23.

I Choose…This One!

Exploring Student Motivation in Response to Assignment Choice

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Abstract

Giving students choices regarding their work is a core principle of gameful course design. Increasing autonomy should support intrinsic motivation, and enable students to increase their competence by creating a safe context in which to try new and challenging tasks. We analyzed the implementation of assignment choice in three large undergraduate gameful courses. Each course featured a different style and degree of support for student autonomy, and these variations related to differences observed in student attitudes. Students' answers on open-response survey questions shed light on the underlying reasons for these differences. We discuss the implications of our findings and identify next steps to guide the design of gameful courses.

Introduction

As gamification, "the use of game design elements in non-game contexts" (Deterding et al, 2011, p. 10), becomes more widespread, researchers and educators need a better understanding of how different aspects of gamified learning environments affect both learning outcomes and students' motivation. Educational settings are inherently messy contexts for research as experimental control is difficult to achieve. This makes it challenging to evaluate the impact specific game elements have on students. Our work operates within an ongoing, multi-year design-based research (The Design-Based Research Collective, 2003) study of gameful learning on a university campus (Aguilar, Holman, & Fishman, 2015). This approach allows us to investigate the effects of isolated game elements by observing their effects across multiple course contexts, design iterations, and student cohorts. In this study we explore how student attitudes shift in response to having varying degrees of control over their coursework.

The Success of Gameful Design: Implementation is Key

The effectiveness of gameful design depends not only on *what* is implemented but also on *how* it is done. Adding points tracking to repetitive tasks like image tagging increases performance but fails to promote intrinsic motivation (Mekler et al, 2015). Similar results have been found with superficial implementations of badges and leaderboards (Hanus & Fox, 2015, Dominguez et al., 2013). However, if badges are framed in a mastery-oriented way rather than as a performance incentive they have been shown to support students' self-efficacy (Abramovich, Schunn, & Higashi, 2013).

Bedwell et al. (2012) conducted a literature review to identify game elements present in gamified learning environments and used card sorting to identify nine distinct attributes. Landers (2014) used these elements as the foundation for his "Theory of Gamified Learning" and proposes that there are two routes through which each attribute can affect "learning-related behaviors or attitudes" (p. 752), a moderating process, and a mediating process. When he tested this theory in an online university psychology course, leaderboards increased performance in the online course as mediated by students' time on task (Landers & Landers, 2015).

Bedwell et al. (2012) identified *control* as one of nine core game attributes for learning. This parallels the work identifying autonomy as key to driving player engagement in video games (Przybylski, Rigby, & Ryan, 2010). When applied to an educational context, giving students control over their own work, including deciding which assignments to do, determining deadlines (Han, 2015; Harrold, 2015), deciding how work will be weighted (Boskic & Hu, 2015), and resubmitting work (Han, 2015; Harrold, 2015) have been shown to promote sustained engagement and feelings of self-efficacy. Yet, the implementation of control can take dramatically different forms. Our own theoretical understanding of the impact of different assignment choice designs on student motivation is grounded in Self-Determination Theory.

Self-Determination Theory

In Self-Determination Theory (SDT) the satisfaction of three basic needs: autonomy (choice and volition), competence (feelings of efficacy), and relatedness (sense of connection to others) are said to promote intrinsic motivation (Deci & Ryan, 2000; Deci et al, 1991; Black & Deci, 2000). Supporting these needs has been shown to promote persistence (Guay, Ratelle, & Chanal, 2008; Hardre & Reeve, 2003), and increased performance (Lavigne, Vallerand, & Miquelon, 2007; Van Nuland et al., 2012) in educational contexts. Gameful design for education takes inspiration from the structure and mechanics of good games and applies them to learning contexts in order to better support the basic needs of SDT. Examples of this include giving students: control over some aspect of their coursework (to establish autonomy), the ability to repeatedly attempt an assignment or customize its difficulty level (in support of competence), and the opportunity to collaborate with peers (to build relatedness). Gamefully designed courses should promote basic need satisfaction and greater intrinsic motivation for learners.

Gameful Course Design

Our work is based on observations of courses within a growing "gameful learning community" on the authors' university campus. We chose to analyze three large introductory courses that each took different approaches to offering students control over their assignments in Fall 2015. The courses studied occupy three different domains: Kinesiology (KIN), Information Science (INFO), and a social science course in the Honors program (SOCIAL). Each course used GradeCraft (http://gradecraft.com), a custom learning management system (LMS) designed specifically to support gameful learning.

This study explored the following research questions:

RQ1: How do students' perceptions of their autonomy relate to different amounts of assignment choice?

RQ2: How do students' perceptions of their ability to recover from failure relate to different amounts of assignment choice?

We hypothesized that having more assignment choice would increase students' perceived autonomy and their perceived ability to recover from failure.

Methods

Course Descriptions

In INFO all 82 assignments were framed as optional, but students *had* to complete a large three-part project in order to earn enough points to get an A. Up to a third of the final course grade could be earned from a category of assignments called "Pickup Quests" that encouraged students to engage with the intellectual community around the university, including attending academic talks, participating in experiments, and reading academic papers. There were 57 of these opportunities but a maximum of 10 were counted, giving students a large degree of control over how and when to do these. Students who earned low marks on a large assignment, or who chose to skip one altogether, could use these opportunities to build towards their goal grade. While the major assignments had identified deadlines, the smaller exploratory assignments were announced sporadically, as events on campus became known.

In KIN, there were fewer assignments (24 in total) and they were all truly optional, with many configurable paths to success. There were two exams, each worth a total of 3,000 points (potentially up to 15% of an A grade), but students could easily choose to avoid them and still have choices regarding what assignments they wanted to work on. Other assignments included writing case studies and literature reviews, quizzes, participating in in-class activities, and completing diet or fitness challenges. The instructor encouraged students to do as many assignments as they wanted and to "take some risks." All assignments were announced at the beginning of the semester, and had deadlines pre-determined by the instructor. There were no other course rules limiting assignment choice or order of completion.

SOCIAL featured a mix of required and optional assignments, and had multiple additional rules regarding sequencing and pace. All students were required to complete two "Novice" assignments at the beginning of the course, after which they earned 20,000 points and "leveled up" to "Apprentice." Students then chose between three categories of assignments, each representing a core learning objective: data collection, data analysis, and theoretical analysis. Students chose one of these three categories to count for double the amount of points towards their final grade. They were able to explore the assignments for the first half the semester, at which point they had to commit to this weighting decision. If students completed one assignment from each category, they leveled up again, received another 20,000 point bonus, and earned the right to complete a Guild Project. Students were allowed to do as many assignments as they wanted before Thanksgiving; after, they were only able to submit two assignments.

Table 1 provides an overview of the different course structures, including the magnitude of the grading scheme points scale, the number of assignments, and the difference between how many points were available and what amount was necessary to earn an A grade—courses with a larger difference between these two numbers have (generally) given students more control over their coursework.

	INFO	KIN	SOCIAL
Total Points	1,250,000	34,850	248,000
Points to Earn A	975,000	21,000	125,000
# Assignments	82	24	32
Class Size	150	247	147
Survey Response	139 (93%)	121 (49%)	59 (40%)

Table 1: INFO, KIN, and SOCIAL course structures

Survey Item Development

We developed a set of survey items designed to capture key motivational responses from students in these courses around their perceived autonomy, effort necessary to succeed, and ability to recover from failure. We consulted with instructors to tailor the survey to their course designs as needed. Students responded to these items on a 5-point scale with 3 being a neutral response, 5 a strong affirmative response, and 1 a strong negative response. The scale anchor language was customized to each item.

Students were also asked to identify up to four things that they liked and four things that they disliked about the class, and to provide any general comments regarding the course and its grading system. The open response data were thematically coded and assigned a valence code to indicate whether it was positive or negative. 13 different topics were identified, producing 26 different codes (positive and negative for each topic). Additionally, we assigned separate codes when students provided positive or negative feedback about the course structure more generally.

Survey Procedure and Participants

The survey was administered at the end of the semester. Students received a link via email and either completed the survey during class or on their own time. On average, it took students less than 10 minutes to complete the survey. $N = 319$ students completed at least part of the survey. See Table 1 for survey response rates per course.

Results

We conducted one-way analyses of variance (ANOVA) and post-hoc Tukey comparisons to determine whether or not survey responses significantly differed between classes, and if so, between which classes. We report Cohen's *d* as a measure of effect size for all significant differences. Cohen (1992) describes an effect size of 0.2 as a small effect, 0.5 as a medium effect, and 0.8 as a large effect.

RQ1: Perceptions of Autonomy in Response to Amount of Choice

Students generally responded positively to assignment choice across all three classes (see Table 2 for a summary of the positive and negative tone per research question topic for each class). In their open-ended responses, students shared that these courses "[a]llowed for specialization," to do work that

"fit best into my schedule," helped to "figure out what you like." Students frequently mentioned that the experience was "empowering" and encouraged them to actively plan their work for the semester. Students across all three classes reported that they took slightly more risks as a result of having increased assignment choice (see Table 3), with none of the course designs differing significantly from the others on this metric. On the downside, students mentioned that the flexible scheduling enabled them to procrastinate, and that the system was sometimes confusing.

	Assignment choice		Recovery from failure	
Class	Positive feedback	Negative feedback	Positive feedback	Negative feedback
SOCIAL	16.27%	5.42%	2.37%	0.68%
INFO	9.02%	4.97%	1.27%	0.12%
KIN	24.24%	3.59%	1.97%	0.18%

Table 2: Percent of feedback concerning assignment choice and recovery from failure

Looking across classes we can see medium to large (Cohen, 1992) differences in students' perception of the ways assignment choice impacted their experience. Students in SOCIAL reported putting in slightly less effort as a result of their choices, while students in INFO reported putting in slightly more–but both responses were centered around the neutral response of 3 ("I put in the same amount of effort as usual"). INFO had by far the most assignments, potentially affecting the perceived effort necessary to succeed in the course. A small but significant number of students in both INFO (12 students) and KIN (16 students) identified their ability to match their effort to their goal as one of their favorite things about these classes, with comments like "The grading system is well organized and you have the opportunity to put in as much effort as you want and you will get the grade that correlates."

Students in each class also differed on their comfort in skipping assignments. SOCIAL students were most comfortable doing so (M = 4.00, where 5 mapped to "Yes, I felt free to skip assignments. I knew I would still get the grade I wanted" and 3 was "I was not sure, I skipped some optional assignments but I was not sure how it affected my grade"), and students in INFO the least sure of this approach (M = 3.00). Students in SOCIAL positively discussed their control over their work almost twice as much (16.22% of the comments, as compared to 9.12%) as students in INFO. Student in INFO called out the way that the LMS grade predictor tool was "cluttered," reflecting the sheer number of assignments they had to navigate. They also highlighted that the LMS did not accurately account for a course rule that limited the number of exploratory assignments students could do to 10. This limitation in the LMS interface (implemented in a later version) may explain why INFO students were less sure how their choices would affect their grade.

Significant differences were again observed between classes in regards to whether students' felt overwhelmed by the number of assignment choices, but again with all three classes hovering on either side of the middle response, which stated "At times I felt overwhelmed but not all the time." Students in INFO reported being the most overwhelmed, and students in KIN the least, mapping directly to the number of assignments available, and thus the number of choices that students had to make.

RQ2: Perceptions of Ability to Recover from Failure in Response to Choice

Students in all three classes generally understood that they had the ability to make up for a low grade by doing additional work, but KIN students were significantly more confident in this (M = 4.66) as compared to both SOCIAL (M = 4.28) and INFO (M = 4.01), where 5 was "Yes, I understood that I could make up for a low grade by completing additional assignments", and 3 was "Sort of, I knew that I could make up for a low grade but I was not sure how").

However, when reflecting on how this affected their expenditure of effort, SOCIAL students indicated they put in slightly less effort than usual (M = 2.93), while KIN and INFO students put in slightly more (M = 3.34 and 3.38, respectively), where an answer of 3 corresponded to "I worked the same as usual." In analyzing the open-ended responses about the opportunities to recover from failure, SOCIAL students offered more positive *and* more negative thoughts: on the one hand they described the course as less stressful and enabling them to take risks, but several also mentioned that the reduced pressure meant they did not feel obligated to "give my 100% for each assignment."

		Mean			Cohen's *d*		
Item	Interpretation	*SOCIAL*	*KIN*	*INFO*	*SOCIAL v KIN*	*KIN v INFO*	*SOCIAL v INFO*
Did having a choice of assignment options affect the amount of effort you put into this class?	Higher score means more effort	2.76	3.03	3.35	*ns*	0.31	0.57
Did you feel like you needed to do every single assignment in this class?	Higher score means more students felt they could choose what to work on	4.00	3.80	3.00	*ns*	0.65	0.85
Did you feel overwhelmed by the number of assignments in this course?	Higher scores mean more students felt overwhelmed	2.77	2.32	3.28	0.41	0.89	0.49
How did the ability to recover from a low grade affect your assignment choice?	Higher scores mean students took more risks	3.57	3.62	3.39	*ns*	*ns*	ns
Did you understand that you could make up for a poor grade by completing additional assignments?	Higher score means better understanding	4.28	4.66	4.01	0.46	0.68	*ns*
Did knowing that you had the ability to recover from failure affect the amount of effort you put into assignments?	Higher score means more effort	2.93	3.34	3.38	0.45	*ns*	0.44

Table 3: Summary of post-hoc comparisons

Discussion

In this study we sought to understand student reactions to different implementations of assignment

choice. While we observed distinct variation in students' reaction to assignment choice, it is more complicated than 'more choice is better,' our initial hypothesis. Although increased choice was received positively across all three classes, having more choice above a certain threshold, and more complex rules around those choices, appears to have required students to put in increased effort to understand the grading system. INFO, which had the highest number of assignments, and SOCIAL which had the most complex rules system, proved more difficult for students to understand, and thus less successful at supporting student autonomy. More study of gameful courses is needed to determine optimal levels of assignment choice and structure.

We observed that variations in the way that courses enacted assignment choice (autonomy-support) led to different student thoughts and behaviors. This is consistent with the first step in Jang and colleagues' (2009) and Landers's (2014) mediation models. Jang and colleagues' model (2009) showed that the relationship between instructor autonomy support and academic achievement is mediated by basic need satisfaction. Landers's (2014) model suggests that students' reactions to gameful course elements are mediated by the relationship between implementations of those elements and academic outcomes. In the current study, we demonstrated that differences in the implementation of gameful design features led to differences in student reactions. We can begin to make recommendations about the best ways to enact assignment choice in gameful courses:

1. Make as much information about assignments, deadlines, and rules available at the beginning of the semester, and change the design as little as possible throughout the semester. If new assignments will be announced throughout, help students know approximately the number and timing of these, and provide a way for them to easily keep track of what is currently available in order to best support student planning.

2. Minimize the total number of rules per course; the more rules students need to keep track of, the more confused they will be, and the more time will be dedicated to keeping everyone apprised of the system.

3. Make sure that tools provided to support students' sense of progress in the course are able to support all aspects of the rule system implemented. Reconsider both tools and rules if the two are not compatible.

4. Minimize the number of systems involved, and ensure that data (due dates, requirements, etc.) is synchronized across all platforms.

Limitations

This study has a number of limitations. This is the first in a series of studies on assignment choice, and as such does not represent an exhaustive examination of all of the ways that choice can be implemented. In future work, we hope to examine how many more courses have done this. Students' open-ended responses provided insight into the course experience, but may not be representative of their experience throughout the whole course. Given that the survey was administered at the end of the semester it is likely that confusion regarding the course setup was underemphasized, while stress about final grades may have been overrepresented. This work took place within an R1 university setting, and our recommendations may not be generalizable to other contexts. We have used artifacts, including syllabi, LMS course shells, and student survey responses, to analyze these experiences, but have not been able

to take into account elements like instructor affect, students' social network within the class, or students' relative preparation for each course, all of which may have had significant effects.

Future Directions

We plan to continue to utilize our theoretical framework to analyze differences in the implementation of gameful design features by applying our conceptual framework to future classes that employ gameful design. By analyzing different implementations of assignment choice we can refine our theory of best practices for its implementation. With a larger number of courses to which to apply our framework, we will be able to make comparisons along comparatively less common gameful design elements such as assignment unlocks, leaderboards, and badges. In addition we hope to incorporate additional data sources, such as instructor interviews, that go beyond student self-report and course artifacts. These results provide a starting point in our own endeavor to categorize and operationalize the features of gameful design. We believe that this study can serve as a framework for further study of gameful course structures in context.

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