

LEARNING TO CREATE OR CREATING TO LEARN

ADRIENNE DECKER, CHRISTOPHER EGERT, AND ANDY PHELPS

Abstract

Splattershmup: A Game of Art and Motion blends elements of a traditional arcade game with the creation of an abstract expressionist piece of art. Upon completion of the game, the actions taken by the player create the lines and colors on the canvas that can then be saved and shared. While not intending to create an educational game, the game was motivated by a desire to have players experience modern art. However, in playtesting and release, these goals were not realized. In order to help connect the player to the art concepts, we engaged an art educator to create scaffolding around the gameplay experience. The resulting materials leveraged both the cognitive and affective domains to engage the players. Results of the pilot testing of these materials confirmed that the player showed a deeper connection to the art content of the game while not minimizing the enjoyment of the gameplay experience.

Introduction

When we contemplate the phrase “educational video game”, we are examining two systems and sets of concerns. One set of concerns involves the game design process in which the creative leads express their ideas through the function of gameplay. As such, design encompasses everything from story, mechanics, user interface, goals, challenges, game balance, and the myriad of experiences that provide entertainment value to the player.

The other set of concerns involves the educational value of the experience. The design must address the educational outcomes conveyed by the game in terms of the cognitive outcomes perhaps like those expressed by Bloom (Bloom, 1956) which we can measure through a process of using a game experience as an intervention and accessing the outcomes with appropriate instruments.

While the ideal is that these elements work in harmony, finding a desirable balance can be a trying and elusive process. If the educational content is too obvious then the game is seen as a thin veneer for what is essentially a typical presentation of instructional content. If the gameplay is the focus, the educational content can be overlooked and its importance downplayed or misunderstood.

To counter these tensions, it is often desirable to introduce gameplay designers and educational domain experts early on in the process. To be effective, each group must balance their expertise with

enough understanding of the other group to create compelling experiences. It is very easy to fall into the mindset that educational game design is an “all or nothing” proposition with sharp boundaries between success and failure.

In *Splattershmup: A Game of Art and Motion* (Splattershmup, n.d.), the design team started with a simple premise – provide an experience that was an engaging arcade-style game while simultaneously serving as a creative endeavor that spoke to the techniques and processes of action painting (Kleiner, 2010). The initial goal for this was not an educational game – the goal from the beginning was to create an experience that informed exploration and contemplation but that was not overtly educational in its presentation. However, it was clear that there was a potential to allow for freeform exploration into action painting through sharing and reflecting on the digital works created through the gameplay experience and the possibility that such engagement would help educate players as to the underlying principles of the artistic movement. Thus, the goal was to create what was termed an “experientially educational game”, one that would, by the sheer act of playing it, incorporate some knowledge transfer and provide potential for reflection.

By using this free-form approach without a specific built-in assessment mechanism, *Splattershmup* is an example of a game that speaks to educational outcome through both intentional goals as well as through opportunities to augment education without a specific set of pedagogical outcomes in mind. The hope was that developers and players would be able to engage with the game on both levels and be able to demonstrate a knowledge of this interplay between the two. In this paper, we will explore *Splattershmup* as a case study of a video game with intended educational potential and entertainment value versus the eventual use by target player audiences.

Our Game

As a video game, *Splattershmup* is best categorized as what is known as the “shmup” (shoot ‘em up) (Rojas, 2012). This genre is characterized by the player controlling a vehicle (usually a spaceship) that is able to move around the screen. The player encounters wave after wave of enemies in attack, and the goal for the player is to defeat as many enemies as possible before losing all health and taking too much damage as to lose their turn. Typically, losing the turn returns the player to the beginning of the level or the game. Images 1 and 2 provide some example imagery from the game.

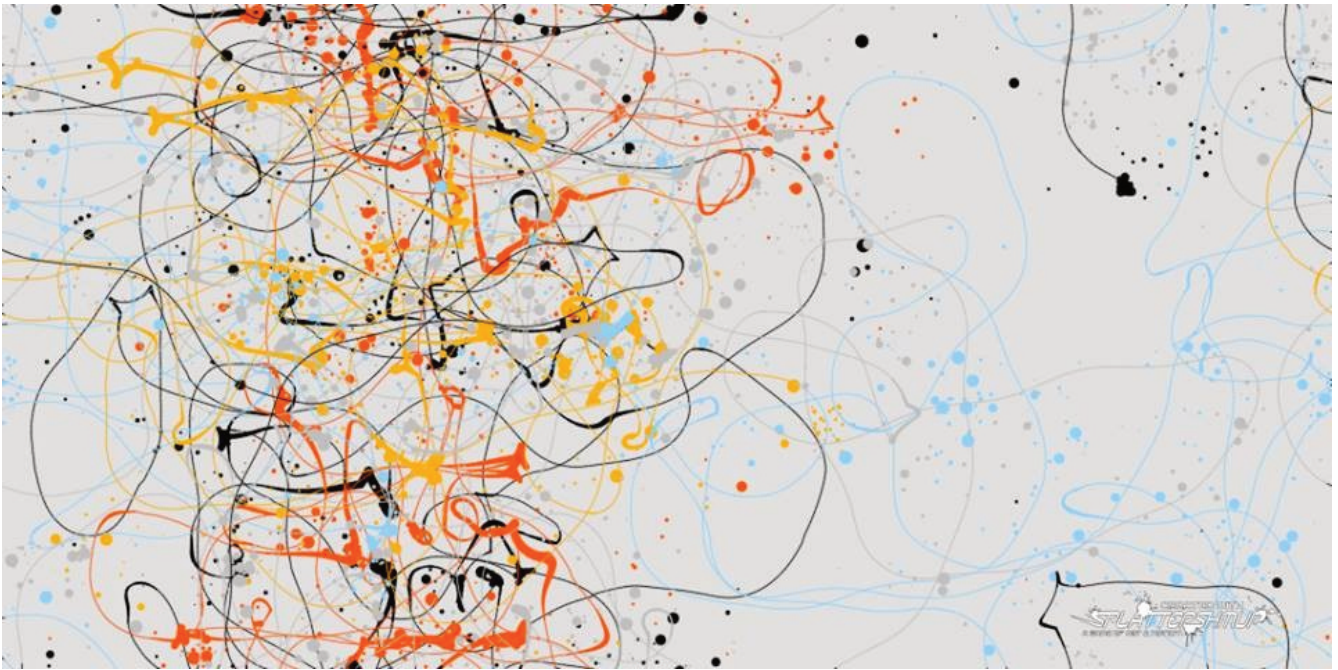


Image 1: Player generated artwork created through Splattershup: A Game of Art & Motion



Image 2: Splattershup gameplay screenshot

The player has the ability to select from a number of offensive and defensive capabilities that must be applied with a level of strategy that balances gameplay. Each capability has its strengths and weaknesses, and the use of these abilities draws from limited resources available to the player. The

player restores resources by collecting power-ups or performing specific achievements within the game. Similarly, enemies have their own offensive and defensive capabilities that vary as the gameplay advances.

From a progression standpoint, the shmup format is characterized by constant navigational advancement. This may be illustrated as continued forward progress without end (with enemy waves breaking the gameplay into segments) or may be punctuated with “boss” encounters throughout the gameplay.

Splattersshmup utilizes the shmup mechanic but contextualizes the game play as the creation of a work of art. The gameplay takes place on a never ending (scrolling) canvas upon which a creative work is constructed. Interaction within the game produces strokes (lines, trails) for each motion and splatters for encounters with enemy elements. Power-ups and progression not only allows for the player to enhance the capability of their vehicle and to recharge depleted resources, but also allows for changes to the visual elements of expression such as color and palette. Success in the game moves beyond a high score as the player also has access to the visual representation of the art he or she created through gameplay, and can choose to save or share the artifact with others via social media. *Splattersshmup* is available for free to play and download from: <http://splattersshmup.rit.edu/>.

Response from Developers

Splattersshmup was created as part of a senior level production studio course (Decker, Egert, & Phelps, 2016; Decker, Phelps, & Egert, 2017). The primary goal of the production studio course was to educate students about the process and practice of game development and production processes. Specifically, the course sought to elevate student outcomes away from a “student project” and towards a “viable commercial work” to the extent possible given constraints of the undergraduate experience. Towards this end, particular attention was paid to the production pipeline, aesthetic quality, integration of art, design, programming, and UI/UX, and perhaps most of all, to critical feedback and reception of the product as developed.

Students enrolled in the course were already familiar with the shmup genre through their previous studies in game design and development. Therefore, the instructor did not need to spend significant time teaching students what type of game needed to be made from the game play and interaction perspectives. Instead, the challenge was posed to the development team to infuse an existing artistic process into gameplay in such a manner that challenged players to not just succeed in the game but engage with the resulting creative aspects as well.

As part of the course, there were lectures on Jackson Pollock including his work, his influence, and his process, as well as how the game needed to mimic aspects of these processes to be effective. Students were provided with interviews from Pollock documentaries where he describes approaching the canvas as “an arena for action” and other similar terminology that is not unlike that used in game design for arcade-style interactions. Students were also encouraged to engage in creating their own action paintings, and the student producer on the project attempted to organize an event with the development team where they could engage in this activity at scale.

These efforts were met with limited success: while some members of the development team seemed to engage with the subject matter and recognize its importance relative to the desired game design,

others were simply interested in the technical aspects of game development and could not seemingly recognize the importance of the subject to their work. There was significantly more engagement when action painting was distilled down from its artistic perspective into a more engineering based discussion – i.e. the physics of paint flow, speed, angle, viscosity, etc. Numerous attempts to define the “paint effect” in the game in these terms were made, and ironically none of them “felt right”. However, it was through these terms that some of the student developers were most engaged.

In teaching the course during the semester, expected challenges were encountered in the students’ transition from the requirements of a typical classroom project to a production-quality product. However, the greater challenge was integrating the gameplay elements with the domain-specific creative and cultural elements. While there was general agreement and buy-in about the concept of the game, there was very little engagement in the underlying artistic subject matter and history. Many of the developers deconstructed the problem of enabling a creative experience by compartmentalizing game design challenges into individual mechanics. Successfully solving those challenges addressed game play function but did provide an opportunity to integrate the mechanic into the overall experience.

One specific example of this was an inability to get the “paint trail” to effectively mimic the drop and trail effect common in the major works of gestural abstraction to a degree such that the output of the game was recognizable as an action painting. Students spent time solving this issue as one of a visual challenge or optimization problem. When the solution was reached, little time was spent on reflecting if the outcome would support the creative expression effectively, or whether the effect even mimicked clearly discernable traits the in the published work of Pollock and other artists that were representative of the artistic movement.

Response from Players

In designing and constructing *Splattershmup*, the intent was to create a game that players would find engaging as a shmup-style action arcade game while simultaneously allowing them to learn more about gestural abstraction as an artistic form. This exploration was intended to open the door to greater exploration of the medium without being overly prescriptive or demanding with the educational message.

When looking at the player response, it is important to examine their perspective at the different points of development and product release. As such, the player response is divided into several categories based upon the game development lifecycle – development playtesting, player download from distribution channels, and player engagement at events and gatherings.

Response from Playtesting

The first wave of player responses occurred during the development of the game as a series of playtests. These playtests were required to help educate the student developers about the process of playtesting, and inform their work during initial development. The playtests were designed to reveal if the player experience was in alignment with the expectations of the shmup gameplay experience, as well as other elements (bearing in mind that the game at this point was incomplete). Early gameplay testing focused on movement and balance – did the player representation handle as expected, did the user interface controls map in an intuitive manner, did the feedback properly inform the player

of state and progress in the game? Simply speaking, the early gameplay tests focused on mechanic and initial game experience. While the developers were being exposed to a number of activities that linked the gameplay to action painting as an expressive medium, these activities were not making it into the early playtests.

Most of the early playtests during development occurred by capitalizing on pre-existing or externally planned visits to the lab by various groups and tours. While beneficial from a scheduling point of view, this meant that nearly every group, either internal or external, was coming to the lab with the preconceived notion that they were coming to see ‘game development’ and or ‘a game that students were making’ and as such this biased their notions as to what to expect from the game. Unsurprisingly, these groups then focused almost exclusively on the ‘game’ aspects of *Splattershmup* as opposed to any utility as an art creation or education tool, because this was the context in which they were approaching it even before arrival. Interestingly, the guides of several of the tours (teachers, parents) were interested in the educational aspects and art-based approach, but often did not play the game themselves, preferring instead to have their children or students engage in the activity.

This began to change later in the development process when the “save your painting” and “share your painting on Facebook” features were implemented. These proved to be particularly challenging from a development perspective, and were never made available while the class was in session, but were completed after the term was complete by a smaller team of developers prior to the full release of the game. As such, most of the early testing allowed for users to recognize they were making a painting, but not to reflect on it as a created artifact after play, or to share it with others. This key component in the learning process was thus absent from the gameplay experience until after a large proportion of the developers had left the project, and a number of the early playtests were already completed.

Response at Release

The second wave of player responses occurred when the game was released. The game was launched via social media, university news articles, presentation at the Game Developer’s Conference in San Francisco, and through a dedicated website that described the experience as “...a game that explores the intersection of the classic shoot-em-up (or “shmup”) arcade game and gesturalized abstraction or “action painting” (a term coined by critic Harold Rosenberg in 1952 and often used to describe the work of American artist Jackson Pollock). It is intended to allow the player to reflect on their in-game actions and strategy through visual record, and to approach the creation of art as an arena of action. Art can thus be created, shared and discussed that comes “from inside the moment” of game-based decision.” (*Splattershmup*, n.d.). Along with screenshots of the game and educational materials, the game was made available for free through a number of distribution channels including direct download for a number of web browsers, standalone executables, and access on the Windows Store.

Much of the player feedback after product release was gathered through social media posts about the game as well as collected email and communications via instant messaging services. Although mostly positive, most of the comments focused on the gameplay experience and the interaction with the work as a shmup. Players valued their interactions through their affinity towards the genre of shmup and fast-paced arcade games. A much smaller segment used social media to post and share their work as opposed to the overall player base. An even smaller segment commented on the educational value of the work. Again, despite a desire to create linkage between the game experience and a deeper

appreciation of the process of creating action painting, most players focused upon the game with only a surface appreciation of the deeper context or its intended, if subliminal, focus.

Events and Festivals

The third wave of player response occurred as the game was presented at various events and festivals. In such situations, there was a more controlled engagement with the public, allowing the developers to interact with the public and to discuss the game. Under these conditions, it was observed that there was more interest from the public regarding the potential of the game to spark interest in art and art processes, although there were still tendencies to avoid these educational elements when lines were long or towards the end of the presentation period. Two events stand out as markedly different in player response: the Imagine RIT festival, and the presentation of the game at the Indie Arcade at the Smithsonian American Art Museum (SAAM).

The Imagine RIT festival is a public festival held annually at RIT every spring wherein groups from across campus demonstrate projects for the general public. Typical attendance is between 25,000 and 30,000 for the one day, rain-or-shine event. Since the festival draws such a large and diverse audience there is a wider range of pre-existing perspectives, and many attendees simply showed up to play the game or explore the exhibits without have a pre-conceived notion of what to expect. As such, both parents and children played the game, and comments during the festival were indicative that they understood what the game was trying to convey about action painting, with several remarks to the fact that they were “painting while playing”. It is also worth noting that a couple of the festivalgoers that spent significant time with the game were students in the art education program at Nazareth College.

The second event, at SAAM, was likely the event that most critically examined the game as an art education experience. At this event, while the general public crowded around the display and had clearly come for the “arcade-style” event, there were numerous attendees, estimated at approximately 30% of the total audience that had specifically come of the event in the context of it being an art show at an art museum. As such, they were engaging with the piece in a markedly different way than those approaching it as a game, often asking “What is the purpose of the work?” or “What is this hoping to say?” even before engaging in playing it. This audience understood the concept of relating arcade games and action painting almost instantly. There were numerous art historians, educators, and connoisseurs in the audience, with insightful questions and challenges to the work, but often with little to no working knowledge of games beyond a casual familiarity of highly popularized classic arcade titles.

Turn Left at the Fork in the Road

It is important to realize that although the team did not specifically set out from the start to create an educational experience with explicit learning outcomes and assessment opportunities, the team came to realize that the combination of the gameplay and the action painting processes did provide the opportunity for potentially deeper and meaningful interactions with the game, and learning opportunities relative to the associated artistic movement. Rather than seeing the game as something that helped to investigate or reinforce cognitive targets, it was clear that the game had potential to unlock curiosity about a given form and practice. It was hoped that players would be able to make the connection between playing and making and that they would be able to discuss their experience

in both game and art terms. However, as outlined in the previous sections, things were not entirely successful in the transfer of these goals and objectives.

Developers

It was evident that there was still a mismatch between what the design team was trying to convey to the development team and what was manifesting with the student developers' priorities in development, scheduling, and testing. In turn, the focus on gameplay as opposed to any discussion of the creative aspects was one of the main reasons for the delay in implementing the features of saving or sharing the painting until after the term was over and most of the students had moved on to other projects. While students had an experience of making a game, they did not make the deeper connection between the game itself and the experience it represented.

Player Groups

While all three of the player groups had responses that were different at some level, they did share a common theme. The players connected with the game as a game but not necessarily as an experience through which to engage in creative expression. As such, the creative element was seen as a novel addition, but not central or intrinsic to the experience and even with the third group at festivals and showcases that did connect to it more, the connections were not as deep or profound as the design team would have hoped for.

Feedback from an Educational Games Community

It should also be noted that there was discussion of the educational aspects of the game at the Games+Learning+Society conference in 2016 where the game was a finalist for 'best education game' in the Learning Arcade. Feedback during judging provided valuable insight, providing positive comments on the visual and aesthetic qualities of the game and game play itself. However, judges had concerns that the game was not truly educational given it didn't have a formal assessment mechanism built into its design.

In many ways, this is a mirror to the response from the developer and playtest groups. Whereas the prior groups focused upon the gameplay elements, this group focused upon the cognitive and assessment capabilities of the game. This speaks to the need to challenge our preconceived notions of what educational games must be, and to re-evaluate our notions of success and transfer relative to the potential of interactive media in an educational context.

Changing Course

In reflection, the interactions with the different groups may have been profoundly different had the team worked with an art educator from the start. We would have been able to develop clear goals, objectives, and outcomes that would have allowed us to situate the game within the curricular materials exploring action painting. We would have been better equipped to answer design and development questions that dealt with the educational targets and would have been able to evaluate the game with assessment mechanisms to see if learning actually occurred when utilizing the game.

While the opportunity of including an educator from the start may have been desirable, not all was lost. The team was seeing potential of the game in a number of venues, including the use of the game

to create and share expression among players, the use of the game with other creative forms (such as music) to provide new experiences to an audience, and questions challenging us and others to do more with the game in an educational context. Therefore, we sought out an opportunity to create a scaffolded educational experience around the game in its current form.

The Splattershmup Teacher's Guide

For the 2017-2018 school year, we worked with an elementary art education teacher (Sara M. Cometto) and asked her to think about how this game could be used in the elementary art classroom. The culmination of this effort is the Interdisciplinary Teacher's Guide (Cometto, n.d.) which is designed for classroom teachers grades 3-8, but could be adapted for grades 2-12. The guide addresses both National Core Art Standards (National Core Arts Standards, n.d.) and the ISTE standard for students as an innovative designer (ISTE, n.d.).

The guide presents several lessons that allow the student to both experience the game through play while weaving content about Jackson Pollock and modern art throughout the experience. The students are also asked to frequently reflect upon what they had experienced in the game and relate it back to what they see in Pollock paintings. For younger students (grades 3-5) a book, *Action Jackson* (Greenberg & Jordan, 2007) is recommended as part of the classroom experience for the teacher to read to the students. This book is partially a biography of Pollock, but also discusses the methods and techniques he used to create his works. Pollock's method was inspiration for the gameplay of *Splattershmup*.

One of the key features of the lesson plan is the discussion points, particularly around dispelling the negative notions around modern abstract expressionism, which are dismissive of the art because it does not seem to some to be as detailed, as realistic, or as meticulous as other works of art. As noted in the teacher's guide, Pollock himself was aware of these criticisms and the guide provides the following quote from the artist to respond to the critique:

"When I am painting I have a general notion as to what I am about. I can control the flow of the paint...There is no accident, just as there is no beginning and no end." (National Gallery of Art Washington, 2009)

Teachers are also encouraged to have the students to play the game in zen mode in order to create their own works of art in the style of Pollock. As a key part of the art education process, students should then present their creations to the class and demonstrate the similarities and differences to the Pollock works they had previously studied. Lastly, the guide presents other in-class art activities to allow students to create their own (non-digital) action paintings.

For the team that worked on creating the game, the lessons and classroom activities really bring to life the intent and focus behind the design. With the scaffolding of the teacher's guide, students are guided through elements of cognitive growth in their knowledge of modern art techniques and artists as well as experiencing it through the affective domain by actually creating the art themselves.

Pilot Offering (2017-2018 school year) and Observations

It was very fortunate that the educator who developed the Teacher's Guide also implemented the lessons in her art classroom in the spring of the school year. The students were in grades 3-5 at an

intermediate school in suburban Western New York. The students worked with the game in two art class periods and an art station at the students' end of the year activity day. Art classes at the school occur once every six school days.

After implementation, the authors discussed the results with the art teacher to determine what the students were able to accomplish and to get her impressions of using both the game and the lessons in the classroom. We were particularly interested in whether or not this treatment helped the players (students) make the connections between the game and the art.

We were very encouraged by the fact that the teacher reported that the students did see the connections and were able to seemingly go between talking about the game and game play and the art concepts.

Building on the excitement of playing a video game in class, the teacher introduced the *Splattershmup* game to the students. They first began by working on their laptops individually in arcade mode. After one initial game play, the students were asked to reflect upon what they did using the artful thinking strategy "I see, I notice, I wonder" (Project Zero, n.d.). Two of the questions that were vocalized during the "I wonder" portion:

- How can I get more colors?
- How can I make more splatters?

While both of these are aspects of the game, they are also aspects that directly relate to the art of the game as opposed to the game play.

Next, students were asked to take their "I wonder" questions back to the game in arcade mode and try to answer them through more game play. The students were encouraged to talk their classmates as they were trying out the game again at this time.

After some time in arcade mode, the students were instructed to try zen mode for the game and then they were asked to discuss the results. They were asked to compare and contrast the two modes of play and the different results. Students once again used art words in describing the product they produced (words like color, lines, thick, thin, splatters, dots) in the appropriate ways.

The work of Jackson Pollock was introduced via a projected image of one of his works. The teacher then asked the students about their strategy used to create their work of art. In particular, how did they use the spaceship to create the art? In addition, how could they use it to create art that looked more like the piece shown? Some of the answers included:

- Not get killed/playing as long as you could (*This refers to arcade mode.*)
- Work totally in zen mode
- Try to shoot more
- Changing the colors

These answers almost totally embody game play elements, which is expected because the question asked about game strategy. However, what we feel is important to note is that the students

understood very quickly how to use the game to produce the art. We asked the art teacher if she felt the students knew they were creating art and she definitely believed they did, primarily because they could answer the question about how the end product was created. She shared that the answer that came up was “by moving the spaceship”. She believed that observation was key in the connection between how the game worked and the art that was produced.

By the end of the first class, several other observations could be made about the students. The first is that many were trying to write down the information on how to play the game when they went home (the URL for the game). The teacher was asked to put a link to it on her school website (which she did). The second is that when given the opportunity to play the game multiple times, students began working together on the same laptop to play the game. During this collaborative play, one student would control the ship and the other would shoot. When asked why they were doing this, the students explained that they could play the game longer and make more art if they worked together. This clearly refers to playing the game in arcade mode rather than zen mode, but it wasn't clear from observation whether they stopped working together in zen mode or continued to do so because they could be more effective working together.

On the second art class day (occurring six days after the first due to the school's schedule), students arrived ready to play the game again, but some of them came prepared. Some brought a mouse from home (the school laptops do not have mice) and others brought headphones to plug in to listen to the music while playing in zen mode. Students reported playing the game at home since the last class. Our conclusion from this is that students who play games at home (or played this game at home) brought equipment with them to make this classroom game experience more like their home game experience.

The second set of activities revolved more around creating the connections between the work in the game and the work of Pollock and the abstract expressionist art movement. To that end the teacher read aloud the book *Action Jackson* (Greenberg & Jordan, 2007) to the students and discussed his work. As a fortunate accident of serendipity, the 5th grade class had just visited the local art gallery as a field trip and the art gallery has a Pollock painting in its permanent collection. In the 5th grade classes, students were asked if they remembered the painting and asked to talk about what it was like to see it up close. The students in the other grades did not have the same field trip, but discussed Pollock's work as well.

After the reading of the text, the students were asked to go back to zen mode and to purposefully work to create a painting inspired by Pollock's work. After they completed this exercise, they were asked about the strategies they used to create their art in zen mode. They once again discussed their work in terms of some of the game play needed to create the work, but were describing their work in the appropriate art terms.

On the second-last full day of school, all students participated in *Field Day*, an annual end of year event that brings the school together in a series of carnival-like social activities. This year, the teacher created an activity outside of the normal athletic events typical on this day. Students came into the art room and were assisted by parent volunteers in creating their own drip paintings. Image 3 shows the students interacting with the volunteers to create the paintings and Image 4 shows the student

artwork. This activity elicited excitement from the students who enjoyed the opportunity to create something in this way.



Image 3: Students being guided to create their own drip paintings on activity day.

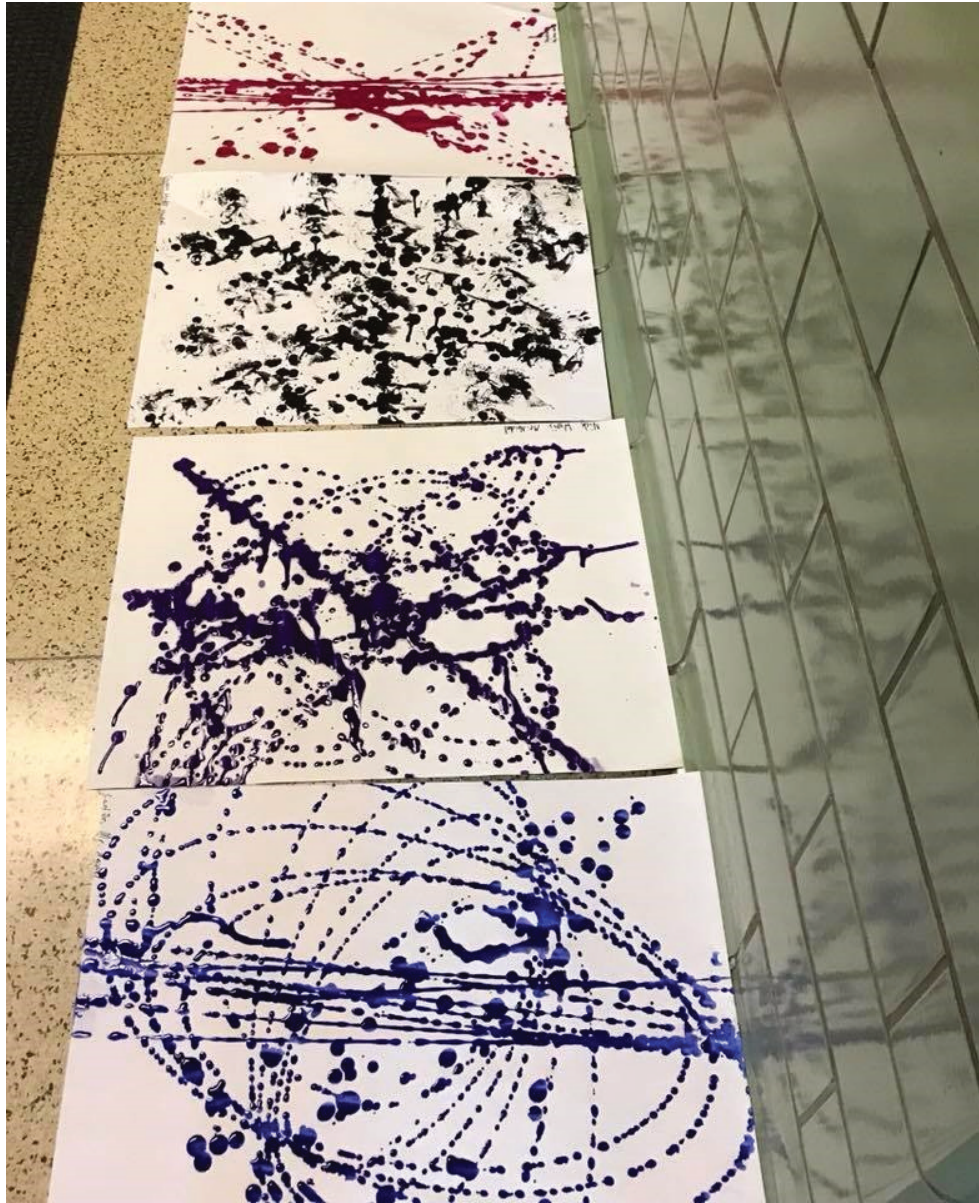


Image 4: Finished paintings drying in the hallway.

During this first implementation of the teacher's guide, we were fortunate enough to be able to capture some quotes from the students (3rd grade) using the game and participating in the activities.

- "You get to shoot stuff and actually get to make art."
- "In zen mode, you can just draw."
- When asked why the student liked the game, they responded "Because you can attack people like in the usual games I play."
- One student commented that they liked arcade mode better "because you can do abstract art and attack."

We believe this first implementation of the teacher's guide to be a success on several levels:

- 1) The teacher was able to implement the lessons.

- 2) The students were able to engage with the material, and they had a positive response to it.
- 3) They reported that they engaged with the game at home and the art teacher received feedback from parents that students were playing the game at home.

In fact, the school principal reported to us (as we were leaving the building from our follow-up interview about the pilot) that his children, who are students in the school, were playing the game at home that weekend. The principal did not know that we were in the building that day to discuss the implementation of the teacher's guide. The comment was solely directed at the art teacher to indicate that the current unit was having an impact on the students outside the classroom.

We asked our art teacher colleague what the students thought of the experience overall and while we spent a lot of time reflecting on all aspects of the activities, we felt that this quote from her summed it up nicely, "the students loved it".

Discussion

In reflecting upon the pilot and the evidence presented in our follow-up interview with the art educator about implementation, the authors are forced to consider how the involvement of the education expert has shaped the experience for the students while playing this game. While our first two groups, the initial student developers and the players of the original release, did not engage with the art and creative aspects of the game experience, it is clear that the elementary school students did. This was, in no small part, due to the structuring of the lessons around the game and the addition of appropriate content to bolster the educational value.

Consideration beyond the cognitive domain and standard assessment

When we address the issue of outcomes and assessment, we often forget that the potential of any video game exceeds the lower levels of the cognitive domain of skills (Bloom, 1956). Game systems themselves are sets of rules and behaviors that the player must address through trial and error to ascertain the nature of a system (Egert & Phelps, 2011). In addition, there is also the value of a game to function not just as a standalone, assessable element, but rather to unlock the value of affective domain skills (Bloom, Krathwohl, & Masia, 1964) and to pique curiosity into new areas of exploration. Rather than mere metrics of cognition and learning, there are also opportunities for valuing trial and error (i.e. learning through initial failure), along with creative potential that extends beyond typically measured outcomes.

Within this pilot, it is clear that there is a successful intersection of the cognitive and affective domains with the ability of the students to see the connections between the output of the game experience and the modern expressionist art they were exposed to in the classroom. The students were also able to use the game to create their own expression in the same style as the classroom examples.

Considerations of augmentation and empowerment

In our case, the game experience itself is not the artifact of learning, but serves as an augmentation or enhancement to traditional classroom presentation of material. As such, the learning may not be internal to the game, but instead externally constructed through a series of encounters or through connecting multiple interventions in a meaningful way.

Within this context, the impact of the game and the lessons is not just the cognitive outcomes or assessment, but engagement with the entire experience and process. We feel that one important aspect to this being successful is the ability for students to engage with the game in a meaningful way and see it as an experience onto itself and not simply as another classroom activity. In this regard, we feel we were extremely successful. First, we can observe that students were interested in doing better at the game by working together to ensure success and get the output they were looking for and by customizing their experience with the game in the second art class through the use of their own peripherals. Also, and perhaps even more encouraging is the fact that the students (and parents of students) reported that they played the game at home, not as an assigned piece of schoolwork, but because they wanted to. In many ways, there is no greater form of success for this type of game.

Conclusions and Future Work

We have many reasons to believe that our experience with Splattershmup was a success. The students made a game, and that game was released commercially and on multiple public channels. A wide and varied audience has downloaded and played the game and reported enjoying the experience. The game has been ranked and judged by professionals within the field, resulting in presentation and inclusion in prestigious venues. Moreover, we have made progress with respect to unlocking the power of the game as an educational tool. All of this, however, has left us with many more questions and much work to do. If we want to make formal claims about the educational value of both the game and Teacher's Guide, a systematic study of its impact needs to be performed, either with the same age group as the pilot or with multiple age groups and skill ranges. We also would like to get information from other teachers who have used the materials in their classroom, in other districts and with different backgrounds and approaches.

It would be very interesting to see if scaffolding could be integrated in the game experience so that those outside of a formal school setting could be exposed to more of the underlying meaning of the game. This needs to be handled carefully, however, as it needs to be an authentic part of the experience and should not detract from the initial intent and ability to enjoy the game for simply its entertainment value.

This experience has also allowed us to reflect on the role of an educator in the game design experience, the role of assessment in educational games, and the role of games in education. While in this case, the educator provided us with a framework for using our game in an educational environment and provided a good amount of scaffolding to support the learning, it was in support of a game that already existed. What would this game have looked like if the educational mission was front and center? Would assessment have been built into the game? How would that have changed the experience? Should all games with an educational mission have an educator in the process from the beginning?

We brought in an educator at a much later stage in our process than is typical for an educational game, but our initial goals were not to build an explicitly educational game. While that has drawbacks in the way the educational content is integrated into this game, it afforded us opportunities that would not exist had the game been totally created with a strictly educational focus. It is unknown what design decisions would have to have been made to support assessment of the educational goals and outcomes,

but it is clear that the game would be different and potentially not have the ability to resonate with players as a game after the fact.

While there is much discussion about using games in classrooms and for educational purposes, most commercially successful games are not built with that goal in mind. Therefore, they are often not easily integrated into any part of a standard curriculum. Further, technology is always a barrier in these types of integrations. Even our game that can run directly in a web browser, suffered from problems in the classroom of older laptops taking a long time to start up and connect to the internet.

Our game had at its outset, underpinnings of an educational mission, which may have ultimately led to success in building additional educational scaffolding around the experience while still creating an experience that can stand on its own as a game with entertainment value for the player.

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