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Original Research

Exploring College Student Experiences in a Kinesiology Course Using a Gamified Grading System

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ABSTRACT

Educational Practices in Kinesiology 3(1): 44-62, 2023. Past findings indicate mixed results on the effectiveness of gamification in college courses. The use of a gamified version of specifications-based grading (e.g., gamified grading) is not yet well understood. The purpose of this two-part study was to understand students' perceptions of intrinsic motivation and engagement in a kinesiology course using gamified grading, facilitated by a gamified grading platform called GradeCraft©. The researchers used qualitative inquiry to capture a robust description of the student experience across a semester, identifying themes describing the course management (e.g., comparison with traditional course, individual approach), and the psychological experience (e.g., autonomy, stress). The following semester, the same research team surveyed students, finding an increase in competence and choice and decrease in pressure from the beginning of the term to the end. Findings suggest that students perceived GradeCraft© to promote intrinsic motivation, but only to a small degree and not without some initial stress due to the novelty associated with the gamified grading system.

KEY WORDS: Gamification, higher education, self-determination theory, motivation, engagement

INTRODUCTION

Across academic disciplines, instructors and scholars of teaching and learning have observed an increased need for strategies to engage students in coursework and enhance their motivation. This trend predates the COVID-19 pandemic (Zepke & Leach, 2010), but has accelerated as public health restrictions have lifted and the groundswell of online education continues (Bashir et al., 2021; McMurtrie, 2022). In response, college-level instructors have continued to design and deploy theory-driven, data-supported approaches to teaching, with particular emphasis on methods for assigning and grading student work. The purpose of this article is to highlight the experiences of kinesiology college students in a course that utilized a gamified grading system. First, the authors will lay out the challenges inherent within traditional course designs, in terms of motivation and engagement for a twenty-first century college student audience. Next, the authors will outline the supporting psychological theory that highlights aspects of courses that could enhance motivation and engagement. Then, the authors will review the literature on course design strategies that have

shown promise for improving intrinsic motivation. Following a review of the literature, the authors present their case study investigating the lived experience of a kinesiology student taking a gamified course. Finally, the authors share their follow-up quantitative study which examined pre- and post-measures of motivation and engagement in a gamified course.

Nature of the Problem

Although instructors in institutions of higher education (IHE) have adopted a wide array of course designs and methodologies, many share features that instructors might call "traditional" approaches to learning and assessment: instructors spend significant time lecturing, adopt a stance as an authority figure in relation to students and course materials, and deploy a predetermined sequence of assessments, usually culminating in a larger summative assessment. These assessments are pre-selected by the instructor, and (a) typically equate to 100% of the possible points, (b) must be completed for a chance to earn a 100% final grade, and (c) are graded against the instructor's perception of correctness and level of expertise. Thus, as each assignment is returned, it can become an occasion of loss. This increased demand on not losing points can shift the student's motivation to become outcome-oriented, eliciting a fear of failure, rather than creating an opportunity to try again and be successful on future assignments, or engendering a sense of accomplishment at earning acknowledgment for completed work (Ryan & Weinstein, 2009).

Self-Determination Theory in Higher Education

Self-determination theory (SDT; Ryan & Deci, 2000) offers a useful framework to understand motivation and engagement and considers the influence of varied social and cultural factors on students' experiences. Studies suggest that students benefit from the kind of intrinsic motivation that may be derived from satisfaction in gaining new knowledge and abilities, as well as the completion of self-determined goals (Jang et al., 2012; Reeve & Cheon, 2021). This work emanates from one of SDT's central components, the basic psychological needs theory (BPNT), in which well-being and optimal functioning are predicted by satisfying psychological needs.

The BPNT predicts students may engage more effectively when they take courses designed to satisfy one or more of three basic psychological needs: autonomy, competence, and relatedness. Relatedness is a sense of belonging in an environment and connectedness to others and may be achieved in a course when students learn through their own experiences, share those experiences with peers or community members, and connect to their instructor. Competence is the feeling of mastery, or ability to achieve mastery, over a task, and is therefore closely related to self-efficacy (Kremer et al., 2011). In a college-level course, students' sense of competence increases when the course provides them with opportunities to demonstrate mastery in a variety of modes, including multiple-choice questions, essays responses, and application projects. Lastly, autonomy is a sense of control over one's behavior. In traditional Western approaches to teaching, the instructor sets the sequence, timing, form, and content of assignments, but increasingly college-level courses have experimented with affording more choices to students to increase their sense of autonomy. Some might allow students to decide on test dates, while others might allow them to choose which assignments to complete, or with whom to work.

In an IHE context, when students' psychological needs are met, intrinsic motivation is likely higher (Jeno et al., 2021; Neufeld & Malin, 2020), and when psychological needs are not met, motivation is likely to become more external or diminish altogether. In a study of 137 university students enrolled

in an introductory organic chemistry course, Black and Deci (2000) investigated student perceptions of their instructors' autonomy support. Higher student perceptions of instructor autonomy support predicted students' self-regulation, perceived competence, and course interest (Black & Deci, 2000). More recently, Jang et al. (2016) found that 91 university students' preferred way of being taught, in a required educational psychology course, was through guest lectures, video clips, and whole-class discussions. When teachers used these preferred approaches, students rated their teachers as being more autonomously supportive. Students also reported feeling greater autonomy-need satisfaction and engagement with the course material as a result (Jang et al., 2016).

SDT Through Gamification

Recognizing that traditional grading schemes may thwart intrinsic motivation, instructors have implemented alternative grading mechanisms such as specifications-based grading or gamification (see Deterding et al., 2011; Leslie & Lundblom, 2020; Moya, 2021). Such approaches may lead to positive experiences with increased intrinsic motivation and course engagement (Jones et al., 2022; Nilson, 2015; Ryan & Weinstein, 2009). Gamification is "the use of game design elements in non-game context" (Deterding et al., 2011, p. 10), and invites students to see assessment elements as game-like in nature. Gamification often involves adopting one or more of the five game-design elements: game interface (e.g., leaderboard), game mechanics (e.g., limited resources), game principles (e.g., clear goals), game models (e.g., challenge), and game methods (e.g., play-centric design).

In a gamified grading system, students are rewarded for effort and accomplishment (Deterding et al., 2011; Enders & Kapp, 2013). Therefore, rather than working to maintain their desired grade or avoid loss outcomes, students work to earn enough points to reach their desired grade—directly addressing one of the primary concerns with need-thwarting features of traditional grading systems. Kapp (2012) identified gamification as a valid method for increasing engagement and promoting learning in education settings, primarily by leveraging the same basic needs that SDT recommends. Gamified grading aims to increase student autonomy and perceived competence (Aguilar et al., 2018). Aguilar et al. (2018) found that an undergraduate course using a theory-driven model of gamification resulted in an increase of (a) the total number of completed assignments and (b) the quality of the work submitted compared to the non-gamified course design.

To help students envision a wide field of play, a gamified grading design may include a large number of possible points, with grade-related thresholds set well below the grand total—for example, an "A" might represent 80,000 points, out of a total of 150,000 possible. To provide some structure for achieving specific learning goals in a gamified course design, some instructors have introduced additional thresholds to unlock specific grade levels, such as combining a point value (e.g., 80,000 points) with additional accomplishments (e.g., 5 learning goal badges). Most gameful grading experiences provide a sense of control over actions and some freedom to fail. For example, if students have choices about which assignments they will complete to earn badges, unlock levels, and accumulate points, they can take different "paths" to earn the same grade. One student may choose to complete more unit quizzes and earn less points per quiz, while another student might choose to complete unit exams, earning more points per exam. Another student may choose to

complete a smaller mixture of some quizzes and some exams, but also complete applied lab activities. With an abundance of possible points above the threshold for the highest letter grade in the class, students are encouraged to take risks. Should they not earn the intended points for the assignment, there are other opportunities available.

In practice, however, researchers have found mixed results on the measured outcomes of gamification in higher education settings (Aguilar et al., 2018; Hanus & Fox, 2015; Huang et al., 2018; Mekler et al., 2017). Despite strong evidence that gamification can have benefits, other researchers suggest that it could also thwart basic psychological needs (Dahlstrøm, 2003) by imposing an arbitrary game framework, or that the benefits over a traditional course design could be negligible (Mekler et al., 2017). Hanus and Fox's (2015) longitudinal study on the effects of a gamified classroom found that across four timepoints, students become less motivated, empowered, and satisfied compared to the non-gamified course. These researchers concluded the gamified course may have resulted in the game-like features increasing external motivation which decreased final exam scores. To date, then, the literature is inconsistent on what mechanisms and tools are best for implementing a theory-driven gamified grading scheme into undergraduate classes to maximize motivation and engagement outcomes and negate psychosocial need-thwarting—and further research in these directions is needed.

The GradeCraft© Tool

Adopting a gamified grading system can present logistical challenges for instructors, as well as extensive preparation time, so software developers have designed new applications to ease instructors' workload. GradeCraft© is one such platform for a gamified grading approach, a web-based tool designed by a team at the University of Michigan, which can be used by instructors independently or within a learning management system (LMS). The creators of GradeCraft© promote a self-determining framework to build motivating classroom experiences (Center for Academic Innovation, 2019). Their four key principles include (1) choice within the learning environment, (2) feedback via mechanisms such as rubrics, auto-graded quizzes, and peer-feedback, (3) freedom to fail, such as minimizing risks for students to choose assignments outside of their comfort zone, and (4) building up points from zero toward a self-selected target. GradeCraft© was designed specifically as a tool for delivering gameful pedagogy and includes (1) a point planner for students to set goals (and make changes as needed), (2) a leveling system for students to meet course-specific point thresholds to unlock grade levels, and (3) badges to recognize students' achievements in meeting learning goal expectations. By using these game-like features and following their four principles, this program claims to increase student autonomy, competence, and engagement with the course.

To our knowledge, other than one previous study (Jones et al., 2022), researchers in higher education have not published results demonstrating the role GradeCraft© may play in changing motivation and engagement across the course of a semester or tracking student experiences with using GradeCraft© in a course design with a gamified grading approach. Previously, our research team (Jones et al., 2022) explored the effects of gamified grading in a study comparing two sections of the same kinesiology course; one section used GradeCraft© (n = 24) while the other used a traditional grading design with a predetermined array of assignments leading to a cumulative grade based on a percentage of available points (n = 26). Intrinsic motivation (Ryan et al., 1991) and test anxiety (Nist & Diehl, 1990) was measured, and researchers found that students in the gamified

section showed an increase in perceptions of choice across the semester and reported increased competency. The traditional course reported decreases in competency over time. Anecdotally, student evaluations at the end of these courses often report positive experiences with GradeCraft©, yet the study's structure did not allow us to understand the mechanisms by which it may have changed motivation or engagement, or to make any causal attributions to the software. Further study was therefore needed, in order to better understand how the specific gamified grading system may influence motivation and course engagement.

Purpose and Aim

The purpose of the present investigation was to (a) holistically capture the lived experience of taking a gamified kinesiology course through a case study, and then (b) quantitatively observe motivation and engagement in three sections of the same kinesiology course using the same GradeCraft© tool. The results of these studies are based on an elective lower-division undergraduate kinesiology course at a large, research intensive (Carnegie R1) university in the U.S. Southeast. The authors first present the findings of the qualitative case study, which followed a student through a semester to capture how the student responded to the course design in real time. Based on the findings from that case study, the same research team designed a follow-up quantitative study, which measured changes in student motivation and engagement across a semester.

■ STUDY 1 METHODS

Participants

After receiving approval from then Institutional Review Board, the researchers recruited participants from an undergraduate course that used GradeCraft©. Students across three sections of an Introduction to Sport Psychology course were recruited to the semester long inquiry. This is a three credit-hour elective course typically taken by sophomores and juniors. Due to the COVID-19 pandemic, the course was offered online during the fall 2020 semester while students were experiencing many disruptions to their higher education experience. Two students consented, though only one participant completed the three interviews throughout the semester.

The consenting participant, pseudonym Emma, was a first-semester senior at the time she participated in the study. Emma was typically a high-performing student earning A's in a majority of her classes. Her instructor described her as motived, organized, and responsible. She initiated a course meeting with the instructor early on to ensure her success with the novel grading scheme.

Procedures

The study followed Ritchie and Lewis's (2003) approach to conducting longitudinal qualitative research studies, by using a panel design to investigate micro-levels of change. The goal of the longitudinal case study design was to describe (not quantify) the changes according to a student's perceptions of the gamified grading scheme throughout the semester. Given the single-course context and limited number of participants, a case study was deemed an appropriate method for understanding student experiences (Stake, 1995). Rather than asking the participant to recall her experiences with a gamified course once a semester had ended, the lead author conducted interviews to capture a student's feelings about the grading system at three timepoints during the semester. Timepoint 1 was in early September, two weeks after the syllabus had been delivered to

participants. Timepoint 2 occurred in late October, approximately halfway through the semester, and Timepoint 3 was in early December, a week before the final assignment opportunity. The researcher conducted semi-structured interviews, with a list of questions about the student's motivation, autonomy, and engagement with the course and assignments. This is the first time, to our knowledge, that researchers have used experiential data on motivation and engagement to explore the GradeCraft© grading system.

Statistical Analysis

Since the goal was to capture change across the semester, researchers used both deductive and inductive thematic analysis approaches to explore the data and identify how themes changed across the three timepoints. Braun and Clark's (2016) six-step guide to thematic analysis was used to analyze the dialogue collected. Step 1, data familiarization, was completed by the first two authors independently. Both authors read through the interview transcripts while taking notes and memoing initial reactions. The authors' initial memos indicated the student experienced some initial stress to the introduction of GradeCraft, though she appreciated the autonomy as she moved throughout the semester and gained understanding of the grading scheme.

Step 2, generate initial codes, was completed by the first two authors independently. Using a deductive approach, grounded in self-determination theory, the authors identified code words or phrases in the interviews. Codes such as "stress," "confusion," and "responsibility" were identified as ways the student spoke about her perceptions of the grading scheme. In the follow-up interviews, the first and second author identified codes for "engagement" and "autonomy" as the student began understanding the grading scheme and felt more confident in her plan.

In step 3, searching for themes, the authors formulated themes from their code list and used a deductive approach to identify themes in the first transcript (Timepoint 1). Themes such as "positive experiences," "initial impressions," "autonomy," "student approach to the course," "online learning," and "student general reflection" were proposed. Using an inductive approach, the authors then used their initial themes to search for changes and similarities in the Timepoint 2 and Timepoint 3 transcripts.

Step 4, review of themes, was completed together by the first two authors. Each author shared their identified themes, how the themes were defined, and the way the themes were represented across the three timepoints. Step 5, define and name themes, was also completed by both authors. Comparing notes from Step 4, the authors agreed on themes that best represented the data across the three timepoints, addressed the research question, and defined the final themes together. After Step 4 of the thematic analysis, the first and second author addressed elements of trustworthiness by incorporating a critical friend who had not been involved in data collection or analysis. The critical friend, our fourth author, was familiar with the research aim and corresponding literature on the topic. This author read through the transcripts and, using the themes provided, scanned for agreeability, theme representation accuracy, and unrepresented themes. These suggestions were considered in Step 5 as the first two authors finalized and defined the themes presented here. In step 6, the first author produced the report of the qualitative results presented here.

■ STUDY 1 RESULTS

The research team identified two main themes related to the student's experiences across the semester: Course Management and Psychological Experience. The results are presented by theme. Within each theme, results are presented by the timepoint in the semester to highlight how the experiences within that theme changed over time (see Table 1 and 2 below).

Course Management

The first theme, course management, included student experiences with the tools and strategy associated with moving through the course. This theme included elements associated with the GradeCraft© grading system, the syllabus, and the online nature of the course. Four subthemes were identified within the course management theme: comparisons with a traditional course, course strategy, GradeCraft© tool, and individual approach.

The first, comparisons with traditional courses, represented direct comparisons made between the gamified grading and traditionally graded courses. At Timepoint 1, Emma (a pseudonym) described the positive reactions she had to the introduction of the course structure: "I feel like I actually learn the content instead of just worrying about getting an A." In her other classes, which do not use GradeCraft©, Emma described working to maintain an A in the course. Using GradeCraft© in this course, allowed Emma to focus on the material and assignments, ultimately engaging better. By Timepoint 2, Emma indicated "it's kind of weird to think of myself as only having a B this late in the semester" as she compared her grade to the A she typically had by this point in a traditionally graded course. She then recognized that "it's weird, but I'm not worried" since she understood the grading scheme and knew what assignments she would continue to work on to earn an A by the end of the semester. At Timepoint 3, Emma indicated that she could use what she learned "to help me with my other classes in the future" as she recognized she could set goals and track her progress in other classes that do not use this specific course strategy.

The second subtheme, course strategy, included comments about the student's goals, how the student made decisions about her work in the course, and reflections on how the student perceived the instructor to make decisions about the course. At the beginning of the semester, Emma spent ample time planning her work for the course and indicated it to be of high importance. At Timepoint 2, Emma indicated her initial strategy for the course made her uneasy with her potential success on tests, saying, "I figured I would do well, but I was like, maybe not. So, I slated myself to get like a high B." However, after taking the first exam, Emma earned an A and realized she did not feel as pressured by the overwhelming number of assignments she could complete and focused on which assignments she wanted to complete. By the end of the semester, she observed that her course strategy was successful, and reflected, "I learned a lot."

The third subtheme, GradeCraft© tool, included comments specifically about using the GradeCraft© platform to monitor her assignments, grades, and end-of-semester grade prediction. At Timepoint 1, Emma expressed a positive reaction to using GradeCraft©. Later in the semester, at Timepoint 2, Emma indicated "I still really like it, especially with using the grade predictor." Emma utilized the grade predictor to adjust her plan as she needed. By Timepoint 3, Emma reflected on the flexibility of using GradeCraft© to plan her work and make adjustments as needed. She enjoyed this process

because "I could focus more on the class" rather than stressing over forced assignments and trying to maintain her desired grade.

The final subtheme, individual approach, includes the mentioning of how the course appeals to varying student strengths, approaches, or success strategies. At Timepoint 1, Emma recognized early on that the assignment choices varied in time demand and modality (e.g., multiple choice questions, open-ended questions, applied questions, lab activities, and so forth). Emma shared that "you can tailor it to pretty much every kind of student." At Timepoint 2, Emma described her experience with choosing the assignments that matched her personal approaches for success, such as "reading or skimming the textbook and then just taking notes," as she indicated she did not need to do all the assignments and homework activities that were offered since that did not suit her approach to learning best. By Timepoint 3, Emma reflected on the individual approach the class took in regard to choosing assignments to earn an individual's desired grade and reflected that "I think it works well for the type of student that I am," and that she was able to use the high-autonomy design to maximize her learning strengths, but recognized that not all students may have enjoyed the high level of autonomy provided in the course.

Table 1. Course Management Theme

Timepoint 1	Timepoint 2	Timepoint 3
Comparison with Traditional Course		
"I feel like I am actually learning instead of just worrying about getting an A."	"I feel like I am in a pretty good spot…Even though it's kind of weird to think of myself as like having a B this late in the semester."	"I'm going to try and kind of use this approach and what I've learned from it to help me with my other classes in the future. And hopefully it'll help me manage them better."
Course Strategy		
"I asked the instructor to help me create a schedule."	"The quizzes definitely help because, I mean, I still do them. I'm just not necessarily doing them for a grade. I mostly do them, so I can see the questions and test my knowledge, but without any pressure."	"I should end up with an A. I don't think there was really a way I can't now, and I think I learned a lot…so it's kind of exciting and cool."
GradeCraft© Tool		
"Trying to remember how many numbers I need for a badge. That is the only thing that is confusing."	"I still really like it…Especially using the grade predictor. You can kind of adjust as you need to go. I initially choose to do a bunch of quiz assignments…and then I realized I didn't even need to."	"I think it helped me throughout the semester because I could kind of modulate if I needed an easier week or a harder week. I could focus on sport psych."
Individual Approach		
"You can tailor it to pretty much every kind of student."	"Some people they need like more little homework assignments...And I just don't really need them."	"I'd say the biggest thing is I really liked this approach. I think it works well for the type of student that I am at least."

Psychological Experiences

The second theme, psychological experiences included the student's psychological reactions to and reflections about the course design. This theme included elements of need satisfaction (autonomy), and perceived behavioral control (differing from sense of ownership), as well as need-thwarting and negative experiences, which occurred early in the course experience. This theme includes three subthemes: autonomy, initial reactions, and stress.

The first subtheme, autonomy, represents the student's response to perceived autonomy at each timepoint in the semester. Responses relating to autonomy-supportive and autonomy-thwarting environments were included in this subtheme. At Timepoint 1, Emma recognized the increased autonomy the class provided, indicating, "You get to choose the grade you want and then earn it." At Timepoint 2, Emma more explicitly said, "I think I especially like the autonomy that it gives" when reviewing what she was enjoying about the course. Similarly, at Timepoint 3 Emma noted that the amount of autonomy provided by the course design "helped me a lot throughout the semester, because I could kind of modulate if I needed an easier week or harder week."

Within the second subtheme, initial reactions, the student reflected on the initial stress caused by experiencing a new course syllabus and grading scheme with which they were completely unfamiliar. Emma indicated, at Timepoint 1, that the course design "caught me off guard" as she had not seen a course with gamified grading prior to this course. However, the initial stress and confusion turned into feeling competent in planning her approach to the course and into enjoyment of the course strategy by Timepoint 2. Emma indicated "it makes more sense…especially after the first unit" by which she meant that Timepoint 1 was the only timepoint in which she'd experienced any adverse psychological reactions towards the course. Though there was a learning curve at first, Emma reflected, "for me, it was like, it took two seconds, I was like okay, I get it" as she thought back on the time it took for her to understand the course material now that the semester had concluded.

The final subtheme, stress, was defined by the initial stress reaction Emma had to the novelty of the grading scheme. At Timepoint 1, Emma attributed stress to "the lack of a schedule" but recognized that it might have been heightened by the overwhelming amount of online coursework she was taking due to the COVID-19 pandemic. Throughout the semester, stress was dissipated by excitement and satisfaction with the course. At Timepoint 2 Emma reflected that, "I'm not like having to like stress about other assignments," indicating a shift in feeling stressed about the course design to feeling less stressed than usual. By Timepoint 3 Emma indicated feeling confident in the projected final grade. Based on the initial class plan she designed with help from the instructor, Emma was able to reduce end of semester stress and indicated that "I planned to not have a lot of work left to do for this class at the end." Because she knew other classes would be busier at this point, she accounted for the end of semester stress felt by most other classes she was taking.

Table 2. Psychological Experiences Theme

Timepoint 1	Timepoint 2	Timepoint 3
Autonomy		
"I think it's a pretty personable way to take a class…I think it is cool that you get to choose the grade you want and then earn it."	"I like that I have control over my grade…I think the biggest thing has been like being able to choose my assignments…I think when you get to choose your path to your grade you are even just held more accountable by yourself…it gives you an extra reason to do your work."	"I think having so much autonomy over your grade and how you get the grade kind of forces you to be more responsible and more engaged with your assignments or your learning because you're the one that chose to do it."
Initial Reaction		
"It caught me off guard with the idea of choosing your assignments and not having to stick to a strict syllabus list."	"Especially after the first unit, I think it really clicked in my brain…I've got it all planed out."	"I think when I just initially looked at the class and maybe first started messing around with the grade predictor…it was confusing and honestly as second later like okay, I get it."
Stress		
"I think because all my classes were online I was like 'woah, what is this?'"	"I like that you build up to it instead of worrying about is this assignment going to drop my grade point."	"I can't think of anything that would really make it better…it was a really good setup and I really wish all my classes are like this."

■ STUDY 1 SUMMARY

Based on descriptions provided from the case study inquiry, the research team learned that the gamified grading scheme was perceived to be a less stressful approach compared to a traditional grading scheme, and the student sensed the increased autonomy provided by the gamified course design. In our previous study (Jones et al., 2022), a larger sample of students (N = 50) perceived high levels of autonomy at the beginning of the semester, but students in the gamified course rated significantly higher levels of autonomy at the end of the semester compared to the traditional course in the control. Though the initial introduction to the gamified course design at Timepoint 1 resulted in stress due to the novelty of the grading scheme, this subsided by Timepoint 2, as Emma shared feeling more competent as the semester went on—again aligning with quantitative trends the research team had previously found. Based on this case, the following semester the same research team conducted a second study.

■ STUDY 2 METHODS

Participants

Before starting any research related activities, researchers obtained ethics approval from the university Institutional Review Board. Sampling was purposive, because only a handful of instructors at the university had access to and used GradeCraft© in their course. Participants were recruited from a 200-level elective undergraduate kinesiology course in the spring semester (N = 97). This course is typically taken by sophomores and juniors. At the beginning of the semester, students completed a non-graded questionnaire evaluating the course design (specifically using a gamified grading system); all the students completed the survey as part of the course onboarding module. Similarly, at the end of the semester, students were asked to complete the same non-graded questionnaire to track changes in the measured variables. After the last exam concluded, students were invited to offer consent for researchers to access and deidentify course materials for research purposes. A total of 49 students (51%) granted consent.

Procedures

Based on our research team's previous work (Jones et al., 2022) and the qualitative Study 1 results, the instructor selected questionnaires to include in the pre- and post-semester course evaluation. Because Study 2 focused on intrinsic motivation outcomes encouraged by the gamified nature of the GradeCraft© platform, the researchers included the same Intrinsic Motivation Inventory (IMI) – Task Evaluation Questionnaire (Ryan, 1982) from our previous investigation (Jones et al., 2022). Additionally, because previous literature and the creators of GradeCraft© suggested gamified grading increases autonomy, the Self-Regulatory Questionnaire (SRQ) – Reasons for Learning (Black & Deci, 2000; Williams & Deci, 1996) was also included as an additional measure of autonomy and control. Measures of relatedness were not considered in this investigation, as this is not an integral feature of the GradeCraft© platform. Finally, as autonomy and engagement were mentioned and perceived during all three of the timepoints in Study 1 (see Table 1), the Student Engagement in Schools Questionnaire (SESQ) – Cognitive Subscale (Badiozaman et al., 2019) was used to measure mental engagement with the course material. The total battery of surveys included 46 total items.

Intrinsic Motivation Inventory – Task Evaluation Questionnaire

The Task Evaluation Questionnaire version of the IMI questionnaire (α = .85; McAuley et al., 1987) included 22 items and four subscales: enjoyment (*n* = 7), perceived choice (*n* = 5), perceived competence (*n* = 5), and pressure (*n* = 5). The enjoyment subscale is considered a subjective measure of intrinsic motivation. Perceived choice and perceived competence are theorized to positively predict intrinsic motivation. Pressure is theorized to negatively predict intrinsic motivation. Items were modified to represent the specific task being measured (e.g., "While I was working on the task…" changed to "While I was working on the work in this class…). Participants responded to each item on a 7-point Likert scale (1 = not true at all, 7 = very true). Items were scored by taking the averages of each subscale. Higher averages indicated feeling more enjoyment, choice, competence, or pressure from doing work in the class.

Self-Regulatory Questionnaire – Reasons for Learning

The SRQ – Reasons for Learning (Black & Deci, 2000) includes 12 items, and was used to assess autonomous regulation (*n* = 5; α = .80) and controlled regulation (*n* = 7; α = .75). Autonomous regulation accesses students perceived autonomy over their learning behaviors, while controlled regulation accesses students perceived control over their learning behaviors. Items were modified to represent the specific class (e.g., "I will participate actively in organic chemistry…" changed to "I will participate actively in sport psychology…"). Participants responded to each item on a 7-point Likert scale (1 = not true at all, 7 = very true). Items were scored by taking the averages of each subscale. Higher averages indicated feeling more autonomous or controlled.

Student Engagement in Schools Questionnaire – Cognitive

The SESQ (Lam & Jimerson, 2008) includes five subscales for measuring engagement: affective learning, affective school, behavioral effort, behavioral extracurriculars, and cognitive. Based on the definitions of each subscale, to best address our research aims of understanding engagement with course material the authors selected the cognitive subscale (α = .95), which included 12 items. Walker et al. (2006) defined cognitive engagement as a student's perceptions and beliefs associated with school and learning. Specifically, this subscale relates to the cognitive process a student brings to academic tasks. Participants responded to each item on a 5-point Likert scale (1 = not true at all, 5 = very true). Items were scored by taking an average of the subscale. Higher averages indicated higher levels of cognitive engagement with the class.

Statistical Analysis

Using Statistical Package for the Social Sciences (SPSS, Version 27), a paired samples t-test was used to examine pre- to post-semester differences for each subscale measured. Using G*Power 3.1 (Faul et al., 2009), an a priori power analysis for differences between two independent means (matched pairs) was conducted. To reach an adequately powered sample (α = .05, d = .90), 44 participants were needed to infer significance accurately. Pre-test data were collected shortly following students' independent review of the course syllabus in an introductory module on the course LMS. Post-test data were collected during the last week of the course once students had submitted all graded assignments. Cohen's *d* was used to measure the effect size of significant differences between pre- and post-test (small = .2, medium = .5, large = .8).

■ STUDY 2 RESULTS

Results are represented in Table 3. Perceived competence and perceived choice significantly increased from pre- to post-semester, while pressure decreased. Perceived enjoyment, autonomy-regulation, controlled-regulation, and cognitive engagement did not significantly change from pre- to post-semester.

Table 3. Pre- and Post-Semester Survey Results

Measure	Pre-Semester		Post-Semester		*t*(47)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
Enjoyment	5.30	0.86	5.18	1.21	0.78	.441	1.13
Pressure	3.59	1.01	2.65	1.18	5.03	<.001	1.30
Choice	4.67	0.93	5.27	1.10	-3.67	<.001	1.15
Competence	5.18	0.81	5.83	0.96	-4.24	<.001	1.06
Autonomy	6.39	0.65	6.13	0.94	1.71	.093	1.07
Control	4.78	0.99	4.59	0.93	1.30	.201	1.05
Engagement	4.27	0.54	4.21	0.57	0.65	.561	0.66

■ DISCUSSION

GradeCraft© was designed and is marketed to elicit specific SDT outcomes by supporting student autonomy and competence (Center for Academic Innovation, 2019), but the findings from the present studies indicated mixed initial reactions. Students' positive reactions suggest that the design does individuate learning, affording students a greater sense of autonomy and competence. These findings were similar to those of Nilson (2015) and Ryan and Weinstein (2009) who identified gamification was a way to enhance classroom experiences through increased intrinsic motivation and course engaging, individualized to each student. In the present study, students enjoyed that they were allowed to make a plan to earn the grade they wanted. Though the increased responsibility was perceived as positive, students also noted negative facets to the process, as they had never experienced a grading scheme like this. These mixed reactions are similar to those of other researchers who studied gamification in higher education (Aguilar et al., 2018; Hanus & Fox, 2015; Huang et al., 2018; Mekler et al., 2017) which suggested that gamification can have benefits but also motivation and engagement detriments as well. Specifically, psychological needs may be thwarted (Dahlstrøm, 2003), decreasing student motivation and engagement (Hanus & Fox, 2015). Contemporary advances within SDT have highlighted the role of "novelty" in intrinsically rewarding pursuits, noting that satisfying a need for novelty may very well be a fourth psychological need (González-Cutre et al., 2016; Stoa & Chu, 2020). However, the pursuit of a novel challenge or context must be autonomously selected and align with the other basic needs. When novelty is imposed upon an individual, this contextual element may thwart other needs (González-Cutre et al., 2016). In the present case, it is plausible that, at least initially, the novelty and uncertainty of this grading design thwarted these psychological needs and induced a stress response. It is also worth noting that novelty, itself, depends on and is constructed by the wider institutional context. In the United States IHE, a gamified grading scheme is still rare, so the "novelty load" is higher than it might be if students experienced more variety in grading methods throughout their degree trajectory.

As revealed in Study 1, the student grew more comfortable with the novel aspects of this grading scheme throughout the semester. Though initially caught off-guard with the course design, she evaluated the novel component of the course design positively. By the end of the semester, Emma shared her experiences were overall enjoyable and pleasant. Specifically, Emma was able to capitalize on the autonomous course design to choose how to demonstrate competence in ways that appropriately challenged her. In this course, she did this primarily through unit quizzes and exams. After Timepoint 1, she saw her efforts rewarded by points which raised her perceived competence to demonstrate mastery throughout the remaining of the course. These findings align with what was found by Aguilar et al (2018) when gamified grading led to an increase in the quality of the work submitted. Because Emma was afforded the opportunity to demonstrate mastery as she chose, when she chose to do an assignment, she did it well. She appreciated the course design, recognized the autonomous benefits, and explicitly indicated she wished more classes used this approach. Though other classes did not use this approach, she emphasized the autonomous nature of the course allowed her to plan ahead and put energy into the other courses that were less autonomous. She also felt she was successful in using GradeCraft© to help her achieve her desired grade and helped her be more successful in her non-gamified courses as well. Though this approach worked well for her, the authors realize that this is a single case and therefore it was assumed not all students would consider this a successful tool.

In Study 2, findings at pre-semester indicated higher levels of pressure, which the authors believe is due to the novelty of the grading scheme. Pressure, theorized as a negative measure of intrinsic motivation, and often related to fear of failure, would therefore decrease levels of intrinsic motivation early in the semester (Wang et al., 2019). Like Jones et al. (2022) measures of choice and competence, both perceived choice and perceived competence increased throughout the semester in this investigation as well, and both are theorized to be positive predictors of intrinsic motivation. Other positive measures, such as engagement and enjoyment, also increased across the duration of the semester, though not significantly. It is plausible that motivation and engagement were suppressed at the beginning of the semester due to the high level of perceived stress and pressure.

To the research team's surprise, fewer indicators of change in autonomy than expected, or than implied by the website that supports GradeCraft© (Center for Academic Innovation, 2021). While Aguilar et al. (2018) proposed gamification may increase autonomy and competence, others suggested gamification can thwart psychological needs instead (Dahlstrøm, 2003). Because the tool is marketed as grounded in SDT and purports to increase students' sense of autonomy, more evidence is needed to support these claims. Additionally, more evidence is needed on gamification to clarify if psychosocial needs are being met or thwarted in most cases when the course design is implemented. This also raises the question of whether the tool itself is needed to elicit these changes or whether an instructor can adopt similar methods for grading without licensing a tool or devoting time on a gameful course design, to elicit similar responses.

Both the qualitative (Timepoint 1) and quantitative findings noted a heightened report of pressure and worry at the beginning of the semester. However, the source of pressure is unclear. Though the student from the qualitative case study indicated the novelty being a source of stress for her, the authors cannot make a generalized conclusion that other students felt the same way, either from this single qualitative respondent from Study 1, or from the purposive sample of quantitative

responses in Study 2. Furthermore, Study 1 represents only a single student case, although qualitative methodologists have posited that a case study approach does assist in making meaning of qualitative data (Smith, 2017). Though the authors cannot statistically generalize our qualitative findings, they can use the qualitative data as evidence to support similar findings in our follow-up quantitative study. However, more qualitative research could explore a wider range of student experiences and perceptions of this course design. Future studies should (1) measure novelty as a potential fourth psychological need influencing intrinsic motivation at several timepoints in the semester and (2) further investigate the initial introduction of gamification by the instructor to the course to understand how students are being exposed to such a novel grading approach in a way that does not thwart other psychological needs.

Gamified grading may elicit increased levels of intrinsic motivation throughout the semester, though to what degree is still unclear. A longitudinal case study of one student's experience with an undergraduate course that used the GradeCraft© gamified grading tool demonstrated an overall autonomous experience that was positive for that student. One quantitative measure (IMI) suggested stronger increases in choice and competence over the course of the semester when using GradeCraft©, while another measure of autonomy, the Reasons for Learning Subscale of the SQR, suggested no change. In the current study, using a gamified grading tool did not increase student engagement with the course. Therefore, instructors may find some benefit in using GradeCraft© to increase potential for intrinsic motivation among students, though more consistent evidence is needed to support these claims.

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