Gaming the Class: Using a Game-based Grading System to Get Students to Work Harder… and Like It

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Abstract: Instructors at all levels of the educational system have been experimenting with game-based grading and evaluation frameworks. What is the effect of these grading systems on student motivation and effort? Using well-validated motivation scales to understand how student motivation profiles relate to effort, this paper examines two different instances of game-based grading systems in university coursework. Our findings indicate that a game-based grading system can overcome typical student motivation profiles, essentially helping students—who might normally underperform in coursework—to work harder. We present two contrasting cases: an elective course on video games and learning, and a gateway course on political theory. Findings were similar for both courses, suggesting that game-based grading systems have generalized potential for use in higher education, and possibly beyond.

Introduction: Games as Model Learning Environments

The Games+Learning+Society community needs no convincing about the power of video games as learning environments. As Gee argued in his seminal book on video games and learning, good games succeed *because* they tap into our deep-seated desire to learn and be engaged (Gee, 2003). Many of the features of well-designed video games—identity play and the formation of affinity groups, exploration in and of semiotic domains, support for risk-taking, amplification of input, support for practice and ongoing learning, on-demand and just-in-time information, multiple routes towards success—are also features of well-designed learning environments. Various scholars have noted that games can also inspire the design of non-game learning environments, such as traditional classroom-based courses. The work described in this paper was first inspired by authors such as Gee (2003), Prensky (2005), and Jenkins, Squire, and Tan (2003), and crystallized by talks such as Jesse Schell's "Beyond Facebook: The Future of Pervasive Games" (Schell, 2010). Schell described a course taught by Lee Sheldon at Indiana University in 2009 that was both *about* MMO design and *taught as* a MMO course. The process of designing and teaching that course is described in a recent book (Sheldon, 2012). What is made clear in Sheldon's descriptions of his design process across multiple iterations of both his MMO course, and several other courses, is that the *grading system* was one of the most difficult components to design. But is it worth the effort? Do game-inspired assessment systems change students' relationship to the class, essentially leading them to work harder? Will all students work harder, or just certain types of students, e.g., students who would normally work hard anyway?

Grading Systems and Motivation

Giving and receiving grades is a ubiquitous part of the formal school experience. The most common system of letter grades (A through E) has been a part of education in the U.S. since the late 1800s (Durm, 1993). Students and instructors, moreover, have come to view grades as measures of both learning and performance; schools use grades to sort students by "ability," and this sorting plays an important part of the gatekeeping process used to decide who is given access to funding, advanced study, and jobs. Grades also shape students' self-appraisal. It is unsurprising, then, that after receiving grades, students begin to see themselves through the lens of formal assessment. They *become* "A" students, "B students," *etcetera*. While instructors may view their course designs as a balancing act of pedagogy, assignments, and evaluation, students typically focus only on the grades they receive and how to achieve them. Indeed, an investigation of student performance in Physics courses at one large Midwestern university indicates that the strongest predictor of future student grades is their grades in *earlier* courses (personal communication, T. McKay, September 28, 2011). This suggests a kind of stasis that is hard to overcome once you are within the system, and is likely a function of student self-efficacy.

Motivation, or the study of what pushes individuals to start, sustain, and finally complete activities, is a critical precursor mechanism for learning. We focus here on self-efficacy or academic self-concept as a key component of motivation. We rely on Bandura's (1977) definition of self-efficacy as a cognitive process that mediates an individual's behavior with respect to effort, according to the individual's expected outcomes. As Dale Schunk put it, "Students who hold low self-efficacy for learning may

avoid tasks; those who judge themselves efficacious are more likely to participate" (Schunk, 1990, p. 74). Self-efficacy is a key component of larger theories of motivation, such as attribution theory (Pintrich, 2003) and Dweck's (1975) seminal work on learned helplessness, which posits two different kinds of learners: *entity learners* who believe that intelligence is a fixed property, and assign responsibility for success or failure either to luck or to external circumstances, or *incremental learners* who believe that intelligence is a function of effort, and if they therefore persist, their chances of success increase. Entity learners tend to give up in the face of challenges, while incremental learners persist and (on the whole) exhibit greater self-regulatory capabilities. There is also evidence that the greater one's self-efficacy, the more effort one is likely to exert towards completing a task (Schunk, 1990).

Turning to video games, there is growing (though mixed) evidence that video games increase learners' motivation in various domains, including mathematics (for a review, see Kebritchi, Hirumi, & Bai, 2010). We argue that *good games* (as defined by Gee, 2003) contribute to increased self-efficacy because of the attributes described above, especially the ability to experiment with low costs for failure; at worst, a good game will make you go back to the beginning of the level or start of the puzzle. Good games also place players into a state of flow (Csikszentmihalyi, 2008), increasing time on task, another key element for effective learning. Most frequently, when research on video games focuses on motivation, it focuses on intrinsic or extrinsic motivation within the game and how that encourages students to keep playing or remain engaged (e.g., Lepper & Henderlong, 2000; Malone & Lepper, 1987). We believe that the same motivational theories can be applied to thinking about student effort in formal education, especially when using a game-based assessment system.

Strong research evidence (Ames, 1992; Blumenfeld, 1992; Elliot & Harackiewicz, 1996; Middleton & Midgley, 1997) suggests that students' personal achievement goal orientations are correlated with academic effort and outcomes. Goal orientation theory describes academic persistence in terms of "adaptivity," or how flexible students are to changing demands and expectations in academic settings. Students that have a strong Mastery Goal Orientation, "seek to extend their mastery and understanding. Learning is perceived as inherently interesting, an end in itself. Attention is [therefore] focused on the task. A mastery goal orientation has been associated with adaptive patterns of learning" (Midgley et al., 2000, p. 7). This is the most productive orientation for persistence and learning. A performance-approach orientation is when, "[a]ttention is focused on the self. A performance-approach orientation has been associated with both adaptive and maladaptive patterns of learning" (Midgley et al., 2000, p. 9). This is a middle ground for student adaptivity. A performance-avoidance orientation is when, "students' purpose or goal in an achievement setting is to avoid the demonstration of incompetence. Attention is focused on the self. A performance-avoid goal orientation has been associated with maladaptive patterns of learning" (Midgley et al., 2000, p. 10). This is the least desirable motivational profile because it is most associated with disengagement. These profiles have been identified consistently in learners across many different contexts, and they relate reliably to academic effort and outcomes.

The Game-inspired Grading Systems in the Current Study

This paper considers student motivation with respect to two different undergraduate courses. The first course is located in the School of Education at a large public research university, and is on the topic of video games and learning. The course is an elective for students, normally taken by upperclassmen from across the university (as opposed to pre-service teachers), with an enrollment of ~80 students. The second course is in the Department of Political Science, and is an introduction to political theory. This course is normally taken by freshmen, with an enrollment of ~300 students. The course is a gateway course that must be passed by any student wishing to major in Political Science. The grading system of each is presented briefly here.

Political Science Course

The grading system of the political science course gives students control over their final grade in two distinct ways. First, students must choose the *types* of assignments that make up 60% of their final grade. In so doing they complete two out of three types of assignments offered throughout the term: traditional essays, an open-ended group project, and posting and responding on the class blog. Second, students are given the freedom to determine how each of the individual assignments is *weighted* for the final course grade calculation. In order to "unlock" their ability to choose and weight their coursework, however, students are required to complete a quiz that assesses their understanding of the course's grading system. Once this has occurred students can choose the path

they will follow to complete the course. The remaining 40% of a student's grade is traditional in that it consists of a core set of requirements: attendance (5%), "keeping up with the reading" (15%, assessed via quizzes and/or blogs), and "section," which consists of attending Graduate Student Instructor (GSI) led discussion sections (20%).

School of Education Videogames and Learning Course
The goal of the videogames course is to examine the learning and motivational theories that operate within—and inform the design of—videogames. Consequently, the grading system is appropriately infused with the design principles that operate within games. To this end, students enrolled in the videogames course accumulate "experience points" (XP) for each assignment completed. Some assignments can also earn students "skill points" (SP). The course has a set of required assignments that are paired with optional assignments. These assignments are divided into three categories: "Grinding" assignments are those typically characterized as necessary for learning the content, but are not always as engaging as other assignments; "Learning from playing a game" assignments are those that center on students reflecting and commenting on a commercial videogame they have chosen to play throughout the term—their "game text;" "Boss Battle" assignments are longer, more complex, and require a certain level of content mastery to complete successfully. As a result, the "Boss Battles" occur near the end of the term. Optional assignments in this course can be seen either as assignments that students complete to exceed the course's main requirements—because they want an "A+," perhaps—or as assignments that students complete in order to regain points that were lost as a result of missing a class, missing a reading reaction, or simply performing unsatisfactorily on a required assignment.

These two courses and their respective grading systems are different from each other, but both could easily be considered "game-inspired." We also believe that these two courses serve as usefully contrastive cases. One is required, the other is not. One is taken by first-year students, the other mostly by upperclassmen. One is on a "frivolous" topic (at least from the perspective of many students and faculty), and the other is on a "serious" topic. By comparing and contrasting these two classes in terms of student motivation, we stand to learn more about the generalizability of game-inspired assessment systems across topics within a university.

Research Questions
Our study focuses on three main research questions:
(1) Do the grading systems of these courses help students feel more in control of their grades?
(2) Do the grading systems in these courses lead students to complete more assignments?
(3) Do students in these courses believe that the grading systems encourage them to work harder?

In examining these questions, we also explore a number of subsidiary questions related to students' attitudes towards the grading systems and the courses themselves, presented below in the context of our findings.

Methods
We used a survey methodology to gather data on student attitudes and motivation profiles. Data on the Education course is from Winter, 2011. Data on the Political Science course is from Fall, 2012. Both surveys were administered to students near the end of the term. Education students were only given one survey, but Political Science students also had a pre-survey given shortly after the start of the term. We compared responses on both surveys in Political Science, and found no significant differences (the responses were stable across time). Therefore, we only report on findings from the end-of-term survey in this paper.

The survey was given online, comprised of 41 items, and took students roughly 15 minutes to complete. All motivation and attitude items were measured on a 5-point Likert scale. There were 76 students in the Education course, and 63 completed the survey, for a response rate of 83%. There were 296 students in the Political Science course, and 176 completed the survey, for a response rate of 59%. It is possible that students who chose not to respond to the surveys were among the less motivated students in the class, but this was deemed a minor concern because the overall response rates were acceptable and we still had substantial variation represented in both groups in terms of motivation profiles (see Table 1 for descriptive statistics).

Course	Male/ Female (%)	Year in School (%)				MGO (%)	PA (%)	PV (%)
		Fr.	So.	Jr.	Sr.			
Education	73.8/26.2	4.9	19.7	11.5	63.9	52.5 (13.6)	53.2 (14.8)	58.3 (15)
Political Science	59/40	30.9	57.6	6.9	3.2	50 (16.9)	45 (14.2)	53.9 (14.4)

***Table 1*: Student demographics and motivation profiles. Motivation profiles are reported as % of students scoring above the mean, and in parentheses % of students scoring 1 SD or higher than the mean, (e.g., 52.5% of students in the education class have a higher than mean Mastery Goal Orientation, and 13.6% are at 1SD or more above the mean).**

To measure student motivation, we used the Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000). These scales were developed to examine the relationship between the learning environment and students' motivation, including: personal achievement and goal orientations, perceptions of the teacher's goals, perceptions of goal structures in the classroom, and achievement-related beliefs, attitudes, and strategies. This instrument has been validated in multiple subject areas, and produces scales that indicate a respondent's mastery goal orientation (MGO), performance-approach orientation (PA), and performance-avoidance orientation (PV). Each of the scales used in the survey was highly reliable (EDUC MGO α=.91, POLSCI MGO α=.92; EDUC PA α=.80, POLSCI PA α=.88; EDUC PV α=.73, POLSCI PV α=.80). Since each scale was internally reliable in our sample, we used principal component analysis to create a single component score for each of the three motivation orientations. These were then used in subsequent regression analyses (discussed below).

To measure student attitudes, we designed a series of questions about the course and the grading system, including a self-report of which assignments students planned to complete. The basic questions asked may be discerned from the summary data presented in Table 2.

Findings

The first step in our analysis was to examine the data relating to student attitudes towards the class and the grading system. On the whole, students felt that they understood the grading systems, they generally believed that the grading systems were similar to video game systems, and generally believed that the grading systems both gave them more control over their course grades and encouraged them to work harder (in terms of choosing to do more assignments and work harder on their assignments). Finally, students generally *liked* the grading system in both courses, and found the courses personally interesting (all data is summarized in Table 2 below). We believe that the Education course and the Political Science course are contrastive cases with which to examine student motivation, and the data also supports this. A comparison of means on the items reported in Table 2 indicate that students in the two classes differed significantly from each other in terms of all items except for their understanding of the grading system. In all cases, the Education class was rated significantly higher than the Political Science course, though ratings in both classes trended positive. The one question on which students did not differ between courses was whether they felt they *understood* the grading system. Students in both courses indicated that they did understand the grading systems, to roughly the same degree.

	Course	Mean	SD	t
Did students feel that they understood the grading system?	POLSCI	4.05	.996	-1.236
	EDUC	4.23	.871	
Did students believe the grading system is similar to video games?	POLSCI	3.26	.977	-5.081**
	EDUC	3.98	.833	
Did students feel that it is easier to earn the grade that they want?	POLSCI	3.24	1.173	-5.003**
	EDUC	4.10	1.053	
Did students feel that the grading system provides more control over their grade?	POLSCI	3.50	1.207	-5.867**
	EDUC	4.48	.813	
Did students believe that the grading system encourages them to work harder?	POLSCI	2.67	1.210	-7.163**
	EDUC	3.93	1.056	
Did students choose to do more assignments?	POLSCI	2.44	1.225	-8.446**
	EDUC	3.97	1.119	
Did students find the class interesting?	POLSCI	3.75	1.016	-5.048**
	EDUC	4.48	.813	
Do students like the grading system?	POLSCI	3.28	1.212	-6.544**
	EDUC	4.40	.887	

POLSCI n = 167, EDUC n = 60, ** = p < .001

***Table 2*: Descriptive data on student attitudes towards grading systems in each class.**

The next step in our analysis was to create regression models to investigate whether any of the motivation orientations (Mastery Goal Orientation (MGO), Performance-Approach (PA), Performance-Avoid (PV)) would serve as significant predictors of student attitudes towards the grading system. In particular, we focused on responses related to our three research questions as outcome variables: Do the grading systems help students feel more in control of their grades, lead students to complete more assignments, and encourage them to work harder? Our analyses did not reveal any significant relationships between the motivation orientations and student attitudes. This was surprising, as in other studies of student motivation in college courses, there is almost always such a relationship.

The final step in our analysis was to expand our regression models, by adding additional predictor variables that, in theory, ought to impact student motivation. Both student interest in the course ("interest") and whether or not students "liked" the course ("liking") were determined to be such items, and were thus included in additional models. Our final models for each of our three research questions have five predictor variables: MGO, PA, PV, "liking," and "interest."

For the Education class, the five-predictor model accounted for 35% of the variance in whether or not the grading system helped students feel more in control of their course grades (R^2 = .35, F(5, 49) = 5.209, p = .001). However, the only significant predictor in this model was the extent to which students reported "liking" the course (β = .57, p < .001). We found a similar result for the Political Science course, with the model accounting for 46% of variance (R^2 = .46, F(5, 150) = 25.03, p < .001), and liking the only significant predictor (β = .64, p < .001).

We observed similar results for the question of whether students felt that they would complete more assignments as a result of the grading system. In the Education class, the model accounted for 32% of the variance (R^2 = .32, F(5, 48) = 4.485, p = .002), with "liking" as the only significant predictor (β = .53, p < .001). In Political Science, the model accounted for 25% of the variance (R^2 = .25, F(5, 149) = 9.661, p < .001), but in this case *both* MGO (β = .26, p = .013) and "liking" (β = .28, p = .001) were significant predictors. This is the only case where one of the motivational orientations was statistically significant.

Finally, in relation to whether the grading system encouraged students to work harder in each course, the only significant predictor was, again, "liking." In Education, the model accounted for 32% of the variance ((R^2 = .32, F(5, 49) = 4.612, p = .002); "liking" (β = .58, p < .001)), and in Political Science, the model accounted for 34% of the variance ((R^2 = .34, F(5, 150) = 16.116, p < .001); "liking" (β = .46, p < .001)).

Discussion and Implications

As noted above, we were surprised when the motivation orientations by themselves were not related to any of our outcome variables. This observation contradicts many years of scholarship in motivation. After conversation with colleagues who study student motivation, however, we have come to realize that this is an indication of the success of these two prototype game-inspired grading systems. In short, the grading systems might help re-focus students to an extent that they overcome typical motivational orientations. A student with a performance-avoid orientation, for example, might typically seek to avoid new challenges in order to avoid demonstrating incompetence. Yet, in these classes, students are more likely to take on new challenges regardless of how they would "normally" respond in a course with a more typical grading system. The only thing that appears to matter is how much students like the grading system, and to a lesser degree (not significant as a predictor but still present in our best models) the extent to which they are "interested" in the course. In one instance, for the Political Science course, MGO was a significant predictor of whether students completed more assignments, but this finding does not contravene our overall conclusions, since that is the motivational profile that one would most expect to predict effort. Indeed, its absence in all the other models is more surprising than its presence in one.

Having a grading system with the potential to trump student motivational profiles represents a powerful tool in one's pedagogical arsenal. In both of these courses—one elective, one required; one mostly first-year students, one mostly upperclassmen—the instructors were able to create an assessment environment that encouraged students to work harder… and like it in the process. We recognize that assessment systems are only one element of the overall pedagogical design and implementation in these courses. Other factors, including course content, activity design, instructors' manner, and so forth will also matter in terms of student attitudes and effort. But given the differences in these two courses, we are strongly encouraged to find similar results for both.

We also recognize that our data is based solely on students' self-reports in our survey. While this is normal and unavoidable for the motivational profiling, we can do better in the future with respect to objective measures of effort. Future research will examine the actual work products students produced in each class. We also plan to link student course data to institutional data, allowing us to develop student profiles that include their performance in other university courses, their high school GPA, SAT and ACT scores, and a host of other factors that may be related to motivation and performance in college. However, given the general lack of quantifiable data on student motivation related to the design of game-inspired courses, we are pleased with our data and findings as a first step. Our research on motivation and effort is still early-stage. We hope to expand this research to include a far broader range of course content, and include comparison cases in our data that include more traditional grading systems.

The empirical research base for games and learning continues to grow rapidly. Building a strong base of evidence related to student motivation and learning is essential to convince critics of the potential in these approaches. And it is also important to acknowledge that there is no single approach, but rather a tremendous variety of ways that game-based and game-inspired thinking may transform the way we think about formal education.

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Acknowledgments

We thank Mika LaVaque-Manty for access to his political science course and for his collaboration on the development of the grading systems at the heart of this paper, and Steven Lonn, Andrew Krumm, and Stephanie Teasley of the USE Lab for support with data and analyses and Stuart Karabenick for helping us think about motivation. We are also grateful to our students for allowing us to experiment with them in our teaching. The opinions reported in this work are those of the authors and not their institution.