Quality Assurance Agency for Higher Education, 2014).

The changing demographics of access to university mean that the student population is highly diverse, comprising a mixture of students from differing economic backgrounds, differing countries due to the drive to secure funding from international students, and differing levels of motivation and academic commitment (Biggs & Tang, 2011, pp. 4-7). Teesside University recruits primarily from students within the immediate geographical area, with 72.33% of full-time students being from the North East of England (Teesside University, 2020). The BA Computer Games Design pathway reflects these statistics. Though there are a few international students, a majority of students are from the local area and from varied economic backgrounds, certainly including students who in previous years would have been unlikely to study an honours degree and who might typically be considered "unmotivated" or "not academic" by teachers focusing only on student ability (Biggs & Tang, 2011, p. 19).

Reflective Commentary by *Nia Wearn:*

It's really interesting to see the parallels with our courses – even though they stand and different ends of our respective students' journeys. There is a lot packed into 12 weeks and it's particularly interesting to read about the move away from traditional Creative Writing practices to look more at the way narrative exists in the different elements of a game. Reflecting on the nature of having this in the 3rd year too is interesting – the need not to worry too much about having to settle students into how to be a student, make friends etc, and also not needing to worry about specifically teaching and supporting learning a new engine much also allow for a lot more creativity in the output of the assignments I would imagine. As we think about redesigning our courses this might prove to be a great insight into other avenues, we could weave narrative into our programme.

COURSE PEDAGOGY

The well-established pedagogical theories of constructivism and phenomenography, agree that education is about conceptual change, not simply the learning of facts or even skills (Biggs & Tang, 2011, pp. 22-23). Gee, likewise, shows education is about entering new semiotic domains and/or taking on new identities; and that videogame play is uniquely situated to facilitate this (Gee, 2007, pp. 84-92). Videogame players, as all my students are, are familiar with the probe-hypothesis-reprobe-rethink process as a core part of their gameplay experience (Gee, 2007, p. 88). The majority of conventional teaching ignores that familiarity and instead attempts to force this population of almost instinctual, engaged, interactive learners into a more 'academic' style of learning… which inevitably causes failure and frustration of the learning and teaching process.

Games scholars have long argued for a more ludic, creative approach to teaching both theory and practice aspects of videogames in universities, in keeping with that art form's own qualities; see, for example, Walz & Deterding (2014). This module uses students' existing understating of the probe-hypothesis-reprobe-rethink process to empower them to take control of their own learning.

What my students are less familiar with, and more wary of, is creative writing. Existing paradigms for teaching this subject, rely on a theoretical understanding of, and ability to analyse, literature and stories, which many games students simply do not possess. Instead, the concepts of iterative improvement and iterative project design are common to both standard creative writing teaching, and to games design teaching. The difference between the way those iterative improvements take place, though, is that in creative writing teaching and practice, as is common in arts teaching and practice more generally, the 'group crit' is standard, whereas in games design and development, playtesting, bug testing, and user testing are more common.

Even for experienced artists and writers, the group crit, in which a practitioner-student makes their creative work available for peer feedback, is a terrifying ordeal: "Criticism, and by implication feedback, is perceived as negative, personal and subjective and fraught with contradiction and loss of 'respect' – in opposition to the students' previous prescriptive and 'objective' educational experiences" (Day, 2012). Ideally students would adapt so as to benefit from a group crit, without too many negative consequences, but it's hard to guarantee that will happen in a 12-week module.

For games design students, more used to sending out prototypes as files, and receiving critique mediated through electronically communicated pre-designed playtest feedback forms, the prospect of having their work discussed in real time is even more unnerving. This can provoke resistance even to small-group crits. Some resistance may be from learners' self-theories: a student with a fixed mindset (also known as entity mindset) regarding education and learning, will shy away from challenging situations for fear of embarrassing failure (Dweck, 1999). Supporting fixed mindset students to develop a growth mindset, shown to be associated with greater opportunity for learning, is difficult, but recent tying of Dweck's work into existing theories of learning is starting to show the way (Campbell, et al., 2019). This has helped square the circle between game designers' connectivist approach to developing their practice, and the community-of-practice approach that the group crit belongs to.

Thus, the module is designed to encourage group crit practices but also offer alternative approaches,

including one-on-one feedback and end-user testing, according to individual student preference, rather than making group crits compulsory. In a typical practical class, whether taught online or in-person, we'll do a mix of the following activities, depending on context such as students' expressed desires, what week it is in the schedule, and whether I've heard much from a given student recently:

- Quiet writing time. This will tend to be for a short, defined and timed period, typically 15 minutes, writing sprint style, with an expectation that the tutor will join in, too, and that most participants will be willing to share excerpts from their work afterwards.
- Group crit, in something close to a traditional writers' circle manner. Modifications to the standard approach include making this optional, and allowing students to put their work up anonymously for group crit, by emailing it to me so I can present it on their behalf. We aim for some focus here: the person whose work is critiqued will guide the rest of us, telling us any specific areas or aspects that they need feedback on in particular.
- One-on-one crit, in which I aim to give a student direct, useful feedback. This is particularly helpful for students who may feel nervous or anxious about group crits.
- Check-ins, in which I either go round the room, or message people in an online class, to ensure that less vocal members of the class are also working well and see if any need my help or feedback.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

This course is largely practical, with a output that is primarily written, so there are no required textbooks or technologies, though a few are suggested as follows:

Microscope (Robbins, 2011), a fractal roleplaying game that makes for an excellent world-building tool.

Twine (Klimas, 2009), an open-source interactive storytelling tool.

Tutors recommend wide engagement with other forms of storytelling, and will often suggest particular genre novels or films that might prove inspirational. Though students often fear that they will make an unoriginal copy of existing material if they, for example, read too many science fiction stories, in practice this does not happen: engaging with some core texts in any genre makes for more original creations.

Octavia Butler's novel *The Parable of the Sower* (1993) gets recommended a lot, partly for its topical setting – a politically divided, violent, ravaged USA in the 2020s – partly for the accessibility of the writing, and partly because the entire novel is told as journal entries, in-universe texts, or similar accounts. It serves as a superb example of this in linear fiction, but the techniques Butler used can just as readily be applied to nonlinear storytelling.

COURSE ASSIGNMENTS

This course involves three milestones and one final hand-in.

The final hand-in consists of 3,000 words, or negotiated equivalent, broken up into 1,000 words of planning documentation, equivalent to a portion from a game bible or similar text that might

reasonably be handed around to other team members such as coders and artists; and 2,000 words of development work that is intended to be encountered reasonably directly by a player of a hypothetical game, such as cut-scene scripts, enemy barks, diaries and letters, audio logs, or text in a text-based adventure game.

The phrase "or negotiated equivalent" is borrowed from typical creative writing practice, and in that context it usually allows for, for example, students to negotiate a slightly lower wordcount if they are writing in forms usually seen as more difficult, such as poetry or song. That can happen on this course, and we do occasionally get students wanting to create one or more in-universe songs or poems as part or all of this hand-in, so that hypothetically a player might hear them as part of bardic entertainment in a tavern or hall. But, the brief is deliberately even more flexible than that, and it is possible for students to negotiate to make, for example, a game environment in Unity or Unreal Engine which incorporates a large amount of environmental storytelling. More common is the negotiation to make a simple, primarily text-based game with the aforementioned Twine. As long as the learning outcomes are met, though, almost anything is possible here.

The three milestones are set dates during the 12-week course, around weeks 3, 5, and 7, in which students hand in a learning contract, a draft plan, and some draft development work, respectively. These hand-ins are not graded, but are rewarded with a small, set number of marks just for uploading by the deadline. Instructors will then offer individual formative feedback on each upload, so as to encourage students to revise and improve their work.

COURSE ASSESSMENT

Final hand-in: Marked out of 100, then weighted to 85%

Milestones 1 to 3: 5% each, for 15% in total, purely for meeting the deadlines.

EXPANDED COURSE OUTLINE

Week 1: Introduction to Games Narrative; Beginning Writing

The lecture is an introduction to the syllabus, and to the assignment and milestones, followed by a question and answer session. Students spend the practical session working on some creative writing exercises, intended to get them thinking about the kinds of stories they are interested in telling. They're encouraged to continue this at home, though this work is not formally assessed.

Week 2: Worldbuilding; Seeding Stories

Lecture on worldbuilding. Practical session on starting and seeding stories: Students read a short excerpt from "Writing Down the Bones" (Goldberg) and continue with creative writing exercises. The intention is that by the end of the practical session, they will have a number of story ideas and can select one to work on between sessions.

Week 3: Worldbuilding Pt II; Giving and Receiving Feedback

The second worldbuilding lecture focuses more deeply on the creation of original fictional cultures, including best practices to avoid cliches and stereotypes. The practical session focuses on asking for, giving, and receiving, feedback, in small-group crits and other environments. Students give each other

feedback on their week 1-2 work and homework. Milestone 1 hand-in: learning contract. Learning contracts empower students "to take charge of their learning and to communicate their plan to the facilitator. Using a learning contract makes the effort explicit and heads off potential undesirable extremes and misunderstandings" (Knowles, et al., 2014).

Week 4: Creativity, Meaning, Metaphor and Themes

Lecture on creativity and meaning. Drawing on theory and practice of creativity and meaning-making, this lecture helps students come up with, refine, and improve their game ideas, and then add subtle meaning to them.Practical sessions remain focused on creating work for the hand-ins and giving and receiving feedback on the work, for the rest of the semester.

Week 5: Character Creation and *Microscope*

Lecture on character creation, and introduction to *Microscope* (Robbins, 2011). Best practices in creating characters for games stories, are considered. The lecture session also includes a short introduction to the *Microscope* worldbuilding tool. Milestone 2 hand-in: draft narrative plan (500 to 1,000 words)

Week 6: Editing and Revising

Lecture on editing and revising. This lecture focuses on best practices for editing one's own or others' work, including avoiding common errors and incongruities, and again the addition of subtle meaning to a text through the editing process.

Week 7: Sound Design for Storytelling

Lecture on sound design for storytelling, including how to use verbal and nonverbal sound to convey mood and story in games. Milestone 3 hand-in: draft development work (500 to 1,000 words)

Week 8: Costume Design for Storytelling

Lecture on costume design for storytelling. This coversconveying character and other forms of story (culture, background, fictional religion, etc.) through costume design.

Week 9: Scriptwriting for Games

Lecture on scriptwriting for games, including how games story ideas are developed, and formatted, including standard film-industry script formats and variants

Week 10: Barks; Editing Revisited

Lecture on writing barks, and editing revisited. A short lecture on how to write barks (one-sentence or one-phrase bursts of dialogue, usually spoken by NPCs), and another short lecture on editing, including a live edit of a volunteer student's work.

Week 11: Epistolary and Found Text

Lecture on diaries, books, letters, and audio logs. Considerations of character voice, creativity, and formatting for these very personal storytelling forms.

Week 12: Introduction to Intellectual Property

Lecture introducing intellectual property rights. A non-technical introduction to non-disclosure agreements, copyrights, trademarks, and patents. Final assignment hand-in.

COURSE BEST PRACTICES

When this course first ran, the structure of teaching was very much based on what has become the standard approach to teaching creative writing in the UK over the past 40-odd years, since its "emergent" or "accidental" creation as a discipline in the 1970s (Briedis, 2015). That is, the assignment was defined so as to require primarily a written submission of 2,000 words of creative writing plus 1,000 words of story planning, with the only real difference between this and a more English Literature style creative writing module being the addition of a submission requirement for a flowchart, level plan, or similar diagram. Further, the module specification mentioned that the teaching would mainly involve students working in small groups, critiquing their peers' work, with an expectation that iterative improvement each week over multiple drafts of creative writing, would result in a high quality, polished, final hand-in. Again this is very much the standard approach to teaching creative writing in UK universities.

Taking over the course at the last minute, due to the unexpected departure of a colleague just before it first ran, I'd had no input into the planning process. Having been taught creative writing at undergraduate level in very much that standard UK approach some 30 years ago, and having since worked in the games industry as a creative writer, I simply followed the aforementioned model laid out in the module specification. This did not work so well, for the reasons explored above in the Course Pedagogy section. I would not recommend trying to run this as a conventional, group crit-focused creative writing class. It needs the added flexibility delineated here.

I found that the majority of students wanted to do at least some worldbuilding as part of their narrative plan, hence the heavy worldbuilding focus in the first few weeks. Providing industry examples, such as excerpts from the much-studied and much-shared *Deux Ex 13.12* game bible, was crucial in helping students understand how to develop and format their fictional worlds. I also devised a worldbuilding pro forma document as a recommended format that they could choose to follow, or not, but which would at least get them to consider most major elements that the player would expect to encounter in a game-world.

FUTURE COURSE PLANS

Storytelling and gameplay exist in a state of some tension, and the types of stories that are told in games may alter as that tension causes a shift in the perceived best practices for suturing the differences between those two elements of game design. There's certainly a vogue right now for environmental storytelling in various forms, and for found insights into characters' lives such as audio logs, diaries, and so on.

That said, there will always be a need for high quality writing for games storytelling, and many of the writing skills, techniques, and processes taught on the course are considerably older than videogames. This, combined with the enormous, negotiated flexibility built in to the course design, whereby students can propose alternate forms of storytelling, via their learning contracts, to be

graded on in the final assignment, means that the course should be robust enough as is to work for the foreseeable future. Games storytelling trends may change the types of work handed in, and I would certainly consider offering different taught lectures later in the semester if, for example, the majority of students wanted to focus on dialogue-writing rather than worldbuilding, in any given year.

The COVID-19 pandemic forced the majority of the classes on the course online, during the 2020-21 academic year, though in practice there was much less impact on teaching than there might have been in, for example, a related course with related course with more expectation of in-engine game design work and access to high-end computers. Some of the changes involving the switch to online teaching, were actively beneficial, and I will incorporate these into future runs of the class. Notably, these include having a text-based chat function available to students during lectures, which encourages many of the less vocal students to have an input into lecture classes; and, recording all classes in some form, even the practical classes, in case students have need of the recordings later.

Writing this book chapter, particularly the collaborations with my colleague Nia, has also prompted me to consider potential changes in future. I plan to strengthen links with Staffordshire University and see if there are any further insights we can offer each other, particularly via guest lectures.

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CHAPTER 26.

FOUNDATIONS OF VIDEO GAME DESIGN (CMPM 80K)

TAD LECKMAN[1] AND NOAH WARDRIP-FRUIN[2]
UNIVERSITY OF CALIFORNIA SANTA CRUZ

Course Title: Computational Media 80K: Foundations of Video Game Design
Course College/School: The Jack Baskin School of Engineering
Course Department/Program: Computational Media
Course Level: Undergraduate
Course Credits: 5
Course Length: 10 weeks
Course Medium: Face-to-face or Synchronous-remote instruction
Course Keywords: video game, game design, foundation, history, technology, art, narrative, ethics, iterative, systems, critical, project-based

CATALOG DESCRIPTION

A generally accessible course in which students explore how video games (and games broadly) shape experiences and express ideas. Students develop novel games, engage in game interpretation, and survey related topics (e.g., game history, technology, narrative, and ethics) through lectures and readings. Programming experience is not required.

COURSE PURPOSE AND OBJECTIVES

This course focuses on two questions: "How are games made?" and "What can games be *about*?" We cover these two questions together, because we believe their answers are closely related. They also provide an entry point for students to begin thinking critically about games as an art form and a means of expression; one which they themselves can engage with.

1. Tad Leckman (tad@ucsc.edu) is a Lecturer in the Computer Science: Computer Game Design and Art & Design: Games & Playable Media undergraduate programs at University of California, Santa Cruz. His focus is teaching collaborative, interdisciplinary tabletop and video game development courses. He has also been deeply engaged in learning and development within large entertainment studios.
2. Noah Wardrip-Fruin (nwf@ucsc.edu) is Professor of Computational Media at the University of California, Santa Cruz, where he codirects the Expressive Intelligence Studio. He is the author of *How Pac-Man Eats* and *Expressive Processing: Digital Fictions, Computer Games, and Software Studies* (MIT Press). His playable media projects have appeared in venues such as the Whitney Museum of American Art and the IndieCade festival.

As with many survey classes, we aim to provide an overview of our subject, hoping students discover aspects that resonate with them to pursue in future classes or through self-study. We also hope students get a basic understanding of the various disciplines that are part of game development so that they are better able to collaborate and communicate as part of a team. Finally, students get a chance to practice research and critical writing about a subject that they are passionate about.

After completing this course, students should be able to:

- Demonstrate a general understanding of the game development process and methods.
- Critically analyze and contextualize games as an art form.
- Write and implement a functional branching narrative using *Twine* (https://twinery.org).
- Work collaboratively as part of a small team to develop a playable game prototype.
- Use a game development tool such as Construct (https://www.construct.net), *Bitsy* (https://ledoux.itch.io/bitsy), *Godot* (https://godotengine.org), or *Unity* (https://unity.com) to author a playable, web-based graphical game.

COURSE CONTEXT

Foundations of Video Game Design serves not only as one of the required foundation/prerequisite courses for both our games Bachelor of Arts and our games Bachelor of Science at UC Santa Cruz, but it also fulfils an *Interpreting Arts and Media (IM)* requirement for a broad range of other liberal arts programs at the school. It serves both students beginning an extended, multi-discipline study of game development and also students for whom this may be their only exposure to formal study of games.

Students who know they want to declare one of our two game design majors will usually take *Foundations of Video Game Design* in their Frosh or Sophomore year in preparation for smaller, more focused art, design and programming courses. It also serves an important role in helping students form collaborative relationships which often last through our senior-year capstone courses. Other students who take *Foundations of Video Game Design* as their IM requirement do so at various points in their academic careers, sometimes early as they try to decide on a major, and sometimes late as they are trying to finish their degree requirements. Every time we offer the course, we attract students from many other programs including: Literature, Theater, Music, Social Science, Psychology and Computer Science.

COURSE PEDAGOGY

The continued growth of both UCSC game design programs and the popularity of the subject as an elective have led to a huge increase in registration for the course, which regularly seats 300 students per quarter.

Despite this growth, faculty have managed to keep the mix of hands-on game-making, lecture material and critical writing. A core learning outcome for both game design programs is the ability to work collaboratively to meet technical and artistic goals, so two of the projects are designed to be created by pairs (and occasionally trios) of students. Multi-week game design projects also

provide an opportunity for students to practice the iterative design process that is at the core of game development.

In recent years, we have applied this collaborative, iterative approach to developing *Foundations of Video Game Design* itself. While input and guest lectures from other faculty and professional game designers have long been part of this course, we have begun formalizing the sharing of curriculum, assignments and materials. Feedback from professors, students, Graduate Teaching Assistants and Undergraduate Graders is incorporated each time the course is taught. An effort is made to update examples and texts used in class to keep current with rapid changes in games themselves and their place in culture. This makes preparing and delivering this course more difficult, but also ensures that it continues to serve as an effective prerequisite for more advanced and specialized courses that follow it.

Scaling this course to accommodate increasingly large rosters of students is possible because of our deep bench of both graduate and undergraduate teaching assistants and taking on the additional project management overhead of such a large instructional team. Project-based learning is also more time-consuming to grade, and assignments with built-in dependencies (like tasks in game development) must receive feedback before the next one can begin.

We designed the course to be delivered in a 10-week quarter. But it is an intense quarter, with three, one-hour course lectures a week (28 total, given two holidays), in addition to a required section meeting each week. To adapt for a 15-week semester, we recommend simply taking the lecture subjects outlined below and offering two per week. The course could also be adapted to a less-intense 10-week quarter. For instructors interested in making the course less intense, two possible strategies would be removing one of the three main projects and/or the initial design exercises (reducing the hands-on design material) or removing the analysis assignments that accompany each project and/or the final essay (reducing the understanding-oriented material).

In general, we hope a class of this sort of design will help students realize that games don't work just one way, or provide just one type of meaningful experience, or address just one type of theme — and at the same time, there is a limited vocabulary of fundamental ways games work, which game designers (even student designers) can use in creative ways to expand what games can be about.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

The core reading for the course comes from two newly-published texts that we have had the opportunity to provide to students in pre-publication form:

- *Elements of Game Design* (https://mitpress.mit.edu/books/elements-game-design) by Robert Zubek – This approachable overview of game design with an emphasis on mechanics and systems is an expansion and update of the pioneering *MDA: A Formal Approach to Game Design and Game Research* (https://www.aaai.org/Papers/Workshops/2004/WS-04-04/WS04-04-001.pdf) co-authored by Zubek, Robin Hunicke and Marc LeBlanc.
- *How Pac-Man Eats* (https://mitpress.mit.edu/books/how-pac-man-eats) by Noah Wardrip-Fruin – Noah's book focuses on three strategies students can use to make games about new topics and provides an excellent introduction to critical writing about game design, with an

emphasis on the relationship between the meanings of games and their operational logics.

Zubek's book provides more of a making-oriented perspective, while Noah's is more focused on understanding games. We were glad to find Zubek's book, because it provides an introductory take on important concepts that we had been teaching with materials aimed at more advanced game designers. Noah's book, on the other hand, in many ways grew out of teaching this course, so it was natural to bring it back into the course. Both books are now available for purchase (don't forget to request copies for your libraries!).

In addition, we include gameplay assignments to help illustrate concepts discussed in lecture and also to help introduce students to playing games critically and analytically. Games range from traditional video games such as *Canabalt* and *Papers, Please* to branching narratives like Matt Youngmark's book, *Time Travel Dinosaur* (https://www.drivethrurpg.com/product/140435/Time-Travel-Dinosaur), web-based interactive fiction like *howling dogs* (http://slimedaughter.com/games/twine/howlingdogs/) by Porpentine, and recent interactive "shows" on Netflix, such as *You vs. Wild* (https://www.netflix.com/title/80227574) (students without access to Netflix were able to sign up for a one-month free trial, so we were not requiring students to purchase a subscription). We find a high rate of engagement for "play this video game" assignments.

We also assign podcast episodes, videos of presentations and talks, online articles and select chapters by game designers about their creative approach to their work.

For game-making assignments, tools range from paper and pencil for initial exercises to the open-source application *Twine* (https://twinery.org), used for making link-based games, and the free version of *Construct* (https://www.construct.net) for graphical game assignments. We have also used other programs for graphical game projects including *Bitsy* (https://ledoux.itch.io/bitsy) and *Godot* (https://godotengine.org). There are many other options for students to use when completing their graphical games, including commercial game development tools like *Unity* (https://unity.com) and *Unreal Engine* (https://www.unrealengine.com/en-US/students), which provide free educational licenses. Deciding which tools to use will depend largely on the ability to support students in learning and using them.

The recent pivot to remote learning has meant eliminating analog game assignments in favor of expanded use of Twine to incorporate some basic resource management mechanics. In future remote versions of the course, we will take what we've learned from online versions of several tabletop game classes and incorporate online collaboration tools such as *Miro* (https://miro.com) and *Tabletop Simulator* (https://www.tabletopsimulator.com) to bring back analog game practices to the course.

COURSE ASSIGNMENTS

The course's game-making is organized around small-scale analog game design followed by three major projects, each of which explores a different fundamental way that games work. In addition to game-making, students also do game analysis work. Each game-making project has an associated piece of critical writing and students also write a game character essay toward the end of the term.

Initial Analog Design Exercises

During the first week of class, students are asked to quickly create three analog games to start the process of actively making games. These games are created outside class and playtested in class (with guidance). After the playtests, students write a reflection (individually). The goal is to provide practice with (1) rapid ideation under constraint, (2) playtesting and constructive critique, and (3) drawing useful design ideas from feedback.

- All exercises:
    - A game that can be reliably played in 5-7 minutes (test beforehand)
    - With two or three possible player actions
    - You can relax/remove one constraint (but do not make longer than 7 min)
- Exercise 1:
    - For one or two players
    - Using primarily materials you find on campus (outside of living spaces)
    - With actions supported by the behavior of the physical world (e.g., how things move through space, their material properties)
    - Meant to elicit feelings of excitement or joy
- Exercise 2:
    - For one to three players
    - Using common household objects
    - With the actions supported by human creativity (e.g., building things, drawing pictures, solving puzzles)
    - Meant to elicit feelings of overcoming or hope
- Exercise 3:
    - For one to three players
    - Using cards, tokens, spinners, and other things used on a flat surface
    - With the actions supported by the collection and exchange/conversion of imaginary resources (e.g., food, money, time, points)
    - Meant to elicit feelings of camaraderie or collaboration
- Playtest instructions:
    - You are all going to partner with someone (sitting near to you) and play your games
    - You can stay in your seats, use the edges of the room, use the front, or go just outside (not close enough to other rooms to bother people using them)
    - In any case, be (back) in this room, sitting next to your partner, 20 minutes later
    - During playtesting, person who designed game only explains how to play
    - Person playing only asks questions about how to play

    - Designer observes play: What happens? How does it compare with expectations?
    - Player observes play experience: How does playing feel? Which elements correspond with which feelings?
    - After playtests, in the classroom, students write what they observed and their further thoughts on papers to give each other, following instructor guidance on constructive critique.
- Reflection instructions:
    - From the playtests of your three design exercises, write ~50 words about the moment that most surprised you.
    - From the critiques, write ~50 words about an idea one of your critiquers had, that you hadn't had, that you agree with.
    - From the design exercises, write ~50 words about the most interesting design problem (identified in playtest or critique) and an idea of how you could fix it.

Major Project Assignments

The three major game-making projects' focus areas are:

- Linking, as commonly found in things like level transitions, dialogue trees, and quest structures, as well as being the foundation of all mechanics in many narrative games,
- Resources, as commonly found in game systems for things like health and inventory, but also used to represent things like the strengths of relationships between characters, and
- Graphically-represented space, as found in the elaborately-rendered spaces of AAA games and as pushed in new directions by many indie, art, and research games.

Link-Based Game

The goal of this assignment is to create a game that emphasizes linking, and that presents a fiction or personal memory.

Links are a common way for games to represent things such as nuanced life choices, or certain kinds of movement through space, or discussions, or the associative structures of memory. These are powerful tools for storytelling. A game structured as a series of choices can move forward propulsively, never letting players turn back (or turn in an uninteresting direction). A game of moving through real or metaphorical space, perhaps examining or collecting items, can tell of what came before — like a haunted house or a museum. A game structured around memory's connections can bring to life the uncertainties, repetitions, and wild leaps we experience when lost in thought.

The first week of this project students will:

- Think about the kind of experiences/stories they want to create.
- The ideas should be interesting to them, and they should also be good containers for linking and branching.
- Then students write short descriptions for 3-5 possible branching narratives.

The second week of this project students will:

- Plan out their complete games, create all the "passages" (nodes in the Twine network, of which they should have more than 30).
- Create the links between passages.
- Put enough text in each passage for a player to understand what is happening in the game.
- Have this draft version at section, as well as uploaded the day before section.
- Include, in the comments on their submission, a note explaining their player experience goal and how they are using links to accomplish it. (For example: "I wanted the player to feel claustrophobic, so I trapped them in a cycle of links it's hard to escape." Or "I wanted to player to feel like they were making hard choices, so each path through the game includes three dilemmas with consequences for the protagonist.")

The third week of this project students will:

- Revise the game based on section feedback (writing a note about this for the submission comments),
- Complete the contents of all passages (full text, perhaps with accompanying images),
- Perform at least one playtest with the completed game (and potentially revise based on this), and
- Upload the final version.

Link-Based Game Analysis

The goal of this assignment is for each to reflect on the structure of their game, as a way of thinking about how games function more broadly. Students' answers are their own. Though they are welcome to discuss ideas with people in class, their TA, their friends, and anyone else, their words should be theirs.

Each analysis should include these sections, clearly labeled:

- What fiction or personal memory does your game aim to present? [20–50 words]
- What is the player's role in your game (e.g., a character, someone shifting the actions of multiple characters, or a disembodied observer)? [20–50 words]
- What player experience goal did you pursue for the final game? How do you use links to help create that experience? [20–50 words]
- Describe your in-section playtest (of the draft). What did you learn from the playtest and what changes resulted from it? [20–50 words]
- Describe your at-home playtest (of the complete game). Who played, when and where did they play, what did you learn from the playtest, and what changes (if any) resulted from it? [30–70 words]
- Describe the concept of agency (as defined in Zubek's chapter 6 and/or in lecture) and

whether your game provides it and, if so, how and when. [150–300 words]

- Zubek's chapter 6 describes a set of narrative patterns, and a further set were identified in lecture. Say which of these patterns your game employs, describe that pattern or patterns, and discuss how your game enacts its narrative pattern(s). If your game employs more than two, do this for two of them. [150–300 words]

Resource-Based Game

The goal of this assignment is to create a game played with physical materials that fit on a tabletop (e.g., boards, tiles, cards, counters, dice, charts) with a design that emphasizes resources. The resources can be of many types — such as money, political favors, health, labor, game moves, military force, willpower, sanity, family members, or prime-time advertising slots. The same game might have a range of resource types, or only one. The resources may be acquired, transformed, destroyed, traded, or dealt with in any other way that works for the game's theme.

The theme of each game is the frame through which the game's resources, and other elements, are presented. For this assignment, the theme must be related to the real world, as each student understands it. Specifically, it must represent a way they think the world is, was, or should be.

The game could be about student loans, or Thanksgiving dinners, or the division of nations after the World Wars, or finding balance in life, or religious orthodoxy, or a political campaign, or designing a mission to Mars, or training a pet, or a child custody battle, or news media reactions to police killing people from different backgrounds. Your game should seek to represent students' thoughts about the world in the moment-by-moment actions of the players (e.g., if the game is a turn-based game about avoiding people at parties, with excuses as a resource, every turn should involve thinking about how to gather or use excuses — unless they think it is still possible to get lost in moments of thought or enjoyment, in which case that should also be possible). Similarly, each game should represent students' thoughts about the world in the overall shape of gameplay (e.g., if the game is about washing a child's hair, with time as a resource, it should not be possible for the hair washing to be done in two minutes, or take all day, no matter how skilled or lucky the players are).

The first week of this project students will:

- Create a team document, with two pieces of contact information for each team member and two times during the week they can meet for at least an hour.
- Write, and submit, paragraph-length descriptions for 3-5 possible resource-focused tabletop games that interest them as a team.

The second week of this project students will:

- Create a resource-focused tabletop game that requires no more than 4 players and takes no more than 30 minutes to play (shorter is better).
- Write up the rules and submit them online the day before their section.
- Bring the game and rules to their section.

The third week of this project students will:

- Revise the game based on section feedback.
- Complete the game's visual and tactile elements.
- Perform at least one playtest with the completed game (and potentially revise based on this).
- Make a video explaining the rules. This should provide a quick overview of the game, its object, rules, and how to play. It must be less than five minutes.
- Bring the final game to section to turn in.
- Upload a document. This should describe their design process, including:
    - How did they come up with their ideas? How did they choose one?
    - How did they develop their draft game? What feedback did they get from playtests?
    - What further revisions did they make to create the final game? What did they learn from playtesting it? Did they make further revisions?
    - What were the roles of each partner? What did each contribute at each stage?

Resource-Based Game Analysis

While games were created as teams, each team member should do their own analysis. Each analysis should include these sections, clearly labeled:

- What about the world (how it is, was, or should be) does your game aim to represent? [20–50 words]
- What actions are available to players, with what potential responses from the game system (i.e., what "mechanics" in Zubek's terms)? [100–150 words]
- What patterns arise, during play, from the actions and strategies of players (i.e., what "gameplay" in Zubek's terms)? [100–150 words]
- What feelings do these patterns evoke, and how do the patterns and feelings change over time for different players (i.e., what "player experiences" in Zubek's terms)? [100–150 words]
- What ideas are communicated through the relationship between your real-world theme and these actions, patterns, and feelings — both ones you intended and ones you may not have? [100–150 words]

Graphical Game Project

The goal of this assignment is to create a game that emphasizes graphical logics, used to create a spatial model — and employs them in an alternative or expansive manner. Students have two choices for how to pursue this, and three different tools to choose between. The default tools are the *Bitsy* and *Construct 3* engines. But if a team has someone with appropriate technical skills, they can use the *Godot* engine. There are two versions of the assignment.

Movement-Based Version

Graphical logics (i.e., collision, control, and physics) are the building blocks of many familiar video games. Games in the tradition of Atari's *Adventure* and Nintendo's Zelda series focus on movement through space and interaction (often through collision) with the objects and characters encountered.

These games also often use linking logics to jump from one space to another (e.g., from the above-ground world to a cave) or for character dialogue. They also often use resource logics to track values such as health or for buying and selling items. But graphical logics remain primary.

These games represent familiar types of space, if often in fantastic settings. One approach for this project is to make a game that functions like these games, but with a setting that is currently unusual for games. (This is following the alternative approach for the assignment.) It could be an everyday urban street, where the player character interacts with advertising images that sap feelings of self-worth — avoiding them, defacing them, or creating alternatives to them. It could be a set of remote desert canyons, previously used as a dump by neighboring communities, where the player character identifies, collects, and assembles the pieces needed to signal for help before an impending nearby nuclear test. It could be that the player character is an insect, bird, reptile, fish, or non-human mammal, trying to thrive either in their natural environment or another.

Other graphical logic games present spaces that are primarily metaphorical, rather than representational. This tradition stretches back at least to the 1982 game *Tax Avoiders,* in which the player character moves around a landscape of financial possibilities. And, of course there are also hybrids: the game *Passage* is created to be deliberately legible as both a representational and metaphorical space. These games often find ways to have players enact familiar dilemmas and struggles, but in new ways, through graphical logics. Students could also make a game like this. (This is following the expansive approach for the assignment.)

Restrictions for this version of the assignment: Players should be able to move through space in different directions (no "corridor" games). Moving in different directions should lead to different encounters / puzzles. Simply trying to move through space should not be the primary activity (no simple platformers, *Flappy Bird* or *Frogger* clones, etc.). Even if doing this version in Godot, the game must be 2D (though an isometric perspective in art assets is okay).

Reimplement and Reskin Version

There is a long tradition of reimplementing games and reskinning them to mean something else. *Pac-Man* has been reskinned to be about a mouse avoiding cats. *Frogger* has been reskinned to be about sneaking aliens out of Area 51. These are alternative approaches, presenting types of spaces and spatial activities that are unusual in games.

At the same time, there are also expansive re-skinnings. *Pong* has been reskinned to be about conversation. *Tetris* has been reskinned to be about disposing of human beings. These take the spatial elements of these games and give them an additional, non-spatial meaning.

In this approach to this assignment, students will choose a single-screen (non-scrolling), two-dimensional game that already exists and they will (a) reimplement its gameplay and (b) reskin the game to be about something else, using either an alternative or expansive approach.

Graphical Game Project Timeline

The first week of this project students will create a document, including:

- Two pieces of contact information for each team member and two times during the week they

can meet for at least an hour.

- Whether the team plans to do the Movement-Based version of the assignment or the Reimplement and Reskin version of the assignment.
- What tool they plan to use.
- 3-5 game ideas that meet the requirements for their version of the assignment, each specifying (1) the game fiction, (2) the gameplay, and (3) the intended players.

The second week of this project students will:

- Plan out the complete game, including both an implementation plan and an explanation of their theme, in the same document.
    - The implementation plan should outline all the spaces, objects, and interactions planned for the final game, ideally in a combination of text and images.
    - The theme explanation should describe the game's world and how they are taking an alternative or expansive approach to specific graphical logics and/or spatial models more generally.
- Implement the types of graphical interactions the game requires.
- Develop a demonstration game (e.g., a single "room") that shows each type of interaction and the proposed art style.

The third week of this project students will turn in a game that is:

- A complete experience, both fully functional and with final text, imagery, and/or sound.
- Building on class concepts through use of graphical logics and spatial models, in a way the team can articulate. (Unless they are reimplementing and reskinning a game for which these logics and models are not key, in which case they should be able to articulate this for their game's logics and models.)
- Original, with clear credit given for any elements not created by the team, and permission to use them (this includes everything from imagery to code).
- Small in scope and clear in concept — explainable in 30 seconds, demoable in 3 minutes, fully playable in under 20 minutes.

Graphical Game Analysis

While games were created as teams, each team member should do their own analysis. Each analysis should include these sections, clearly labeled:

- What alternative or expansive approach (or approaches) are important to your game? For example, if you chose the movement-based game option, what (alternative) unusual representational space(s) and/or (expansive) metaphorical space(s) does your game present? If you chose the reimplement and reskin option, was your high-level approach alternative and/or expansive, and why was that a good fit with the game's new theme?
- What is the player's role in your game? What mechanics are available to the player? How does

the system respond?

- What graphical logics (and other logics, if applicable) support those mechanics? In what ways?
- How does the player's experience of the game unfold over time? What different types of experiences are possible? What tradeoffs and consequences (if any) does the player face?
- Assuming your game includes graphical logics, compare your game's use of graphical logics (control, collision, physics) and/or spatial models (representational or metaphorical/overloaded) with one of the games assigned for you to play and/or discussed in lecture. Explain at least one meaningful similarity and one meaningful difference. (If you chose the reimplement/reskin option, and reimplemented a game which does not include graphical logics, choose the logics that support its key playable model.)
- Give a brief (few sentences) description of how you and your partner divided the tasks for creating this game.
- If you deviated from the plan you submitted week 2 in any significant way, please explain how and why.

Critical Analysis Assignments

Game Character Essay

Unlike earlier writing assignments, which were about students' own games, here they will write about their experiences with one or more games created by others. Specifically, in a well-constructed, 400-500 word essay, they will discuss a single issue about their personal relationship with characters in video games that interests them. Questions they might consider include, but are not limited to:

- How do you see yourself in relation to game characters?
- Are game characters you play an extension of who you are, who you'd like to be, or just someone who isn't you?
- Do you have a different relationship with fixed characters (the *Pong* paddle, Mario, Laura Croft, Winston, Sora, Frisk, Henry M., Aloy, Link, etc.) than you do with characters that you make using a character creation tool (*The Sims, Dragon Age, Saints Row, Skyrim, Monster Hunter World, ARK,* etc.)?
- What about games that allow you to randomize character appearance?
- What different ways do you think about the characters you control in games? About their appearance?
- Is there a difference between games in which you can see your character (third-person) or ones in which you are seeing through the character's POV (first-person) or ones that address "you" (second person)?
- Is it different in games you play with other people? If they know you? If they are strangers?
- If you play tabletop roleplaying games, feel free to discuss your relationship with characters in those games as well.

They should be specific, describing a significant game, character, or specific incident that helps

illustrate their point. They should consider which aspects of the readings associated with this assignment spoke to them most. (These readings, linked from the class schedule, are: "My disabled son's amazing gaming life in the World of Warcraft" by Vicky Schaubert, "The Power of the Makeover Mage" from the Imaginary Worlds Podcast, and "Saving Grace" from The Nod Podcast.) They should try to include specific details of those sorts, even if none of their game character experiences are similarly dramatic.

Students will tie their thoughts together into an essay with a clear thesis idea that expresses the central issue they are exploring. They should be sure to proofread their work for spelling, grammar and clarity. We highly suggest them reading their writing out loud, or enlisting a friend to read it out loud to them if possible.

In-Class Quizzes

Beyond project and writing work, students get weekly reading/listening/watching/playing assignments to give context and additional insight into both the lecture material and the students' own work making games. The texts assigned include critical work, practical reflections on design by game designers, journalism and interviews. Their understanding is evaluated through game-making and analysis (where concepts from this material are applied) and through regular, low-stakes quizzes.

Extra Credit Playtesting

Finally, because we teach this course during quarters in which seniors in our game design programs are working on their collaborative capstone games, we offer extra credit to students who participate in organized playtest events that are held during the term.

COURSE ASSESSMENT

As you can see from the breakdown below, we put emphasis on hands-on game-making projects, which, including the final project account for 65% of a student's grade:

- Critical Writing and Analysis: 25%
- Link-Based Game: 20%
- Resource-Based Game: 20%
- Graphical Game Project : 25%
- Quizzes 10%

Quizzes often serve a dual function of both validating that "reading" assignments are being completed and also serving as an attendance-taking tool.

We always try to offer an extra-credit assignment in the form of an optional critical essay or an additional component to one of the game-making assignments.

EXPANDED COURSE OUTLINE

Weekly instruction is split between lecture presentations and study sections. Lectures are typically delivered in a large lecture hall to 300 students, and are either scheduled as three 60-minute classes or

two 90-minute classes per week. Lecture presentations include video examples, live gameplay, active learning experiences, and occasional small-group playtesting. 60-minute study sections are held once per week and are led by graduate teaching assistants, with assistance from undergraduate tutors. Section activities include discussion, playtesting and team-based game design work. Section size is limited to 30 students, so we typically have 10 sections scheduled at various times throughout the week. When the course is offered remotely, lectures and sections are held synchronously via Zoom and recordings of lectures are also posted to Canvas.

Week 1: Introduction to the Course and Game Design

Class Topics /Activities

- Instructor Introduction(s)
- Course Overview
- The Game Design Process
- Playtesting
- Game Criticism

Assignments

- Reading/Playing/Listening/Viewing
    - "How I Design a Game" by Andrew Looney, excerpted from *Kobold Guide to Board Game Design* (https://koboldpress.com/kpstore/product/kobold-guide-to-board-game-design)
    - "Elements" (Chapter One) from *Elements of Game Design* (https://mitpress.mit.edu/books/elements-game-design) by Robert Zubek
- Game-Making
    - Analog Design Exercise / In-Class Playtest One
    - Analog Design Exercise / In-Class Playtest Two
    - Link-Based Game Part 1 – Ideation

Week 2: Links in Games

Class Topics /Activities

- Links in Games
- Game Fictions and Agency
- Links and Narrative Patterns

Assignments

- Reading/Playing/Listening/Viewing
    - "Macrostructure" (Chapter Six) from *Elements of Game Design* by Robert Zubek

    - *Time Travel Dinosaur* (https://www.drivethrurpg.com/product/140435/Time-Travel-Dinosaur) by Matt Youngmark
    - Listen to Imaginary Worlds podcast episode "Choose Your Own Adventure" (https://www.imaginaryworldspodcast.org/choose-your-own-adventure.html)
    - Play *You vs. Wild* (https://www.netflix.com/title/80227574) on Netflix
    - Play through *howling dogs* (http://slimedaughter.com/games/twine/howlingdogs/) by Porpentine
- Game-Making
    - Analog In-Class Design Reflection
    - Link-Based Game Part 2 – Draft

Week 3: Player Experience

Class Topics /Activities

- Player Experience
- Quantifying Players
- Operational Logics

Assignments

- Reading/Playing/Listening/Viewing
    - Play *Passage* by Jason Rohrer (http://hcsoftware.sourceforge.net/jason-rohrer) (around five minutes of gameplay) – Play *Passage* before you read "Operational Logics and Playable Models" You can play it in a browser here: http://passage.toolness.org/
    - "Player Experience" (Chapter Two) from *Elements of Game Design* by Robert Zubek
    - "Operational Logics and Playable Models" (Chapter One) from *How Pac-Man Eats* (https://mitpress.mit.edu/books/how-pac-man-eats) by Noah Wardrip-Fruin
- Game-Making
    - Link-Based Game Part 3 – Final Game
- Critical Writing
    - Critical Essay – Link-Based Games
    - Link-Based Game Self- Analysis

Week 4: Game Mechanics, Art and Narrative

Class Topics /Activities

- Game Mechanics, Art and Narrative
- Game Taxonomies and Art Style
- Story and Gameplay

- Game Mechanics
- Logics, Mechanics and Genre
- Games and Rhetoric

Assignments

- Reading/Playing/Listening/Viewing
    - "Metaphor vs Mechanics" by Matt Forebeck excerpted from *Kobold Guide to Board Game Design*
    - Play *Florence* (https://annapurnainteractive.com/games/florence) by Mountains
    - Play *Canabalt (http://canabalt.com)*
    - "Mechanics" (Chapter Three) from *Elements of Game Design* by Robert Zubek
- Game-Making
    - Resource-Based Game Part 1 – Team Document and Ideation

Week 5: Game Systems

Class Topics /Activities

- Game Systems
- Game Mechanics and Systems
- Game Loops and Gameplay
- Engagement and Motivation
- Game Design Frameworks
- Content Warnings

Assignments

- Reading/Playing/Listening/Viewing
    - "Systems" (Chapter Four) from *Elements of Game Design* by Robert Zubek
    - Watch "The Royal Game of Ur" (https://youtu.be/WZskjLq040I)
    - Play *Frog Fractions* (*https://store.steampowered.com/app/1194840/Frog_Fractions_Game_of_the_Decade_Edition*)
    - Read *MDA: A Formal Approach to Game Design and Game Research* (https://users.cs.northwestern.edu/~hunicke/MDA.pdf) by Robin Hunicke, Marc LeBlanc, and Robert Zubek
    - "Gameplay" (Chapter Five) from *Elements of Game Design* by Robert Zubek
- Game-Making
    - Resource-Based Game Part 2 – Draft

Week 6: Prototyping and Playtesting

Class Topics /Activities

- Prototyping and Playtesting
- Prototyping, Playtesting and Iteration
- Constraints and Affordances
- Design Documents
- Game Interpretation using Logics and Models
- Resource Games

Assignments

- Reading/Playing/Listening/Viewing
    - Read "Prototyping and Playtesting" (Chapter 7) from Elements of Game Design by Robert Zubek
    - Watch "It's not you. Bad doors are everywhere" (https://youtu.be/yY96hTb8WgI)
    - Read "Understanding Games Through Logics and Models" (Chapter Six) from *How Pac-Man Eats* by Noah Wardrip-Fruin
- Game-Making
    - Resource-Based Game Part 3 – Final Game and Videos
- Critical Writing
    - Resource-Based Game Part 4 – Analysis

Week 7: Themes and Approaches

Class Topics /Activities

- Novel Game Themes and Expansive Approaches
- Game Spaces

Assignments

- Reading/Playing/Listening/Viewing
    - Read "Alternative Approaches" (Chapter Two) from *How Pac-Man Eats* by Noah Wardrip-Fruin
    - Watch "Gaming for Understanding" (https://www.ted.com/talks/brenda_romero_gaming_for_understanding) by Brenda Romero
    - Watch "Games Change How We Think" (https://youtu.be/qV64XgFQFUg) by Mary Flanagan
    - Read "Expansive Approaches" (Chapter Three) from *How Pac-Man Eats* by Noah Wardrip-Fruin

- Game-Making
    - Graphical Game Part 1 – Team Documentation and Ideation

Week 8: Literal and Metaphorical Game Spaces

Class Topics /Activities

- Literal and Metaphorical Game Spaces
- Player/Character Relationships
- Novel Spatial Games

Assignments

- Reading/Playing/Listening/Viewing
    - Read "My disabled son's amazing gaming life in the World of Warcraft" (https://www.bbc.com/news/disability-47064773) by Vicky Schaubert
    - Listen to *The Nod Podcast* episode: "Saving Grace" (https://gimletmedia.com/shows/the-nod/rnhzog/saving-grace)
    - Listen to *Imaginary Worlds Podcast* episode: "The Power of the Makeover Mage" (https://www.imaginaryworldspodcast.org/episodes/the-power-of-the-makeover-mage)
    - Play *Parable of the Polygons* (https://ncase.me/polygons/) (play all the games and read all the way to the bottom)
    - Play (optional): *Papers, Please* (https://papersplea.se/)
    - Read "Refinement" (Chapter Eight) from *How Pac-Man Eats*
    - Read "Doubling" (Chapter Nine) from *How Pac-Man Eats*
- Game-Making
    - Graphical Game Part 2 – Draft Game
- Critical Writing
    - Personal Player/Character Essay

Week 9: Social Connections

Class Topics /Activities

- Social Connections
- Social Models in Games
- Working Conditions in Game Development
- Game Studio Culture and Diversity

Assignments

- Reading/Playing/Listening/Viewing
    - Read "EA: The Human Story" by ea_spouse (https://ea-spouse.livejournal.com/274.html)
    - Read "Wives of Rockstar San Diego employees have collected themselves" by Rockstar Spouse (http://is.gd/yPcj9t)
    - Read "The Human Cost Of *Call of Duty: Black Ops 4*" by Jason Schreier (https://kotaku.com/the-human-cost-of-call-of-duty-black-ops-4-1835859016)
    - Read "How 'Slime Rancher' Made a Ton of Money And Stuck to 40-Hour Workweeks" by Patrick Klepek (https://www.vice.com/en/article/d3ba3m/how-slime-rancher-made-a-ton-of-money-and-stuck-to-40-hour-workweeks)
    - Read "Inside The Culture Of Sexism At Riot Games" by Cecilia D'Anastasio (https://kotaku.com/inside-the-culture-of-sexism-at-riot-games-1828165483)
    - Read "Riot Employees Say Company Has Made Real Progress Fixing Its Sexism Issues" by Cecilia D'Anastasio (https://kotaku.com/riot-games-and-sexism-one-year-later-1837041215)
    - Read "Riot Games to Pay $10 Million to Settle Gender-Discrimination Lawsuit" By Todd Spangler (https://variety.com/2019/digital/news/riot-games-10-million-gender-discrimination-lawsuit-settlement-1203422127/)
    - Read "Inventive Approaches" (Chapter Five) from *How Pac-Man Eats*
- Game-Making
    - Graphical Game Part 3 – Iterate to Playable Game

Week 10: Ludic Loops, Game Research and Historical Contexts

Class Topics /Activities

- Ludic Loops
- Game Research and Historical Contexts
- Game Research at UCSC (presentations by graduate students)
- Games as Art and Protected Speech
- Game History and Games in Context

Assignments

- Reading/Playing/Listening/Viewing
    - Listen to: Addiction, Ludic Loops, and Why Smartphones are Mobile Skinner Boxes (32 minutes) (https://www.mike-walsh.com/podcast/natasha-schull)
    - Read: "The Lucid Truth of Ludic Loops" by Matilda Zhang. W. Buckleitner (https://medium.com/interactive-designers-cookbook/the-lucid-truth-of-ludic-loops-

caec3ad272da)

    - Read: "Supreme Court says video games are protected free speech, California can't regulate sales of violent games: a complete analysis" (https://www.theverge.com/2011/6/27/2515183/supreme-court-video-games-protected-free-speech-analysis)

- Game-Making
    - Graphical Game Part 4 – Final Game
    - Graphical Game Statement
    - Graphical Game Instructions
    - Link-Based Game Part 5 – Link-Based Game Archiving

Finals

Class Topics /Activities

- Final Exam and Project Presentations
- Students Present Selected Game Projects
- In-Class Final Exam

Assignments

- Game-Making
    - Graphical Game Archiving
- Critical Writing
    - Graphical Game Analysis

COURSE BEST PRACTICES

Be open to student-sourced material

There are many parts of the Foundations of Video Game Design curriculum that came directly from student suggestions. 300 students, many of whom are deeply interested in games, but all with very different backgrounds and other interests, are exposed to lots of material relevant to the class. Be sure that students know you are interested in their suggestions for additional game examples, articles, and videos… even after the course is complete! It is particularly gratifying to get an email from a student a year later which includes a link to a gameplay video that perfectly illustrates a challenging concept from the class. It also makes the next version of the course stronger and often timelier.

Have more than one project

A previous iteration of the course (offered for several years) was organized around one large, graphical game project. This was exciting, because students could do multiple prototypes and iterations. However, many students emerged from the class only understanding the graphical elements of games. And the stakes for the projects were too high for an introductory course. Some students steered away from their own exciting, innovative ideas because they were worried that they might be working on a

"failed" idea all term. Moving to multiple projects, each focusing on a different way that games work, has broadened student understanding and encouraged experimentation.

Include gameplay examples in lecture

As often as is technically possible, we like to do live gameplay examples in class. For games like *Canabalt*, *Pac-Man* or *Florence* with simple gameplay and controls, we get the appropriate version for the machine we are delivering lecture slides from (either in a classroom or via Zoom) and switch to screen sharing while the game is played. Having students volunteer to play adds a level of engagement and allows the instructor to lead discussion of the gameplay that is taking place. Even if live gameplay is not an option, there are plenty of recordings of nearly any game imaginable on YouTube that enhance discussion and can be used to illustrate concepts. (Pro Tip: add the phrase "no commentary" to your YouTube search to avoid YouTubers talking over the game.) For some instructors, recording their own specific gameplay clips may be an option. It is definitely an additional technology and skill hurdle, but allows for more precise/relevant examples. This is another area in which asking for help from students and Teaching Assistants might bear fruit. In addition to video games, we have also had positive experiences using overhead projectors and secondary cameras (both in the classroom and in Zoom) for playing boardgames live in class.

Consider the number of tools that students need to learn to use (and that you need to support)

We have tried to focus on a core set of game-making tools in the course, but changing licensing terms and our desire keep material costs for this class low have meant that we've had to change the recommended graphical game tool several times. Each time put pressure on faculty (and especially TAs) to develop new instructional and support material. In order to accommodate students who are at different levels of experience we have started designating a recommended tool (like the free version of Construct 3) for which the course will provide basic instruction in section/lab and support from Teaching assistants, while also allowing students to use alternate tools such as Bitsy, Godot, Unity and Unreal Engine. Students choosing unsupported tools understand that they are on their own and bound by the same assignment requirement as others. This has also become a great way for us to discover and test potential new tools for the course and also to let TAs with experience using other game development programs to mentor students who want to try them.

Examples of student game projects

We are in the process of making a more comprehensive and accessible archive, but this collection from our Winter 2019 class are a good example of the types of link-based and graphical games that students produce in the course: https://80kgames.soe.ucsc.edu/80k-games/

FUTURE COURSE PLANS

A hands-on game design survey course will continue to be a challenge to keep updated and interesting to students. The constant release of AAA studio games, indie games, art games, critical writing, academic research, and even the most basic tools used to complete projects in the course, make updating the course vital… and time-consuming.

Applying the iterative, collaborative processes that we teach to developing the course itself has been very successful and will no doubt continue. Increasingly, we have been inviting other professors

and external subject matter experts to give guest lectures, and we expect to continue to expand this practice. These collaborative efforts produce a far richer course than would be possible for a single professor to design alone.

In this spirit, we will also continue our efforts to document the course, assignments and material to make it easier for other faculty to teach (or co-teach) but still make their own. And, of course, sharing what we've learned outside of our institution by sharing our curriculum on Canvas Commons and in publications like this!

The hands-on portion of the class has been increasingly difficult to manage as the number of students in any given class increases, and has only been possible with access to graduate Teaching Assistants and undergraduate Graders. While decoupling the lecture content and the game-making content is regularly considered, the benefit of integrating both learning modes into a single class has outweighed the logistical challenges so far.

Given our unexpected pivot to remote teaching due to COVID-19, we have also been trying out multiple new learning tools and methods which we expect to integrate into our classroom-based course: streaming lectures and guests, real-time chat feedback from students, messaging apps like *Discord*, collaboration tools such as *Miro* and *Google Workspace* apps, and analog game spaces like *Tabletop Simulator*. We hope these resources will also accelerate our work to make the course more accessible to students with disabilities and all students for whom traditional lecture/section learning is difficult or impossible.

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CHAPTER 27.

GAMEPLAY APPLICATIONS (GAME50172)

ESTHER MACCALLUM-STEWART [1] AND NIA WEARN [2]
STAFFORDSHIRE UNIVERSITY

Course Title: Gameplay Applications (GAME50172)
Course College/School: Digital Technologies and Arts
Course Department/Program: Games and Visual Effects
Course Level: Undergraduate – 2nd Year (Level 5)
Course Credits: 30
Course Length: 2 semesters (24 weeks)
Course Medium: *Face-to-face, Online, Blended/Hybrid*
Course Keywords: boardgames, gameplay, games studies, game design, emergent play, games industry, prototyping

CATALOG DESCRIPTION

Gameplay Applications investigates how gameplay affects gaming design and development, and why it is such an essential element of making games. You will produce a complete, ready to play boardgame by the end of the year, and will take part in a games 'expo' to showcase this*. The two semester course (24 weeks) takes students through the process of iteration, development, design and marketing a boardgame, as well as producing a physical copy of a boardgame that has gone through rigorous playtesting and development. You will learn how to produce a complete game, as well as pitching, how to demonstrate games and explain rules, create market sheets, balance rules and produce a physical boardgame from start to finish.

*Either online or virtually, depending on current guidelines about social gatherings.

COURSE PURPOSE AND OBJECTIVES

The formal objectives (presented below) have allowed us a playful flexibility that takes the idea of gameplay beyond the videogame. As we discuss elsewhere, this is vital for our students, as it provides them with a solid vocational pathway and gives them insight into a rapidly expanding area of the

1. Dr. Esther MacCallum-Stewart is an Associate Professor in Game Studies at Staffordshire University, Her work examines how players understand and play games, and the narratives they create as a result. She has written widely on roleplaying, representation in games and analog gaming, including boardgames and boardgaming cultures.
2. [Nia Wearn, Course Director for Esports, Games Studies and Communities, Staffordshire University n.h.wearn@staffs.ac.uk. Her teaching focusses on the production, communications, and gameplay aspects of the university

games industry. It also means that they can finish the course with a physical product, which has been taken through multiple design iterations and which has had to be designed according to industry activities associated with games production such as pitching, producing appropriate box art, and working with marketing sheets. The objectives therefore take us beyond the physical product, and enable a more robust approach to the boardgames industry. We have provided a short rationale of these objectives below.

We include two versions of the course – one taught pre 2019 in-person, and one post 2020 virtually. We were concerned when the COVID pandemic began, that physical design would be eschewed altogether, and indeed, saw many other courses make this choice. Despite this, the sales of boardgames continued to increase incrementally. We wanted therefore to encourage students to develop physical artefacts despite being taught online – boardgames are not a virtual medium, and despite many platforms that emulate them it was physical sales that grew. Future plans to teach more consistently through online platforms mean that this course is already fit for purpose.

Course Objectives

1. Analyse researched information in order to plan a project that fulfils the identified needs of a modern game. [Analysis, Enquiry]
2. Evaluate the appropriateness of choices and varied approaches to solving problems that occur during the preparation and presentation of gameplay mechanics. [Problem Solving]
3. Determine game characteristics and mechanics in order to select appropriate tools and methods required to support the design and development of a rapid prototype game. [Reflection; Enquiry; Problem Solving]
4. Plan and create an analogue game that utilises the correct documentation. [Application]
5. Review the product creation process, evaluating the effectiveness of your role during the project. [Reflection]

Breakdown of objectives

Overall the objectives combine the joint criteria of producing a game that is predicated on the joint aspects of effective gameplay, and its application within a functioning artefact.

Objective 1 lays the groundwork for the project. Students on this course follow a pathway that studies Games Design and Production, as well as the theoretical precepts of games and gameplay. This means they have already produced videogames and worked together on project management teams, as well as studying 'Fundamentals of Gameplay' in an earlier module. In producing a boardgame, the students get experience of working on their own on a solo project, which does not replicate work done elsewhere on their courses. The course builds on their previous work in understanding that gameplay moves beyond traditional games design into other aspects of the industry and played activities.

Objectives 2 and 3 develop aspects of the Games and Visual Effects department's undergraduate journey as a whole, by emphasising the importance of gameplay and mechanics. Students score poorly if their game is unoriginal or uses mechanics that are not well thought out and tested; likewise if their game is entirely luck-based without good reason, they are not considered to have

succeeded in developing effective mechanics for enjoyable play. These two objectives underscore this criteria, as well as helping the students to understand why work done elsewhere (rapid prototyping of videogames) is reflected across the games industry in similar but different ways. These objectives have perhaps been the most tweaked over time as a result of feedback from students and external examiners, in order to provide clarity and purpose within the course.

Objective 4 identifies the type of output required and emphasises that it is not the sole final product – documentation is also an assessed / expected part of the work submitted.

Objective 5 enables the student to reflect on their overall development throughout the two semesters. In the past this has taken the form of continuous monitoring throughout the year – for example the student produces a SWOT analysis of their game, and also works closely with industry standard feedback forms.

COURSE CONTEXT

This is a mandatory course for students studying the 'BA (Hons) Games Studies' and 'BSc (Hons) Computer Gameplay Design and Production undergraduate courses at Staffordshire University. Students are second year undergraduates. The course comprises about 60 students, taught together in one class. Students in the UK do not pick their courses from a pool – instead, their undergraduate journey is highly thematic, and they must follow a set pattern of study which remains within their chosen subject area. The Games and Visual Effects department at Staffordshire University is the largest of its kind in the UK, comprising about 1500 students. This means that the undergraduate pathways within it are highly stratified, enabling students to specialize in a given area of Games and/or Visual Effects.

Students on this course (module) have previously completed a 24 semester in their first year on Fundamentals of Gameplay, which introduces them to the philosophy and underlying precepts of effective play mechanics and structure in games. This previous class is also intended to show them how gameplay manifests beyond videogames in daily life and activities, as well as making them case study a free to play mobile game of their choosing. The students are therefore used to studying 'beyond AAA'.

The students are well versed in videogames and digital design, however they often have little or no experience of playing modern boardgames (with a few exceptions who play boardgames very regularly). This has proven a major challenge as a significant percentage of the course in its early stages had to be tailored towards giving students the breadth of knowledge that they needed in order to appreciate what they were studying. A secondary issue arising is demonstrating the *value* of learning to design boardgames, as it takes students beyond the digital environments they are used to. This value is both financial (the boardgames industry is a multibillion, international juggernaut, grossing $17.2 billion in 2016, and continuing to grow exponentially, including throughout the COVID pandemic), and vocational – as a key skill in games design.

COURSE PEDAGOGY

Gameplay is a fundamental aspect of games design and development, but is rarely taught beyond videogaming. This belies the vast amount of gaming that happens beyond the keyboard or controller

– in person, in public spaces, as part of emergent behaviours in daily life, and in other mediums like boardgaming. Boardgaming is a multibillion dollar industry, and thriving in the UK. It has also seen even greater popularity during COVID, proving that the industry is hugely resilient.

Using boardgames as a fundamental tool to examine gameplay not only provides insight into this industry, but also exposes students to a more visceral, hands on type of gaming. The emphasis on aspects such as teaching and explaining rules, giving useful critical feedback and understanding how strategy, luck and game balancing can work together provide vital learning about how games can be effectively developed.

Gameplay Applications provides a robust introduction to the full process of developing a boardgame, with an emphasis on industry practice and iteration. It is underscored by the philosophy of gaming and gameplay – identifying the ways in which these inform our understanding of Games Studies as a theoretical and vocational study.

The course also intends to take students throughout the process of developing a successful product in the wider context of industry requirements – marketing, pitching, demoing and iterating through playtesting. Relying heavily on the type of holistic play practices described by Miguel Sicart in *Play Matters* (2014), it refigures philosophies of play and gameplay in order to give students a broader understanding of the Games Industry and its working practices.

The course uses a predominantly practiced based approach, which encourages active learning, agile development and emergent play. We have previously discussed how we decided to deliberately maintain this element, despite shifting the teaching itself to an online format. This is because boardgames are a physical medium, and often rely on proprioceptive play. More cynically, boardgames saw massive growth throughout 2020, with an estimated growth of $5.81 billion between 2020-24 (Businesswire 2020) demonstrating a massive desire for physical play between people who were able to interact together.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

Students are allocated a game from the current Top 100 on BoardGameGeek.com, the largest boardgaming review / discussion / forum website on the internet and a central hub for all boardgaming knowledge. Because of the cost of these games, they are not expected to purchase their allocated game. Instead, we encourage them through a series of tasks to investigate resources such as playthroughs, boardgamegeek.com discussions, sales figures, market reports and reviews. Students are encouraged to play the game if they are able, although we appreciate this is not always possible. A wide range of virtual resources are used in the first semester, a physical boardgames library is available for use, and there are written and audio resources available in the library.

Play sessions will be held when possible, allowing students to learn how to play modern boardgames, and also understand aspects such as their physical make up, how rules work, and how communities interact when playing. For the virtual version of this course, we encourage students to set up play groups and use the various simulation programmes available through platforms such as Steam (*Tabletop Simulator, Tabletopia* etc. Students are dissuaded from using these as part of their final submission, as we require a physical copy of their work to be produced.

In the second semester, students are expected to manufacture a box design in order to create a finished boardgame, however again we are aware that cost and availability of technology is a barrier to entry for some students. The university provides access to 3D printers and colour printers, however if it is not possible to use these, then the assessment is tailored so that they can submit a ready to print version.

In the past we have also experienced students ordering expensive components such as meeples, with the mistaken assumption that style will triumph over design and content in their final mark. Subsequent issues have included these components not arriving, since they often have lengthy shipping times, students overspending their own funds, or students designing their games around fixed content which later proves unviable during playtesting (so, they are beholden to an early design and resist changing it when it fails). The current iteration of the course advises strongly against this, and instead we promote the use of in-house 3D printing, as well as a limit on processed parts in the final submission. During COVID, a requirement that the finished game fits through a letterbox (approx. 24cm x 6cm) has also been added. Key elements of the assessment brief for the physical aspect have been competitions run by board game publishers in recent years. This adds to the live brief nature of the assessment and helps validate many of the themes around validity and employability the module sets out to encourage.

Playtesting

We used playtesting documents in every session where this took place. There are two documents – one for the games designer and one for each player. These record experiences during the playtest on a graduated scale and also allow for written feedback. These documents are freely available at http://www.playtest.co.uk/, and chosen as they are used by industry professionals at playtesting events across the UK.

Suggested Reading

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COURSE ASSIGNMENTS

We have included two forms of assignment here. The first 'Blended Learning' section details our pre-COVID strategy, which relied on students being able to participate in classes together, and to have access to devices such as printers, 3D printers, Microsoft Office Suite and a dedicated exhibition space to hold an in-person event at the end of the course. The second details an entirely virtual approach which can be taught online, and assumes students are technology poor, potentially unable to access materials that allow them to build finished versions of their games or design tools such as Photoshop.

The assignments are split over two semesters – 1 and 2, with all assignments marked 1-x for the first semester, and 2-x for the second semester. Progression and development is important here, and we follow the path of iterative development.

Students move from initial pitch – which may not bear much resemblance to the finished game, but will allow them to iterate on a theme – to formulating their rules, through playtesting, development and final presentation stages. A sell sheet, is included in the final submission as a marketing tool, but also allows students to showcase multiple vocational aspects in their portfolios and at the annual end of year Graduate Fair. The final self-reflection is a way to reconsider their work and amass needed marks if, for example, a game performs poorly.

We've noticed that often, courses that teach boardgames design have immediately shifted to virtual equivalents. We wanted to demonstrate that teaching this course and retaining its core elements online is not only still possible, but that avoiding virtual substitutes for boardgames themselves is still possible.

1. Blended Learning

This is a solo, analog game project, on a given theme, that should be finished and presented at our annual 'Board Game Expo' to the university.

Assignment 1-1 [10%]

Thematic 10 slide PowerPoint pitch deck with slides. The slides should cover the following:

- Working title
- High Concept
- Genre
- Game Play
- Features
- Setting
- Target Audience
- Market
- Competitive Analysis
- Game Summary

Assignment 1-2 [20%]

Draft Rules in English. There is no minimum or maximum word limit on this, not is there a right way to present the rules, however bear in mind that aspects like set up, descriptions of specific pieces or board layouts, or player order may be needed to support these.

Assignment 1-3 [10%]

'Let's Play' Video which explains how the game works and shows it in action. There is no time limit, but you will be judged on how well the game is explained. To be uploaded to YouTube, and a link added to the assessment folder.

Assignment 2-1 [40%]

Produce a complete and playable physical prototype, including English rules and all necessary components. Professional Art is not required but the game should have all necessary graphic elements for play. The game will be presented and assessed at the Board Game Expo in Henrion Gallery.

Assignment 2-2 [10%]

One Page Sell Sheet, on A4 and printed in colour.

Assignment 2-3 [10%]

Self- Reflection – a short document reflecting on your progression throughout the course and thoughts on your final work. What worked, what went to plan and what did not? Are you happy with the final game? What would you change, given the chance?

2. Virtual Learning Version

This is a solo, analog game project, on a given theme. The final version that should be finished and posted to us at the university. We will also hold an online showcase event, which will be recorded.

Assignment 1-1 [20%]

Analyse the analogue game play market as it stands in the final quarter of [year the course is being taught]. The focus, scope and range of this report is up to you but relevant reference (both industry and academic) should be included. Max 1000 words (excluding bibliography)

Assignment 1-2 [30%]

You will be allocated a game at random from the BoardGameGeek Top 100, and will have already completed a number of supplemental tasks for this.

1. Analyse the mechanics of your allocated game. Use flowcharts and diagrams where appropriate.
2. From this analysis (and your own knowledge) pick 3 or 4 mechanics that you wish to explore in your own game, explain why these are the mechanics that you are interested in exploring in your game.
3. Showcase the feedback you've received on the planned mechanics for your game from your peers.

Assignment 2-1 [40%]

Figure 1: Badger in a Box is looking for new games!

'We're developing a series of small box games that celebrate the breadth and creativity of the tabletop game design medium and are looking for more submissions for this collection.

We're specifically looking for games that take an innovative approach to the use of classic and modern mechanics and styles, and carefully apply those ideas to a well-crafted game design. Each of the games in this series will be housed in a standardised but individually illustrated box, provided at a low price point for maximum accessibility. We want to celebrate as many types of games as we can!

Games will have to cleverly use a small number of components to ensure low cost production, so that

we can focus on making the parts of the game as high quality as possible. Games that rely on very specific high cost components such as plastic miniatures are fine but these should be limited to one or two pieces. We're not looking for reimplementation of existing games – innovation wins!'

Design a game that is playable with one or two people (at a maximum) – Use the theme given to you by the Theme Generator. The final copy of the game must fit into a box or package that fits into a standard letterbox – 25cm wide x 6cm deep, or be available in a format that can be easily printed on a cheap colour printer. The rest of the plans for the games are up to you. You should explore print and play games or games that have very few components that would post easily.

The following types of games are not recommended for this assignment:

- Trivia Games
- Party Games

Hand in Requirements

- Single page Sell Sheet that provides an overview of game concept & marketing info
- Details of Game Components sufficient for a full play through [including art]
- Full Rules to play the game
- Information for how the game will be contained / packaged

Assignment 2-2 [10%]

Self- Reflection – a short document reflecting on your progression throughout the course and thoughts on your final work. What worked, what went to plan and what did not? Are you happy with the final game? What would you change, given the chance?

COURSE ASSESSMENT

Short Version of the Assessments:

1. *Blended Learning*

Assignment 1-1 [20%] Thematic 10 slide PowerPoint pitch deck with slides.

Assignment 1-2 [10%] Draft Rules

Assignment 1-3 [10%] 'Let's Play' video explaining gameplay

Assignment 2-1 [30%] Complete prototype, including rules and components, to be showcased at the Staffordshire University Game Expo [Year] and assessed by the course team.

Assignment 2-2 [10%] 1 page sell sheet on A4. Printed in colour.

Assignment 2-2 [20%] Self reflection document

= 100%

2. Virtual Learning Assignment 1-1

[20%] Analyse the boardgames market in the final quarter of [year the course is being taught]

Assignment 1-2 [30%] Analyse a top 100 Boardgamegeek.com title in terms of its game mechanics. [The boardgame is automatically assigned by the tutors in week 2]

Assignment 2-1 [40%] Create a small 'out of the box' game for 1-2 players, that can fit through a standard letterbox (24cm x 5cm).

Assignment 2-2 [10%] Critique and evaluate your work on your game.

= **100%**

EXPANDED COURSE OUTLINE

The following is the information provided to students in their Course Handbook:

How will I learn on this module?

Semester 1

Students will attend two weekly seminars. During these sessions students are expected to participate in lectures, workshops and group exercises. Some of these exercises will be set in advance, others will take place entirely within the framework of the session. The first session in the week will contain a taught element, whilst the second, which will occur later in the same week, will provide feedback and discussion. We will often set tasks in the first session that need to be completed by the second.

Depending on social guidelines and university policies, these sessions will be in person, or hosted on Microsoft Teams.

Semester 2

Students will attend two weekly seminars. In this semester students will develop a boardgame through a series of workshops and playtesting sessions, resulting in a completed boardgame with rules, a sell sheet and fully realised art. We encourage you to create a physical version and post it to us, but if this is not possible, or if you produce a print and play game, it should be submitted as a final version that can be printed from a colour printer and played by the examiners. Finally, you will reflect on the work you have done throughout the year. This semester you will be assessed through two written pieces – an assessment of the boardgaming market, and a discussion of which mechanics you plan to use in your game next semester.

Depending on social guidelines and university policies, these sessions will be in person, or hosted on Microsoft Teams.

Both Semesters

Students are expected to prepare for each seminar by doing the stated reading or viewing / gamesplaying. Learning outside the class will consist of research, both written and otherwise, use of the virtual systems available, short written and other exercises, and independent activities to enhance

understanding of the topics covered. Students will need to specifically engage with writing such as that found in weblogs, podcasts, on industry specific sites and other critical texts. Students will need to, where possible, play games with other members of the group. We will provide a number of online resources to enable this.

Class 1 will be a Lecture, and Class 2, held later in the week, will be Student Discussion. You are expected to complete a task set during Class 1 in order to participate in Class 2

Semester 1

Week 1

Class 1. Introduction and Expectations.

Task. Write up on your blog what exposure to boardgames you've had

Class 2. Discussion of your experiences – what do you know about games and why?

Week 2

Class 1. What is the current state of the boardgames industry, and why is this so important?

Task. You will be given a boardgame to analyze

Class 2. Discuss your preliminary analysis of your boardgame

Week 3

Class 1. Boardgame Origins: A short history of boardgames.

Task. Add three different images of the same boardgame to your blog, with a short written analysis of the differences.

Class 2. Discuss similarities and differences in the ways boardgames are marketed.

Week 4

Class 1. Industry Reports 101. The boardgame industry today. Who is making games and where / why?

Task. Collect on your blog 3 different sources relevant to your report.

Class 2. Discuss these sources and why they differ / who they address.

Week 5

Class 1. Boardgames Cultures: Who plays boardgames, where and why? What sort of paratexts affect the players of these games?

Task. Watch a boardgame playthrough of longer than 20 minutes.

Class 2. Drawing everything together for assessment 1-1.

Week 6

Class 1. 1-1 Assignment Workshop

Task. This week we will be available in both classes to give feedback, answer questions and help you with any roadblocks

Class 2. 1-1 Assignment Workshop

Formative Assessment. 1-1 Market Analysis – Submit this Work

Week 7

Class 1. Types of Boardgame: A guide to boardgaming terminology and slang. Why is this so important to designing boardgames?

Task. List five recent games and what genre they fall into. Find a different genre for each example

Class 2. Drawing it together for your assessment 1-2.

Week 8

Class 1. Mechanics Analysis Overview: Mechanics, balancing and games rules. How do we get boardgames working?

Task. Draft the mechanics analysis of your assigned game.

Class 2. Drawing it together for your assessment 1-2.

Week 9

Class 1. Understanding Mechanics 1 – *Pandemic*. Esther talks with games designer Fergal Mac Carthiagh about why *Pandemic* is such an important boardgame, and why it means so much to boardgamers.

Task. Gather feedback on your planned mechanics.

Class 2. Support for assessment 1-2.

Week 10

Class 1. Understanding Mechanics 2 – *Go Nuts for Donuts.* Nia talks with a surprise guest about *Go Nuts for Donuts*

Task. Gather feedback on your planned mechanics

Class 2. Support for assessment 1-2.

Week 11

Class 1. 1-2 Assignment Workshop drop-in.

Task. Continue to work on your mechanics for assessment 1-2.

Class 2. 1-2 Assignment Workshop drop-in.

Week 12

Class 1. 1-2 Assignment Workshop drop-in.

Task. Continue to work on your mechanics for assessment 1-2.

Class 2. 1-2 Assignment Workshop drop-in.

Formative Assessment. 1- 2 Mechanics Analysis. Submit this Work

Semester 2

Week 13

Class 1. Introduction to Semester 2. You will be given your theme for your game.

Task. Reflect on the theme the theme generator has chosen for you.

Class 2. Discuss how to make the mechanics you planned to use in semester 1 fit with the theme you've received.

Week 14

(This week has two lectures)

Class 1. Analysing Mechanics 1 – how to write a turn.

Task. Think about how to plan your game design.

Class 2. Analysing Mechanics 2 – using your theme.

Week 15

Class 1. Analysing Rules.

Task. Write the set up for your game and think about how the turn order will work.

Class 2. Set up and turn order workshop.

Week 16

Class 1. Assets: What pieces and elements will your game need, where will you get them / how will you create them?

Task. Write your rules and consider the layout of your board.

Class 2. Writing Rules Workshop.

Week 17

Class 1. Marketing Sheets. What makes a good marketing sheet, who is it aimed at and why do you need one?

Task. Create a marketing sheet – it should fit on a single side of A4 paper.

Class 2. Show and Tell – analysis of marketing sheets.

Week 18

Class 1. Game Box Art: What works, what doesn't, and how do you make your game stand out?

Task. Make your game box art (see brief for dimensions).

Class 2. Practicality analysis on box and components.

Week 19

(Note this week has two lectures)

Class 1. How do I Playtest? How do you become an active listener? What makes a good playtester? How do you use feedback to change your game?

Task. Make a list of what your game needs to do next. Sign up for playtest sessions.

Class 2. Self directed playtest how to.

Week 20-23

We will be available in all of these classes to give advice, but you should concentrate on developing and playtesting your games in groups with other students.

Class 1. Playtesting / Feedback on Self Directed Game Creation.

Class 2. Playtesting / Feedback on Self Directed Game Creation

Week 24

We will be available in these classes to recap on any work needed and check work to make sure it fulfils the criteria for submission.

Class 1. Assignment workshop

Class 2. Assignment workshop

Formative Assessment.

2.1. Completed Boardgame, Box/Container and Sell Sheet

2.2 Self Critique.

Submit this Work

COURSE BEST PRACTICES

We have split this into two sections. The first deals with common problems (and solutions) that we have discovered whilst teaching boardgames design. The second looks at effective classroom support and teaching.

Design

- The demographic for boardgames players is slightly older than the average student (25-40). Therefore, assuming that students know about modern boardgames is a mistake. Many classes are specifically designed to address this – both by teaching students to play games and understand how to read and explain rules, and giving them a basic 101 in how boardgames are produced, their recent history, an introduction to genre and key terms etc.
- Style over content is a frequent issue. A gorgeous looking game may have virtually no gameplay. In addition, students submitting beautiful games often made them early on and thus the contents had become fixed, meaning they couldn't be playtested effectively. We were very clear throughout that students should not purchase or commission components before their design was finalised.
- Conversely, many small components are specialised, and take time to ship. We tried where possible to encourage maker technologies, or using mundane items more easily available to students.
- A game should be fun, but this is an ineffable quality. Despite classes on the philosophy of play, our biggest area of negative feedback was from students who had not understood the role that fun played in their design. Our criteria for marking the games themselves was developed with the students, who determined where the spread of marks should lie, and we also discussed this extensively in design sessions, usually in the context of sales ('a fun game will sell, a boring game will not'), to give a rational context.
- 'Race to the End' games are the bane of every boardgames class. These are entirely luckbased games where players take turns rolling dice and sometimes 'events'(e.g. 'miss a turn' or 'go back a space') happen. However, this is the type of game that most students are familiar from their childhoods, and they will default to as designers. Breaking this deadlock with play sessions, and introducing them to new types of gameplay is essential. We therefore emphasised mechanics in the first semester, and included a marked component where students had to pick and analyse three different types. We also taught a class each semester which discussed different types of play and highlighted the variance available in one mechanic (a 'turn', a 'move', an 'action', etc.)
- Teaching students to give effective feedback, and to be active listeners, is a vast part of the second semester. The students initially hated the session where they had to give each other their rules, but later saw the value of it. Encouraging them to use the Playtest UK forms, and to say 'why' a game rule, aspect or system didn't work was a huge barrier to overcome. Even when students were assessing a game sight unseen, they would often say games were 'good' 'didn't work', were 'complicated' or had 'good aspects', without saying what these were.
- Making students play games when the designer is not present is an effective way to troubleshoot bad writing and rules. We frequently reminded students that 'you do not come with the box' and to use the feedback sheets effectively, and ran sessions where playtesting had to occur without the designer present.

- This is a course where more than one tutor is essential, so that the students have a range of experiences. This also enabled us to emphasize different play habits or preferences, discuss mechanics and 'fun' more effectively, and approach different genres of games.
- When students are learning to play games, they need to be left alone. Allowing them to discover things like 'one person needs to read the rules whilst the others wait', or that setting out a game may be a complex process, is an essential part of later iteration. Self directed learning is extremely important here.
- If possible, we timetabled classes for the end of day, so that students could continue to play. For online sessions, we emphasised permanent breakout rooms or playtest spaces.
- Students should be encouraged to make full use of the teaching space. Different games need different spaces to play. This might involve different types of table (round and square), sitting on the floor, moving furniture or having clear areas to throw or manipulate game pieces. We'd like to thank the student with access issues who alerted us to this potential – their tendency to lie on the floor meant that other students got down to their level and started to use the space more effectively as a result.
- We found that inviting games designers or other professionals confused students, as the speakers often either assumed a level of understanding that was not present, or went over ground we had already discussed (despite sharing the course with them in advance). These speakers often discouraged students accidentally, by suggesting that the bar was very high, and discussing complexity with too high a level of games literacy. This felt very counterintuitive, but games were more effectively realised without these voices.

FUTURE COURSE PLANS

The course has changed every year since we started to teach it in 2017. This is partly because it is totally novel, but also because we committed to an iterative teaching process from the beginning. As a result, it is agile in content, and we expect it to continue to be so. Much of this change is keyed to feedback from students, including development sessions where we worked through course content in order to produce a robust programme for them.

A key element here has been working with students on aspects that they felt were confusing or difficult. We removed an core assessed criteria revolving around 'game aesthetic', for example, as it was too abstract a term for students to understand when designing. Feedback also showed that students felt the marking for this section was arbitrary. Subsequent classes revolved instead around the idea of 'fun', with discussions of how to make mundane aspects of play (eg. a game turn, or deciding the first player), more entertaining and enjoyable. Coupling this with the idea that games that are 'not fun' do not sell, this was a much more productive technique.

We have already detailed some of the changes due to switching to a virtual teaching environment, whereby classes were delivered online. Although the individual class topics did not change greatly, we repurposed many of them to accommodate a virtual space and reconsider possibilities / limitations. This is an evolving process, but the iterative nature of the course means that we are comfortable with continuing to adapt it as differing needs arise. We found that engagement for some aspects of the

course improved online; such as engagement with the supplemental tasks, which we used as the basis of the second seminar in each week, and that some aspects we had struggled with during in-person sessions; eg. breaking the 'race to the end' deadlock on games design were elided by changing the content of lectures and practice based tasks online.

Future work (and the annual reiteration of the course) therefore follows two core aspects – industry trends, and student iteration/feedback. The boardgames industry is not only innovative at present, but experiencing a huge boom. We have noticed a rapid growth in two person games (the topic of 2020's assessment), and games that can be posted flat – certainly a response to the pandemic. We have taught on aspects like play in the household and the rise of playful toys such as jigsaw puzzles – German company Ravensburger sold 28million units in 2020, 38% of which were for adults (Wood 2021), which have combined boardgame elements such as escape room puzzles to their jigsaw puzzle images. Iterating the course is therefore a case of keeping an eye on current developments, as well as fulfilling assessment and teaching criteria for the university.

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CHAPTER 28.

SYSTEMS ENGINEERING MASTER: GAME DESIGN PROJECT (SEN9235)

HEIDE KAREN LUKOSCH [1], GEERTJE BEKEBREDE [2] AND MARIA FREESE [3]
UNIVERSITY OF CANTERBURY, DELFT UNIVERSITY OF TECHNOLOGY

Course Title: Systems Engineering Master: Game Design Project (SEN9235)
Course University: Delft University of Technology
Course College/School: Faculty of Technology, Policy and Management
Course Department/Program: Master program Complex Systems Engineering and Management
Course Level: Graduate, PD (Elective)
Course Credits: 5EC
Course Length: 10 weeks
Course Medium: Face-to-face, Blended/Hybrid (only in 2020)
Course Keywords: Game Design, Complex Systems, Engineering, Applied Games, Serious Games, Games for Decision-Making

CATALOG DESCRIPTION

The game design project offers conceptual insights as well as hands-on experience with simulation gaming (SG). SG is an established field of practice with proven value for instance in the field of spatial and urban planning, ecology, engineering and design, public administration, business management, learning, research and consultancy. The staggering growth and success of the video gaming industry has triggered the interest in simulation games – from paper based games to video games for learning and policy making – even more. In this course, experienced speakers will give lectures on history, future, design, typology and facilitation of SG. Experts and students will discuss the role of computers and video games, but emphasis is NOT on technology! Students will have ample opportunity to try out a number of (role-playing, board etc.) games that hold powerful messages about decision-making and management. Students are challenged to design, develop, test and facilitate their own

1. Heide K. Lukosch (heide.lukosch@canterbury.ac.nz) is an associate professor at the HIT Lab NZ, University of Canterbury, Christchurch, New Zealand. Her research focuses on the design of physical, hybrid, and digital applied games to make individuals, organisations, and societies more resilient.
2. Geertje Bekebrede (g.bekebrede@tudelft.nl) is assistant professor at Delft University of Technology and does research about the use of gaming in the design and management of complex systems and teaches about game design and games as research method.
3. Maria Freese (m.freese@tudelft.nl) is a postdoctoral researcher at Delft University of Technology and researches how simulation games can be designed and developed to analyse complex systems and in particular, the role of emotions in decision-making processes of human beings.

simulation game to support decision-making, learning, training, business, management and change. In a small group, they will also work on a scientific question related to game design. Besides creativity and enthusiasm, there are no entry requirements. Lectures and workshops will be arranged in a condensed fashion on 10 full days from 9.00 to 17.00. External companies and organizations provide brief problem statements and game requirements, and act as clients. There is a (restricted and conditional) possibility for external participants (from companies, non-profit organizations, other universities) to participate in the course.

COURSE PURPOSE AND OBJECTIVES

After completion of this course the students will have acquired knowledge and insights about the history, backgrounds, key-concepts, formats and applications of simulation games. This knowledge is transported by interactive workshops, game play sessions and lectures, delivered by staff of the Faculty of Technology, Policy and Management of Delft University of Technology and international and national guest speakers. The guest speakers are academics in related fields and practitioners in game design. The lectures are always placed in the context of the course, which is games for the analysis and design of complex systems. All lectures address games as means to support actors in complex systems, which represents the main message the course conveys.

After completion of this course the students will be able to:

1. Design a (prototype) of a simulation game to be used for learning, research or intervention. Prototypes are developed usually on paper, or in a low-fidelity digital environment. The students get familiar with the different stages of prototyping, from understanding the problem, to requirements analysis, to idea generation, testing, and implementation.
2. Apply a game design cycle (or systematic design steps)

The course discusses a variety of game design approaches, yet the preferred one that is introduced in more detail is the Triadic Game Design Philosophy by Harteveld (2011). Students combine the game design approaches with problem analysis and evaluation methods.

3. Define, conceptualize and construct the various game components

Students learn about game mechanics, dynamics, and aesthetics, and make design decisions that are related to the problem statement, requirements space, and user needs.

4. Facilitate short simulation games
   Students learn how to prepare, facilitate and debrief short games as warm-up or team building element throughout the course.
5. Write a scientific essay on the design and use of simulation games, and review other essays' quality as well as provide constructive feedback on other students' work.

COURSE CONTEXT

The course is delivered by the Faculty of Technology, Policy and Management of Delft University of Technology, in the Master program 'Complex Systems Engineering and Management (COSEM)'. Within this program, the game design course is part of the specialization 'Modelling, Simulation and

Gaming'. This specialization provides students with state of the art knowledge in modeling, gaming and design. Advanced modeling and gaming are ways to understand, manage and design complex systems. As a follow on from basic courses on systems modeling and design, this specialisation:

1. Deepens students' knowledge in the area of modeling and simulation.
2. Introduces the fields of simulation gaming and participatory systems.

Within the specialization, students have to choose 3 out of the 4 offered courses. Students from other master programs (e.g. civil engineering, geomatics, information sciences) can choose the course as elective, too. Usually, students do not have prior academic knowledge in the field of game studies or game design, but come from various engineering disciplines. With games being a popular cultural medium of the younger generation, students are usually familiar with entertainment games of different forms. That means that the course starts at the very beginning of explaining how games are defined in the academic context, what the specifics of games for complex systems design are, and what types of game design approaches exist. According to the course evaluations, the learning curve is very steep in this course.

COURSE PEDAGOGY

The course follows a learning-by-doing approach. Our educational vision follows the idea that you can only learn how to develop simulation games and facilitate gaming sessions by playing games and design and build games. However, as students mostly do not have experience in these areas, we provide them a structure and use presentations to inspire the students. This leads to a combination of lecture-based and project-based approaches. The course day at the university always starts with a 30-minute warm-up game (including briefing and debriefing), in the first week facilitated by the teachers and thereafter by the student teams. The students are able to gather new knowledge on the design, use, and evaluation of simulation games during interactive lectures and workshops. These are provided by lecturers of Delft University of Technology as well as international and national guest lecturers from academia and industry. The lectures and workshops usually fill the morning sessions of the full-day program. After a break, the students gather in their teams. These teams are self-organized by the students around their chosen topic at the beginning of the course. That is, teachers and industry contacts pitch their project ideas briefly during the first class gathering. Students are able to express their interest for the respective projects, and enrol in the project list. Student groups are usually between 4 and 5 students large. In the afternoons, the students are supervised by experienced teachers and game designers, who guide them through the development process of their game concepts, and provide feedback. It is expected that students work on their projects outside of the classroom, too, and that they self-organize the communication and collaboration with the clients, and providers of the cases they are working on. Each day ends with a debriefing session where students and teachers discuss progress, challenges, and experiences of the students. Every week, students are also expected to work through the related literature, and have to complete one assignment in groups of two, which is writing a short essay on a topic related to the science of game design and discuss the essays with each other. This element is implemented to ensure the scientific depth of the course, at the same time is gives an in-depth analysis of some topics related to game design.

COURSE TEXTS, GAMES, SOFTWARE, AND HARDWARE

The core game design approach this course is developed around is the Triadic Game Design Philosophy (Harteveld, 2011. Harteveld's book and related game design workshop are used as basis. Additional required readings as well as optional further materials are provided to the students through the Learning Management System (LMS) of the university, and the university library. For the game play, we use games we developed within research projects and games facilitated by game design companies (e.g., The Barn, Pracownia Gier, Accenture). For the practical work on the projects, the faculty offers low-fidelity material, such as Lego© blocks, dice and other physical game materials. There is no further advanced technology needed. One lecture usually comprises a level design workshop, for which the software and hardware (Unity, Laptops) are provided by the university, for the use within this lecture. A lecture hall set-up that allows a huge amount of flexibility is needed for this course, as it combines traditional theatre-like set-ups for the lectures, and has to allow for large and small group work.

COURSE ASSIGNMENTS

1. Assignment – Game Design

The main assignment in the course is to produce the conceptual design of a game, based on a pre-defined problem description. This is a group assignment. The group has to deliver a playable game including instructions, material, facilitation, and debriefing that is played with the other student groups at the end of the course. A design documentation, that explains the underlying problem, reference system and actors, purpose of the game, and its play elements, has to be submitted, too. In this document, the students have to reflect on their design decisions.

2. Assignment – Game Facilitation

In the same group constellation as for the game design assignment, students have to facilitate one large-group (warm-up/learning/team-building) game at the start of one course session. This entails that they have to choose (not design) a game that can be played with the group of students in the course. They have to prepare the material needed, have to introduce the game to the group, and facilitate a game play of about 15-30 minutes. After game play, the group is asked to facilitate a debriefing. At the beginning of the course, the students are introduced to the 'Systems Thinking Playbook' (Sweeney & Meadows, 2010), which includes a number of shorter games and exercises to use in relation to systems. Students can choose from this book, but can also look for existing games from other sources.

3. Assignment – Scientific Essay on Game Design

In groups of two students, this assignment requires to write a scientific essay that deals with one aspect of game design. In line with the format of an essay, it should represent a critical discussion of a statement based on arguments for this statement and counter-arguments, with a clear opinion at the end. These essays have to be uploaded to the LMS, and shared with a group of other students (usually, sub-groups are organized to make this assignment more workable for the students). All students are then asked to read each others' essays, and to discuss the opinions and arguments of the authors in an online discussion forum. The authors have to react to the questions and arguments in the forum. The

forums are monitored by the teachers, who may or may not give feedback on the essays in this stage, too.

COURSE ASSESSMENT

1. *Assessment – Game Design*

The assessment of this course element is the main element of the assessment, too. As an exam, students have to prepare a game session with the other students of the course. The game demonstrations are organized at two different days to allow enough time for each team to demonstrate their game (maximum of two hours per team). Students are graded along the following criteria of their game design, which are openly communicated to the students:

- – Questions of the client
- – System analysis
- – Objective in and of the game
- – Game concept
- – Game specification
- – Game facilitation.

The game concept and design, the facilitation of their game, as well as their critical reflection in the game design documentation are part of the assessment [weight = 80% of the final grade].

2. *Assessment Game Facilitation*
   This assignment is not part of the grading and is not formally evaluated. However, the students receive feedback from their peers, and from the teachers on what went well and what could be improved, or what would be important to consider.
3. *Assessment Scientific Essay on Game Design*

The scientific essay is graded along pre-defined criteria, such as quality of the discussion, and relevance of the topic. The feedback students provide to other essay writing groups is also part of the assessment for this assignment [weight = 20% of the final grade].

In general, the university uses the metric grading system with grades between 1 and 10, where 1 is insufficient, 6 is sufficient and 10 is excellent. Students need a 6,0 to pass this course. Due to the high interaction between students and teachers, the success rate is almost 100%.

EXPANDED COURSE OUTLINE

The general set-up of a course day is as follows:

1. Facilitation and play of a warm-up game (30 minutes), facilitated by the students.
2. One or two lectures (about 45 minutes per presenter) on a variety of topics, such as game design approaches, facilitating games, use of micro games. In these presentations, students learn about more about topics that are relevant for game design.

3. During an interactive workshop or a game play (about 1,5 to 2 hours) students play a game to experience what game play is about and together with the developer of this game, they discuss the design and design process of this game. In the interactive workshops, students learn about the triadic game design philosophy or to develop a (level in a) the unreal engine. The objective here is to gain some experience in game design.
4. After a lunch break, students work in groups on their game design. While they are working, teachers and game designers walk around and give feedback, answers questions and test game mechanics and game prototypes. In the last weeks, students organize test sessions with the other student groups.
5. The day is always closed with a central debriefing, where some issues or breakthroughs observed in the afternoon are discussed.

Week 1: Course Introduction – Introduction to (serious) Gaming-Simulation and Game Design

Class Topics/Activities

- Introduction to the course structure and syllabus
- Class introductions
- Introductory lecture on simulation gaming
- Workshop on Triadic Game Design (https://web.northeastern.edu/casperharteveld/tgd/)

Assignments

- Readings: Duke (1980), Greenblat (1988)
- Game Development: Define Requirements for your game, prepare questions for client
- Essay Assignment: Select Topic

Week 2: Gaming-Simulation Design: Methods, Procedures, Tools, and Techniques

Class Topics/Activities

- Lecture: on Games for Complex Systems Design
- Interactive workshop and lecture on: 'From Entertainment to Seriousness: How to translate Entertainment Games into Simulation Games'
- 'Game Design Group Work

Assignments

- Readings: Duke (1981), Duke & Geurts (2004)
- Game Development: Define Requirements for your game, prepare questions for client
- Essay Assignment: Select Topic

Week 3: MicroGaming – An Approach

Class Topics/Activities

- Lecture: on MicroGaming
- Game play: one MicroGaming example: PortConstructor (https://play.google.com/store/apps/details?id=nl.inthere.port.constructor&hl=in https://apps.apple.com/gb/app/port-constructor/id1230017902)
- Game Design Group Work

Assignments

- Readings: Salen & Zimmermann (2004), Fullerton – Chapter 2 (2014)
- Game Development: Finish Conceptualization of system, and come up with the big picture, explore possible game formats
- Essay Assignment: Write paper

Week 4: Digital Games and Simulations

Class Topics/Activities

- Lecture on Simulation and Games: about the similarities and differences between games and simulations
- Level Design Workshop: develop a level in a maze in the Unreal Engine
- Game Design Group Work

Assignments

- Readings: Fullerton – Chapter 4 and 5 (2014)
- Game Development: Develop game concept, start making game components (rules, players, scenarios etc.)
- Essay Assignment: Finalise paper and upload to LMS

Week 5: Application of Simulation Games: Biotechnology

Class Topics/Activities

- Lecture: on the development of a serious game for biotechnology (MachiaCelli, Freese, Lukosch & Tiemersma, 2020)
- Game Play: MachiaCElli
- Game Design Group Work

Assignments

- Readings: Peters, Vissers & Heijne (1998), Kriz (2003)
- Game Development: Continue developing game concept and system

- Essay Assignment: Read papers of colleagues and start discussion

Week 6: Games and Society, Games in Transportation

Class Topics/Activities

- Lecture on Games, Art, and Society (about the use of games within theatre performances)
- Game Play: Rail Cargo Challenge Rotterdam (simulation game for transportation)
- Game Design Group Work

Assignments

- Readings: Fullerton – Chapter 9 (2014)
- Game Development: Specification Game (collecting information of all game elements). validation of your game
- Essay Assignment: Read papers of colleagues and continue discussion

Week 7: Games in context

Class Topics/Activities

- Lecture: about the meaning of play and games ('Gaming from the other side')
- Lecture on Facilitation: about tips for facilitators organizing and leading game play sessions
- Game Design Group Work

Assignments

- Readings: Fullerton – Chapter 10 and 11 (2014)
- Game Development: Testing your game, develop facilitation documents
- Essay Assignment: React on the discussion

Week 8: Games for Research and Clients

Class Topics/Activities

- Lecture: on Games for Research, about the use of games as research tool
- Interactive Workshop: on Games and Clients, about the design thinking approach and team work
- Game Design Group Work

Assignments

- Readings: Peters, Vissers & van der Meer (1997)
- Game Development: Finalizing and building your game
- Essay Assignment: React on the discussion

Week 9: Game demonstrations – "exams"

Class Topics/Activities

- Playing games developed by the students

Assignments

- Game Development: Prepare game documentation and upload to LMS

Week 10: Game demonstrations – "exams"

Class Topics/Activities

- Playing games developed by the students

Assignments

- Game Development: Prepare game documentation and upload to LMS

The topics of the lectures and activities change slightly every year, to give the students state-of-the-art lectures. The idea is to have a balance between more scientific contributions and practical experiences of experts and between presentations and workshops/gameplay.

COURSE BEST PRACTICES

This course has run for 15 years now and gets high scores in the students' evaluations. There are multiple aspects of the course that are mentioned by students, including in the formal evaluation of the course.

1. The positive feedback students often provide is related to the high variety of activities, topics of the presentations and the interactivity with each other and with the teachers. This requires an investment in teachers available on the teaching days; with 5 or 6 project groups the course is usually taught by two experienced teachers and a professional game designer providing feedback to the students and supporting them in their design process.
2. Furthermore, the cases from and for external clients related to a real-world problem encourage the students to get the most out of it. In combination with the requirement to play the game at the end of the course, students cannot skip a part of the development. This leads to high quality games, some of them are further developed and implemented in the organizations after the course. Some examples with a follow-up are Team-up (nowadays developed and exploited by the Dutch game company The Barn), Biomadness (CE Delft) about energy, food and nature, and Cue Kitchen, a card game to support the communication between people with Parkinson and relatives. Other topics of games are synchromodality, energy transition, disaster management, training project management skills and many more. In the years, we decided that the ownership of the game is with the client, student and university together, and that each party can use, adapt and further develop the game. Sometimes this set-up leads to internships or graduation projects for the students. This process is always made very clear for the clients as well as the students at the start of the project, to manage expectations. Organisations have to understand that they will receive the

result of a students' project, and students have to be aware that they are working with a real client, and learn how to manage this process.

3. In the 15 years since the launch of the course in 2005, the course developed especially in structure and assessment criteria. At the start, we hardly had any criteria for the assessment, except that the games developed had to be playable. To be taken seriously in the academic community, we needed to define clear learning objectives and assessment criteria. These criteria are still written in a broad way to leave room for creative thinking and development.

Impact of Covid-19 on the development of the course

Due to the ongoing Corona pandemic and the rules of the Dutch Government, we also had to think about a special edition of the game design course in 2020. Most of the morning sessions have been organized online. During the afternoon, students had the possibility to come to the university and to work on their game design projects in different lecture rooms (under consideration of all Covid-19-related rules and measures), but we also gave feedback to some of the groups online. For guaranteeing an interactive (online-) version of this course, we used a combination of a communication platform and a digital whiteboard. The use of a digital whiteboard made it possible to let students work on their game design process in an online environment. In addition, we used this whiteboard for making notes, drawings and for many interactive exercises. Finally, instead of playing board games on location, we played online games or translated board games to an online board game.

FUTURE COURSE PLANS

Due to the ongoing success of this course, which can be drawn from the student evaluations and their positive feedback, as well as growing student numbers, we plan to keep the course in its current form for the next years. However, there are some topics to discuss with regard to our future plans.

- *Role of essays*
    - The results of the course evaluation showed us that not all students recognized the added value of the essay assignment. It might be an idea to make them more aware of the fact that they have the freedom to choose a game design-related topic that cannot be treated during the course or to deepen a discussion about a topic mentioned by one of the guest speakers. In addition, the essay assignment should be communicated clearer, maybe with good examples from former years. Students should know that they have to write an essay and not a research paper. For instance, the assignment could include that the students should adopt a mindset of writing a newspaper article rather than a research article.
- *Facilitation and (De)Briefing of games*
    - We recognized that it would be of added value to focus more on the facilitation of games. We already included one lecture on this topic, but as facilitation covers different topics, such as briefing and debriefing, it might be good to provide more input on it. This topic is relevant if students not only design, but also use games in their future work places, and to teach them different approaches to as well as the role of facilitation in relation to simulation games.

- *From system analysis to initiating the design process*
    - Many students have asked how they should start the designing process of their game after they have completed their system analysis. As this is still a blind spot in research, we think it would be beneficial for the students to highlight this topic in future, and confront the students with the most recent research insights.
- *Post-Covid19: Going back to the campus*
    - Although the course was mostly given online in 2020, we hope that we can go back to campus in 2021. As the main focus of this course is to develop a (non-digital) board game, it is relevant to experience non-digital games and game plays as well. We experienced that the social and emotional interaction when playing digital games online is different than it is when playing board games, so we hope that our game design course students can play some of our board games in 2021 again. However, ee learned a lot about technical possibilities to improve presentations from abroad. Before 2020, we already used a remote communication tool for one workshop facilitated from Poland and other guest-lecturers from abroad. In 2020, we experienced better software and many different ways to guarantee interactive online presentations, workshops and game plays.

The game design project follows up-to-date developments in games research. We regularly update the choice of presenters and topics, as the combined course set-up of guest lectures, workshops, and group work makes this possible. This will be an ongoing process in the future. In addition, the game design assignments change every year, following the latest questions of clients and stakeholders.

We regularly discuss whether we should include a lecture on new technologies, such as virtual and augmented reality, and their relationship to simulation games. However, up to now we decided to keep the course's focus on the conceptual design of games. A follow-up course called 'Building serious games', organized by the department of Computer Science of Delft University of Technology in the subsequent semester of the same teaching year, teaches skills around the technology of digital game design.

The course works well with a group of around 20-25 students. In that case, 5-6 groups can be formed, and group work in a larger group is still possible. This group size allows for interaction with all lecturers, and between all students. The university would like to grow the number of students for the course, which makes us to explore new ways to keep the quality of the course and its interactive nature at least at the same level when upscaling.

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