Multiple Paths, Same Goal: Exploring the Motivational Pathways of Two Distinct Game-Inspired University Course Designs

Stephen Aguilar, Caitlin Holman, Barry Fishman, University of Michigan
aguilars@umich.edu, cholma@umich.edu, fishman@umich.edu

Abstract: We explore gameful design in two large university courses: an introduction to political theory course, and an introduction to information studies course. Each course was designed by its instructor to mirror the motivational affordances found in video games, and while the foci of the gameful elements within each course's grading system were distinct, both systems align with some or all of the three pillars of Self-Determination Theory (SDT): support for autonomy, belonging, and competence. We employ path analysis to understand the direct and mediated relationships among variables that measured students' perceptions of the grading system's features, and the adaptive outcomes associated with gameful course designs. Results indicate that both courses have similar path structures defined by positive relationships between grading system features, the perceptions of those features, and the adaptive outcomes. We conclude with design implications for would-be gameful course designers.

Introduction

In his seminal work, James Gee (2003) elucidated many of the mechanisms behind what makes video games engaging. In the decade since his book was published there have been many attempts to further explore and apply his principles in both digital and face-to-face environments (see Aguilar, Holman, & Fishman, 2013; Fishman & Aguilar, 2012; Deterding, S., Dixon, D., Khaled, R., & Nacke, L., 2011; Huotari, & Hamari, 2011; and Thom, Millen, & DiMicco, 2012, for examples). These efforts have ranged from designing "gamified" digital environments, to courses and entire schools with "gameful" structures (e.g., Sheldon, 2012; Salen, Torres, Wolozin, Rufo-Tepper, & Shapiro, 2011).

Our work explores gameful approaches, which typically involve deliberately increasing student autonomy—and mitigating the impact of failure—so that students are encouraged to put forth effort in academic areas that they might have otherwise shied away from. To that end, we report on the latest progression of a larger design-based research project that seeks to both understand and support gameful course designs. This latest iteration represents an examination of two gameful courses within the same institution, but with varying designs. Both courses were undergraduate, high-enrollment, gateway courses, were designed with an eye towards gamefulness to support student engagement, and were supported by "GradeCraft", an in-house Learning Management System (LMS) designed specifically to support gameful instruction and pedagogy (Holman, Aguilar, & Fishman, 2013). The nature of the course's gameful grading systems, however, differed substantially. We examine if the divergent design decisions made by the instructors resulted in similar or different outcomes in terms of the motivational pathways associated with adaptive student outcomes (e.g., reporting feeling "in control" of their learning).

Specifically, we examined the following research questions:

(RQ1) How strongly is assignment choice associated with student effort, assignment exploration, and control over their learning pathways (key affordances of gameful designs)?

(RQ2) What are the direct and mediating roles of students' perceptions of the following grading system features: regard for the grading system, perceived fairness of the grading system, ease to earn one's desired grade, and control over one's grade?

In so doing, we had the following working hypotheses:

(H1) Students' assessment of being given choices over which assignments to pursue will strongly and positively predict perceptions of gameful grading system features.

(H2) Students' assessment of being given control over assignment weighting will strongly and positively predict perceptions of gameful grading system features.

(H3)   Students' assessment of competitive community activities (i.e., leaderboards) will likely be negatively associated with perceptions of gameful grading system features, while perceptions of non-competitive activities (i.e., house points) will be positively associated with gameful grading system features.

(H4)   Overall, the gameful grading system features and students' associated interpretations of them will be positively associated with adaptive academic behaviors.

Gameful Course Designs and their Players

Each course used videogames as a design metaphor to encourage student engagement, support student autonomy, and explain the grading system to students—neither course was *about* games or used off the shelf games in instruction. Both course instructors also utilized GradeCraft to support their course's gameful features; students, for example, were able to engage in a modest level of "play" through use of a grade prediction tool and interactive syllabus tool designed to help students manage various components of the course. The following sections briefly describe the major gameful mechanics of each course.

Introduction to Political Theory Course

The grading system in the political theory course supported student autonomy and students' feelings of competence in two distinct ways. First, students chose which two out of four assignment "types" to complete throughout the term. The assignments consisted of "boss battles" (short in-class exams), academic essays, blogging, or a group project. Second, students were given the freedom to determine how their assignments would be weighted within a 60% allotment. The remaining 40% of a student's grade was more "traditional" and consisted of a core set of requirements: lecture attendance (5%), weekly reading quizzes (15%), and participation in a weekly discussion section (20%).

Introduction to Information Studies Course

The grading system in the introduction to information course also supported student autonomy and students' feelings of competence in two ways. First, course assignments were framed as a series of "quests," through which students earned points ("XP"). These quests were either "adventures" (akin to regular assignments on a standard syllabus), or "pick up quests" which included a wide range of activities, such as exploring campus resources and participating in class "events" like "Laptop Liberation Day". Students began with zero points, and had the potential of earning over 1,000,000. A grade of "A" was achieved once students earned more than 950,000 points. The instructor ensured that there was an overabundance of choices so that students could make mistakes, avoid assignments, and have a sense of control over their experience.

The instructor also established structures to encourage students' feelings of belonging to a larger learning community by instituting "leaderboards". These boards were optional and anonymous; students who opted in were able to pick pseudonyms that would be displayed in GradeCraft. To further encourage students' sense of belonging in the course community, students were also put into "houses" led by graduate student instructors, and awarded house points for various challenges throughout the term (e.g., the Digital Content Playlist Challenge, where all house members worked together to design and build a website of online resources around one of the primary themes of the course).

Design Guidelines Informed by Self-Determination Theory (SDT)

SDT emphasizes the importance of self-determined action, which is a precondition to intrinsic motivation—an adaptive frame of mind for students to have. The gameful approaches used in each course are rooted (albeit implicitly) in the desire to promote students' intrinsic motivation by designing grading systems that leverage the "ABCs" of Self-Determination Theory (SDT; Ryan & Deci, 2000). Support for autonomy (A) is defined as a person seeing him-or-herself as the primary locus of control in a learning environment. A sense of belonging (B) serves as a pathway from extrinsic motivation to intrinsic motivation; as students enter a new learning environment they participate in it partially as a function of how connected they feel to other learners. Support for competence (C), serves to motivate learners towards engaging with course content by asking students to accomplish tasks that have the capability to complete successfully. Table 1 summarizes each of the gameful elements described above as well as their link to SDT.

Course	Term Taught	Game-inspired Elements	SDT Component
Political Theory	Fall 2013	Flexible Assignment options, Assignment weighting, Power-Ups	Autonomy, Competence
Information Studies	Fall 2013	Flexible Assignment options, Leaderboards, House points	Autonomy, Belonging, Competence,

Table 1: Summary of the two course designs as they relate to SDT.

Methodology

Data from both courses was gathered using online surveys administered at the end of the term. All but one item were measured on a 1-5-point Likert scale. In the political theory course "assignment choice" and "assignment weighting" were both measured on a 0-100 sliding scale, with 0 indicating "no control" and 100 equaling "total control". The entire survey took about 15 minutes to complete in each course.

Sample

There were 292 students enrolled in the political theory course, and 268 completed the survey for a response rate of 91%; there were 231 students enrolled in the introduction to information course, and 205 of them completed the survey for a response rate of 89%. Table 2 summarizes students' grade point averages for the term, final course grade (both on a 4 point scale), and ratings concerning how similar each grading system was to video games and other courses they were enrolled in (both measured on a 1-4 Likert scale).

Variables	Political Theory (N = 268)	Information (N = 205)
Academic information		
Cumulative GPA	3.3 (0.5)	3.3 (0.5)
Final course grade	3.5 (0.5)	3.9 (0.4)
Grading System...		
Similar to other courses	1.6 (1.1)	1.7 (1.1)
Similar to videogames	3.7 (1.0)	3.5 (1.1)

Table 2. Means and Standard Deviations of Academic Achievement and Grading System Similarity Judgments

Measures

We measured political theory students' interpretation of their grading system's features by asking them to rate how much control they believed being able to choose which assignments they committed to gave them (assignment choice) and how much control being able to choose how the two assignments they committed to were weighted (assignment weight). Both choices were measured on a 0-100 scale, with 0 = "no control", 50 = "some control", and 100 = "total control" serving as anchors.

We measured information students' interpretation of their grading system's features by asking them how motivating it was for them to: 1) rank high on the leaderboard 2) earn house points, and 3) have flexible assignment options. The three options were measured on 1-5 Likert scale, with "very motivating" and "very unmotivating" serving as the endpoints.

We operationalized the variables measuring students' perception of the affordances granted by each grading system on 1-5 Likert scale (see Table 2 for means and standard deviations of measured variables, and endnotes for survey items).

Variables	Political Theory (N = 268)	Information (N = 205)
Grading System Feature		
House points	--	3.3 (1.2)
Leaderboards	--	3.1 (1.2)
Flexible assignment options	--	3.8 (1.2)
Assignment choice[*]	80.5 (22.2)	--
Assignment weighting[*]	78.4 (24.2)	--
Perception of Grading System Feature		
Ease (1)[†]	3.5 (1.2)	3.2 (1.3)
Fairness (2)	4.0 (1.1)	3.7 (1.1)
Control over grade (3)	3.7 (1.2)	3.5 (1.3)
Regard for grading system (4)	3.8 (1.2)	3.4 (1.3)
Result of engaging with Grading System		
Exploration (5)	3.2 (1.2)	3.3 (1.2)
Control over learning (6)	3.9 (1.1)	3.6 (1.2)
Effort (7)	3.4 (1.1)	3.1 (1.2)

[*] = measured on a 0-100 scale; with 0 = "no control", 50 = "some control" and 100 = "total control" serving as anchors
[†] = see endnotes for (1) - (7) for exact wordings of items.

Table 2. Means and Standard Deviations of Measured Variables

Results

We used path analysis to better understand how assignment choice was associated with student effort, assignment exploration, and control over their learning (RQ1), and the direct and mediating roles of students' perceptions of grading system features (RQ2). Working hypotheses are examined and path analysis results are described below.

### Introduction to Political Theory Course

Using Figure 2 as a guide (and reading from left to right) we can infer a strong direct relationship between assignment choice and assignment weighting, yet assignment weighting did not prove to play a further role in the rest of the path model, which suggests that once students chose their weights, they did not see the ability to make the choice as motivating them one way or another. Modest direct relationships between assignment choice, and grading system fairness and ease were found, which in turn were moderately predictive of overall regard for the grading system and control over final course grade. Regard for the grading system also predicted effort and control over learning, while control over course grade moderately predicted effort, exploration, and control over learning. In short, students' ability to control their grade and their overall regard for the grading system were found to have positive direct and mediation relationships with adaptive student outcomes of effortful work, exploration of new assignment types, as well as how much control they felt over their overall learning.
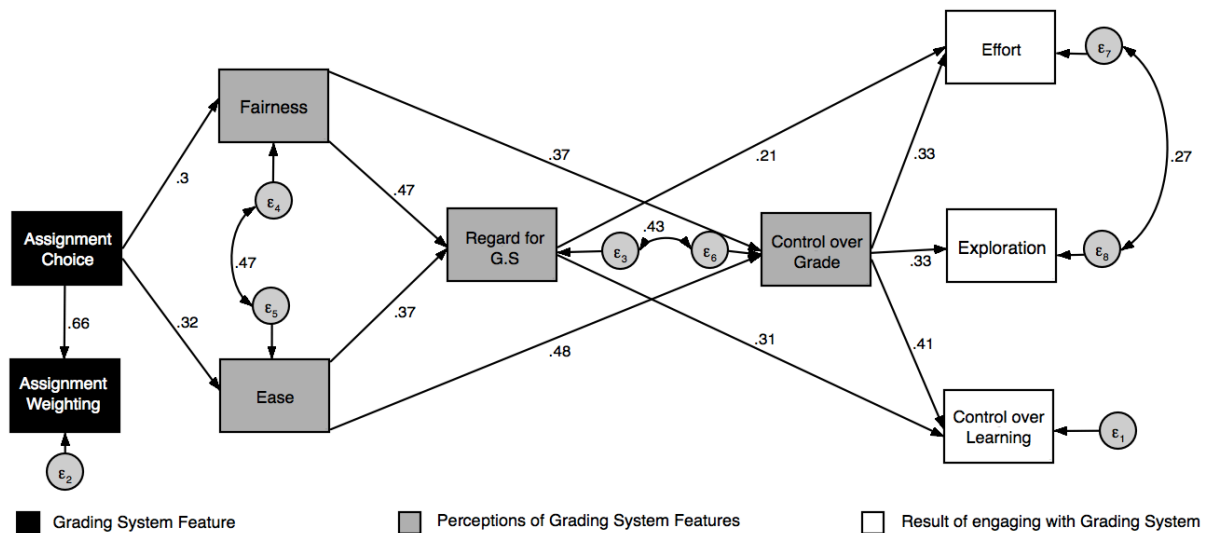
Figure 1: Path analysis for political theory course indicates good fit [χ^2(21, N = 268) = 57, p < .001, CFI = .97, RMSEA = .08, SRMR = .05] and fit better than alternative models. All paths were statistically significant with p< .01.

Introduction to Information Studies Course

Using Figure 3 as a guide we can infer a positive and direct relationship between how motivating house points and leaderboards were in predicting how motivating assignment options were to students. House points and leaderboards were also positively correlated. This was in line with our expectations since both house points and leaderboards are course mechanics that relate to the course community. They did not, however, play a further role in the model. Moderate direct relationships between assignment options, ease, fairness, and regard for the grading system were found. This makes sense, given that students' choice of assignments was the primary gameful mechanic in the course, and would influence their regard for the grading system, as well as assessing its ease and fairness. Ease and fairness also moderately predicted control over grade, and regard for grading system. As with the political theory course, both regard for grading system and control over grade were positively related to the adaptive outcomes of effortful work, exploration of new assignment types, as well as how much control they felt over their overall learning.
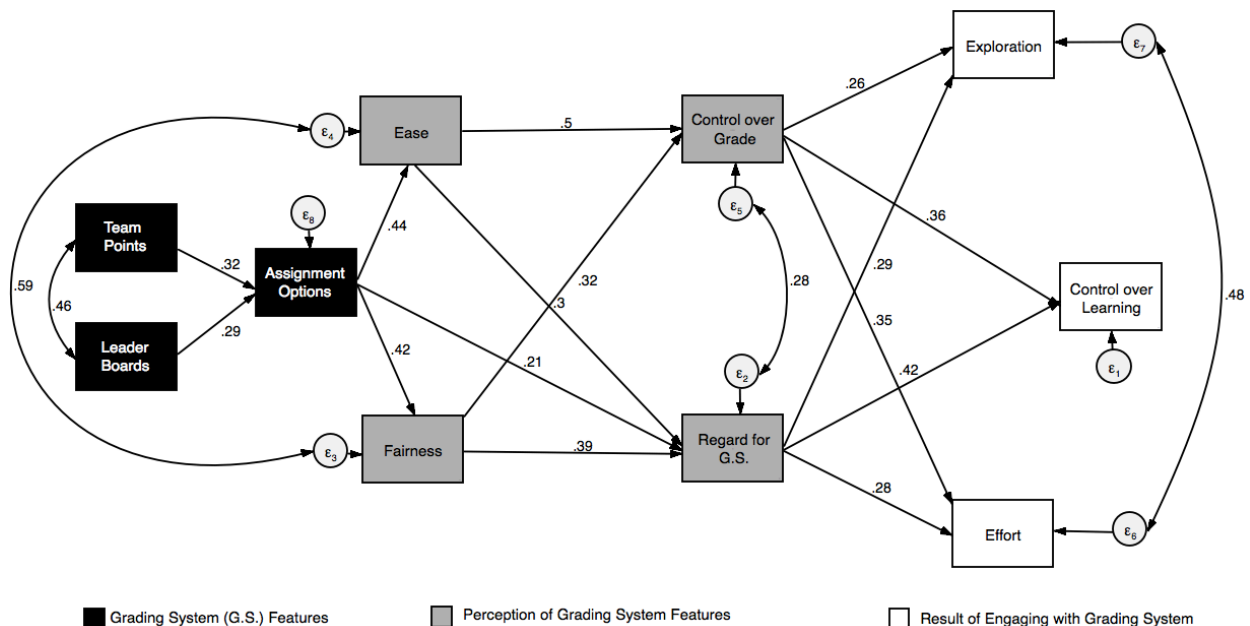
Figure 2. Path analysis for information course [χ^2(36, N = 205) = 62.2, p = .001, CFI = .97, RMSEA = .06, SRMR = .05] and fit better than alternative models. All paths were statistically significant with p<.01.

Implications

The above analysis lends some support to working hypotheses one and four, which posit that the affordances of gameful grading systems lead to positive perceptions of the grading system themselves as well as predict adaptive student outcomes (i.e., students working harder and feeling in more control over the learning process). While each of the models are slightly different in their respective path structures, both show that gameful mechanics were positively predictive of students' assessment of various aspects of the course, which in turn predicted positive non-cognitive motivational outcomes. This was expected, since it seems likely that a well-designed course structure will lead to positive assessments of that structure, which in turn influences student engagement. It is important to note, however, that this is the first time *gameful* course structures have been analyzed in this way, so we interpret the fact that students reacted well to a consequential shift in the traditional— and near-ubiquitous—course structure (i.e., where 100% divided up between assignments and aggregated later on) as a positive sign.

Hypothesis two (the central role of assignment weighting) and three (the negative association of leaderboards to various student motivation measures and positive association of house points to outcomes of interest), were not supported. This is interesting, because we believed assignment weighting to be more central to the positive outcomes associated with gameful grading systems. We speculate that weights did not have the predicted effect because of the generally "static" nature of the assignment weighting mechanic; once students decided how their assignments would be weighted there was no need to further dwell on assignment weights. In this way the mechanic may be analogous to triggered videogame "events" (i.e., where an in-game event forces a player to make a decision that impacts the rest of the game), which are important in shaping the narrative arch, but subsequently less important once over.

Leaderboards were also a surprise—results indicated that they were a net *positive.* This is perhaps the case because students who participated in leaderboards adopted a performance-approach motivation orientation towards leaderboards, which may have enabled them to be driven by competition in a positive way. Research shows this approach to be a more adaptive form of the performance motivation construct (see Elliot, 2005 for a historical review of the achievement goal constructs). Indeed, further analysis may show that students with a more performance-*avoid* orientation to the course (i.e., students who did not wish to be seen as incompetent compared to their peers) may have opted out. This would further support the need for gameful systems to allow for student autonomy. As "players" in the course game, students are well suited to avoid engaging in the course in ways that would not motivate them.

Limitations and Further Study

While our results are promising, we understand that there are key limitations. First, there is a need for better baseline measures of student effort and motivation around *gameful* courses. While many measures exist, they often presuppose the standard and ubiquitous course designs and do not take into account the peculiarity of gameful designs. So, there is a need for better measures that predict student's proclivity towards gamefulness.

As with much of this work, we are also limited by our context. This work represents an important step in exploring and comparing two gameful courses, but more contexts need to be examined. It is also important to use similar measures in "normal" courses to establish a baseline for how students may interpret our scales in more ubiquitous course settings. Overall, our evidence indicates that gameful courses can take many shapes, so long as they support student autonomy, competence, and a sense of belonging. Future designers of such courses are welcome to use either course as inspiration for their own course, or develop a hybrid course that uses elements from both. We do not assume, however, that these two courses represent all of the possibilities and opportunities for gameful course designs. There are many possible gameful designs each with multiple paths driven by similar goals.

Endnotes

(1) "Compared with my other classes, it was much easier to earn the grade I wanted because of the grading system."
(2) "I believe the grading system is fair to students."
(3) "I have more control over my final course grade because of the grading system"
(4) "I liked the grading system"

(5) "The grading system encourages me to work on assignment types I would normally avoid."
(6) "Compared with my other classes, the grading system gave me more control over my own learning."
(7) "The grading system encourages me to work harder than I would in a different kind of grading system."

References

Aguilar, S., Holman, C., & Fishman, B. (2013). Leveling-Up: Evolving Game-Inspired University Course Design (pp. 46–52). Presented at the GLS'13: *Proceedings of the 9th international conference on Games + Learning + Society Conference.*

Bogost, I. (2011, August 8). Gamification is bullshit. Video game theory, criticism, design. *Blog.* Retrieved July 19, 2013, from http://www.bogost.com/blog/gamification_is_bullshit.shtml

Csikszentmihalyi, M. (2008). *Flow: The psychology of optimal experience* (P.S. Edition ed.). New York: Harper Perennial.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining gamification. In *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp. 9-15). ACM.

Elliot, A. J. (2005). A Conceptual History of the Achievement Goal Construct. *Handbook of Competence and Motivation*, 52–72.

Gee, J. P. (2003). *What videogames have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Fishman, B., & Aguilar, S. (2012). Gaming the Class: Using a Game-based Grading System to Get Students to Work Harder... and Like It (pp. 110–116). Presented at the GLS'12: *Proceedings of the 8th international conference on Games + Learning + Society Conference*. Madison, WI

Holman, C., Aguilar, S., & Fishman, B. (2013). Designing a Game-Inspired Learning Management System (pp. 189–194). Presented at the GLS'13: *Proceedings of the 9th international conference on Games + Learning + Society Conference*. Madison, WI

Huotari, Kai, and Hamari, J. "Gamification" from the perspective of service marketing. *Proc. CHI 2011 Workshop on Gamification*. 2011.

Nolen, S. B. (1988). Reasons for studying: Motivational orientations and study strategies. Cognition and Instruction, 5, 269-287.

Meece, J. L., Blumenfeld, P. C., & Hoyle, R. H. (1988). Students' goal orientations and cognitive engagement in classroom activities. Journal of Educational Psychology, 80(4), 514.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78. doi:10.1037/0003-066X.55.1.68.

Sheldon, L. (2012). *The multiplayer classroom: Designing coursework as a game*. Boston, MA: Cengage Learning.

Thom, J., Millen, D., & DiMicco, J. (2012, February). Removing Gamification from an Enterprise SNS. In *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work* (pp. 1067-1070). ACM.

Salen, K., Torres, R., Wolozin, L., Rufo-Tepper, R., & Shapiro, A. (2011). *Quest to Learn: Developing the school for digital kids*. Cambridge, MA: MIT Press.

Acknowledgments