

APPLYING GAMIFICATION TO UNDERGRADUATE ACCOUNTING
EDUCATION: A MIXED-METHODS STUDY

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ABSTRACT

By 2023, gamification was entering just about every sector and industry including education, fitness, crowd sourcing, social media, and corporate environments. Gamification often offers promises of motivation, engagement, fun, and even higher performance. At the time of the study, there were few studies that examined gamification in accounting higher education. Thus, the purpose of this mixed methods study was to understand the effect of badging (a gamification element) in an undergraduate accounting course. This study contributed to the literature by testing different badging merit systems while holding a classic feature of gamification fixed, namely the leaderboard. More specifically this research examined the effect of participation badges versus skill-based badges. The quantitative results found no significant differences in student motivation, behavioral engagement, and academic performance across the three groups even after controlling for pre-existing factors that are known to be associated with gamified learning experiences. Females experienced differential motivation and behavioral patterns between groups compared to males. Although motivation did not change significantly over the five-week period of the study, the findings around motivation may be of practical significance for sustaining student engagement since the study was implemented at a time when motivation and engagement normally dips during the semester. The qualitative results found varying levels of motivation and behavioral engagement. Some students enjoyed the feeling of being recognized for their efforts by the instructor while others did not see any value in badges. Overall, the gamification intervention had positive and negative outcomes reported. With two varying experiences, the average of those outcomes may have contributed to average, non-significant quantitative results for the gamification intervention. Findings indicate that badging may not be as impactful on motivation, behavioral engagement, and academic performance of students in an introductory accounting course.

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CHAPTER 1. INTRODUCTION

With the waning of the COVID-19 pandemic, more universities have resumed normal operations with variations of masking and vaccination requirements (Knox, 2023). As educational systems recover, student engagement concerns are one of the biggest challenges instructors face today according to Inside Higher Ed (Alonso, 2023) and Harvard business publishing (2022). The Chronicle for Higher Education (2022) defines the state of engagement as a student-disengagement crisis with professors reporting a lack of student motivation as students struggle to complete assignments and while class attendance plummets (Williams, 2022). More than half of the 5,256 students surveyed by Wiley (2022) reported that they are having trouble engaging in class and retaining information. Two-thirds of the 2,452 instructors surveyed in higher education reported that keeping students engaged is a problem (Wiley, 2022).

The Harvard Business Publishing (2022) reports students have experienced mental health challenges and the feeling of being overwhelmed. Suggestions to help the problem include creating active learning experiences that nurture engagement. Shabeeb et al. (2022) reported that accounting students experienced less satisfaction, motivation, and support/feedback within the COVID-19 pandemic compared to before the pandemic. Sangster et al. (2020) provided insights of accounting education from 45 countries about how COVID-19 has affected students and educators. After experiencing technological issues, changes to learning delivery, and stressful learning environments, Sangster and colleagues offer suggestions to enhance the quality of accounting education in a post-COVID world. One suggestion given was the use of technology to present novel types of learning activities for students to engage in deeper learning.

A method of engagement that has gained attention is gamification, or the use of game elements in a non-game context (Chugh & Turnbull, 2023; Irwanto et al., 2023; Murillo-Zamorano et al., 2023; Oliveira et al., 2023). Gamification and more specifically badges and leaderboards have been a trending topic to boost engagement and enhance user activity (Abadi et al., 2022; Chugh & Turnbull, 2023; Tahir et al., 2022). Understanding if gamification and more specifically badging and leaderboards really work, and who they work for, is a practical and relevant issue for educators to make wise decisions when delivering content. This study focused on the gamification elements of badges and leaderboards within an undergraduate accounting course in a traditional-learning environment context.

Statement of the Problem

Though the research behind gamification is generally positive (Abadi et al., 2022; Kim & Castelli, 2021; Ortega-Arranz et al., 2019), the research behind the use of badging within higher education contexts is applied heterogeneously (e.g., Abadi et al., 2022; Chugh & Turnbull, 2023; Oliveira et al., 2023; Tahir et al., 2022). Additionally, gamification has been applied in many small-scale educational contexts with insufficient statistical evidence especially regarding learning performance (e.g., Díaz-Ramírez, 2020; Kyewski & Krämer, 2018; Van Roy & Zaman, 2018). As such, the best-practices for the most effective use of implementing badges are still being compiled (Fanfarelli & McDaniel, 2017; Ortega-Arranz et al., 2019). Student engagement is often recognized as having an important role in learning and achievement in higher education (Kahu, 2013; Quintero et al., 2022; Tahir et al., 2022). Student engagement has multiple benefits including improving student performance in courses, increasing student satisfaction, reducing sense of isolation, and enhancing student motivation (Martin & Bolliger, 2018). With the negative impact on behavioral, emotional, and cognitive engagement as a result of the COVID-19 disruption, it is increasingly relevant to see if the use of badges in class can have a positive impact on motivation, behavioral engagement, and academic performance, to better serve higher-education students (Alonso, 2023; Daniels et al., 2021; Salta et al., 2021). According to Fredricks et al., (2004) behavioral engagement can be defined in three ways: positive conduct (adhering to the classroom norms, avoiding school absences, and following the rules), involvement in academic and learning tasks (concentration, contribution to class discussion, effort, persistence), and school-related activity participation (e.g., school governance or athletics). This study focused on one of the three ways that behavioral engagement is defined by Fredricks et al., (2004), which is the participation and involvement in learning and academic tasks.

Some previous studies have awarded both participation and skill-based badges in tandem within a course setting making it difficult to see if there are differences between the type of badge (skill-based and participation-based) (Kyewski & Krämer, 2018; Ortega-Arranz et al., 2019; Tahir et al., 2022). Different from previous works, this study looked at differences between participation and skill-based badges while controlling for covariate game preferences and cumulative GPA in accounting education. Although some gamification studies have presented descriptive demographic data , including gender, few quantitative analyses have been

performed to see if there are statistical differences between genders (Putz et al., 2020; Rincon-Flores et al., 2022; Sanchez et al., 2020). This study looked at differences between genders.

This study was guided by self-determination theory. Self-determination theory (SDT) is a theory that identified three basic human needs for social development, social well-being, and self-regulation (Ryan & Deci, 2000). The three basic needs for social development include competence, relatedness, and autonomy. With these three needs satisfied, an individual is more likely to be intrinsically motivated within a specific task. Ryan and Deci (2000) have identified other aspects of motivation including extrinsic motivation that is regulated by an external force and even amotivation, which is a lack of motivation. Alternatively, extrinsic motivation that is aligned with the individual's values is defined by Ryan and Deci (2000) as "integrated extrinsic motivation". This type of motivation can still have positive academic outcomes although tasks are initiated outside of the individual. More information about self-determination theory will be described in the literature review.

Purpose

This mixed methods study investigated badging as a gamification element within an undergraduate accounting course. A concurrent, embedded mixed methods design was used. The primary purpose of this study was to use the Situational Motivation Survey and learning analytics to test the self-determination theory. Self-determination theory predicts that adding autonomy and a sense of competence and relatedness will positively influence motivation (Deci & Ryan, 2008), which could lead to positive outcomes in behavioral engagement and academic performance. By using the game element of badging as a measure of achievement (Bai et al., 2020; Rincon-Flores et al., 2022), students can feel competent as they achieve success and overcome challenges (Abadi et al., 2022; Baard et al., 2004). Having optimal challenges drives a desire for exploration that is inherent to the individual and is described as intrinsic motivation (Ryan & Deci, 2000). It has been suggested the game element of leaderboards in a gamified environment highlights the social element of relatedness (Alsawaier, 2018; Bai et al., 2020; Rincon-Flores et al., 2022). Students who experience autonomy within an educational context have volition and choice-making in pursuing their learning (Alsawaier, 2018; Bai et al., 2020). Additionally, students may take more responsibility for their own actions (Alsawaier, 2018). Optional assignments could give students this autonomy. Deci and Ryan (2008) state the benefits

of having all three basic psychological needs (autonomy, competence, and relatedness) of self-determination theory present within a learning context. They state: “considerable research has found interpersonal contexts that facilitate satisfaction of the basic psychological needs for competence, autonomy and relatedness to enhance autonomous motivation, which comprises intrinsic motivation and well-internalized extrinsic motivation” (Deci & Ryan, 2008, p.14). This study examined motivation, behavioral engagement, and academic performance within the demographics of gender in an undergraduate introductory accounting course. This study used a quasi-experimental design with one control group, one experimental group with participation badges, and one experimental group with skill-based badges for the quantitative portion. All three groups had a leaderboard. The control group controlled for leaderboards while the researcher focused on differences (if any) between the type of badge (participation-based vs. skill-based badge). The researcher paired badges and leaderboards together in the experimental group, because they are the most used gamification elements besides points, levels, and progress bars (Dichev & Dicheva, 2017; Klock et al., 2020; Tahir et al., 2022). Arguably, these two gamification elements have had the most success with motivation and behavioral gains (Haruna et al., 2018; Ortega-Arranz et al., 2019; Rodrigues et al., 2022). Since students often want more gamification elements than just an individual element and in consideration of faculty workload, the researcher paired badges with leaderboards. Leaderboards were based on a point system by counting the number of participations, but points as an applied, individual gamification element was not utilized. Additionally, since students could earn points based on their normal grades in the course, the researcher excluded the gamification element of points for the purposes of the study. Additionally, qualitative focus group data was gathered from the students in the two intervention groups to explore student experiences of the badging intervention.

Research Questions

This study used the Situational Motivation Survey (SIMS) and learning analytics during a badges and leaderboard intervention to test the self-determination theory. The research questions attempted to address some of the gaps in the literature that were presented in the statement of the problem. The following quantitative and qualitative questions guided this study.

Q1: Is there a difference in motivation, behavioral engagement, and academic performance between students who were in the control group and the badging experimental groups (participation-based or skills-based badge intervention). (QT)

Q2: Are differences in motivation, behavioral engagement, and academic performance moderated by gender? (QT)

Q3: How do students in the experimental groups (participation-based badges, skill-based badges), perceive that the badging intervention influenced their motivation, behavioral engagement, and academic performance? (QL)

Q4: How do students with different genders perceive that badging influenced their motivation, behavioral engagement, and academic performance? (QL)

The hypothesis of this study was that badges have an impact on student motivation, behavioral engagement, and academic performance. In findings from studies such as Ortega-Arranz et al., (2019), Rodrigues et al. (2022), and Sanchez et al., (2020) suggest that badges can promote behavioral engagement. Haruna et al. (2018) and Legaki et al. (2020) found that significant gains were made in academic performance in a gamified classroom. Zhan et al., (2022) noted that gamification had the largest effect on the outcome of motivation. Other positive outcomes of gamification have emphasized the effect size of gamification interventions across the literature. Huang et al., (2020) in a meta-analysis of 30 gamification studies confirm that gamification in educational studies has produced mixed results but overall, the gamification condition has produced a small to medium effect size, with $g=.464$ in favor of the gamification condition. When examining the variable of gender, some studies have found no differences in gender in terms of retention (Sanchez et al., 2020) or motivation (Rincon-Flores et al., 2022), while others have found differences in gender in terms of academic performance (Legaki et al., 2020; Rodrigues et al., 2022) and types of motivation (Polo-Peña et al., 2021). Furthermore, the purpose of this research study was to help understand more about implementing badging (participation-based and skill-based) and leaderboards in undergraduate courses.

Significance of the Study

Understanding more about badging and leaderboards within an undergraduate classroom can be helpful for instructors to see the possible benefits of utilizing gamification elements.

Using mixed-method research provided a more comprehensive approach to answer the research

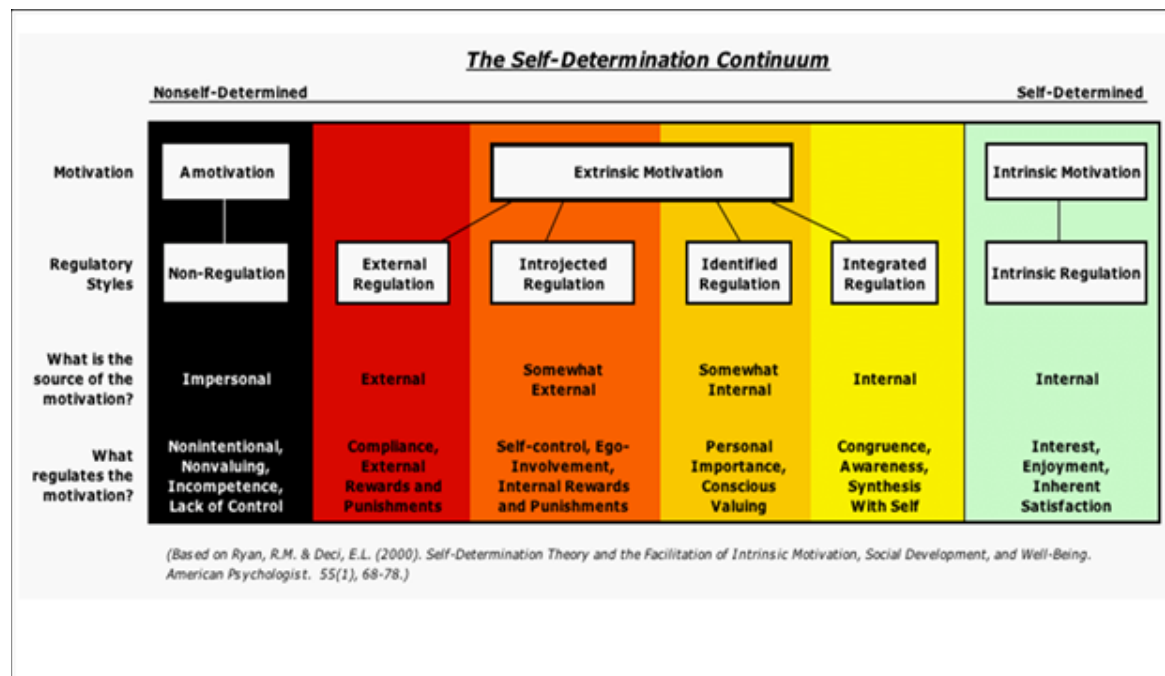
questions and to overcome the short-comings of quantitative and qualitative research (Creamer, 2018). The implications for students are that with the adoption of more gamified technology, there may be increases in learning and learning outcomes. The implications for educators include alternate ways to deliver materials that make class more engaging or fun. The implications for decision-makers are that empirical studies could give insight on the benefits of gamification. These benefits could influence budgeting decisions to support gamified courses, even with the high-cost barriers to entry (Accredible, n.d.-a). The implications for instructional designers could be a better understanding of how to use current and emerging technologies to implement gamification interventions, more strategies for creating compelling course material/content, and engaging learning activities within gamified learning environments for feedback and learner assessment.

Conceptual Framework

The framework of this study was based on self-determination theory (Deci & Ryan, 1985). Self-determination theory is a broad framework of motivation that proposes the degree of support or lack of support within three needs, autonomy, competence, and relatedness, have an impact on well-being within a setting. Competence is the perceived extent of one's own actions as the cause of desired consequences in one's environment; autonomy is the need for people to experience their behaviors as self-determined; and relatedness is the need for people to feel close to others (Mekler et al., 2017). The intrinsically motivating nature of digital games has been attributed to their ability to modify the environment and their potential to satisfy the psychological needs for autonomy, competence, and relatedness (Abadi et al., 2022; Sailer et al., 2017). A quantitative perception survey (SIMS survey) captured students' levels of motivation (from amotivation to intrinsic motivation). Figure 1.1 reflects the self-determination continuum.

Figure 1.1

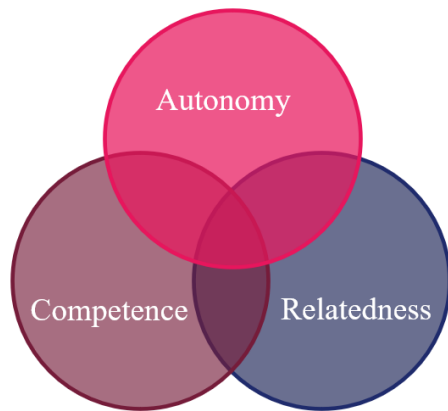
The Self-determination Continuum



Qualitative focus groups helped to understand how the gamified intervention influenced students in terms of the three basic psychosocial needs of autonomy, competence, and relatedness. The intrinsically motivating nature of digital games has been attributed to their potential to satisfy the psychological needs for autonomy, competence and relatedness (Sailer et al., 2017). Figure 1.2 represents the basic psychological needs of autonomy, competence and relatedness. Autonomy: Students who experience autonomy within an educational context have volition and choice-making in pursuing their learning (Alsawaier, 2018; Bai et al., 2020; Sailer et al., 2017), alternate activities are selected to fulfill the need of autonomy (Seaborn & Fels, 2015). Competence: As individuals achieve optimally challenging tasks and achieve success, they can feel competent students can feel competent in the task or activity (Baard et al., 2004). Relatedness: Leaderboard can highlight the social element of relatedness (Alsawaier, 2018).

Figure 1.2

The Three Basic Psychological Needs of Self-determination Theory (Deci & Ryan, 1985)



Relatedness: the need for people to feel close to others (leaderboards)

Competence: the perceived extent of one's own actions (assessments to earn badges and for leaderboard rank)

Autonomy: the need for people to experience their behaviors as self-determined (optional assignments)

Abadi et al. (2022), Bai et al. (2020), Rincon-Flores et al., (2022), and Seaborn and Fels (2015) link the gamification element of positive feedback to the basic need of competence. This study used assessments through optional quizzes to earn badges to satisfy the need of competence. A leaderboard was created based on the number of optional quizzes that the student completed for the control group. Leaderboards were created based on badges awarded for the experimental groups to satisfy the need of relatedness.

Summary of Methodology

The study used an embedded or nested, mixed-method study to measure the effect of badges on motivation, behavioral engagement, and academic performance of students in an undergraduate accounting course. Embedded designs can be conducted either sequentially or concurrently (Creamer, 2018). For this study, the data sets were collected concurrently or at approximately the same time. Mixed methods research is defined as a method of research that includes both a qualitative and quantitative strand that are mixed at some point in the study (Creswell et al., 2003). The rationale for using a mixed methods approach was to understand if the badging intervention had an impact on outcomes as well as the process and experience of the badging intervention. Mixing can happen in the phases of designing the research questions, data collection, sampling, analysis, interpretations/conclusion or in reporting (Creamer, 2018). This study mixed quantitative and qualitative data in the analysis, interpretation, conclusion, and reporting phase. A quasi-experimental research design was used to gather quantitative data while focus groups were used to gather qualitative data. A true experimental study was not feasible as

students were free to register for classes based on their time and schedule preferences. The researcher had no control over which section students enrolled in.

The participants were undergraduate students who participated in a traditionally delivered course at a postsecondary institution. The researcher gained access to the participants during the Fall 2022 semester and the Spring semester 2023. During the fifth week of the semester, the researcher distributed a Qualtrics survey to measure motivation. Additionally, the researcher asked students to provide demographic information of gender, cumulative GPA, and their preferences and experiences with video games as well as their perceptions about learning opportunities and video games. During the intervention, the researcher collected LMS data analytics on participation, activity time, and page views. At the end of the intervention, the researcher administered the SIMS survey to measure motivation again.

The researcher invited students for a focus group using semi-structured focus groups based on purposive sampling by gender from both experimental groups. The data collected from the survey, data analytics, and focus groups were analyzed and written-up. These processes are described more fully in Chapter 3.

Role of the Researcher

The role of the researcher was as an educator with interest in studying student motivation and engagement. The researcher took the accounting course as a student in an undergraduate accounting degree, but during this study, was an assistant professor in the same accounting program. The researcher was a subject matter expert in financial accounting and was a CPA with a master's degree in business administration. The researcher had over five years of teaching experience in teaching fundamental, core accounting courses. The researcher approached students as a doctoral candidate and as their instructor which may have led to bias and socially desirable responses from students. The researcher addressed potential bias by using reflexivity and journaling their thoughts throughout the qualitative data analysis. Reflexivity helps the researcher reflect on their experiences, perspectives and aspects of power dimensions (Ary et al., 2019). Moreover, reflexivity is one of the most common strategies to enhance rigor in qualitative studies (Ary et al., 2019). Other strategies for maintaining validity and reliability are discussed further in Chapter 3.

Limitations

This research study was not without limitations. Although cumulative GPA was controlled for by using a two-way MANCOVA analysis, quasi-experimental designs do not provide full control over the study as students are not randomly assigned to treatment groups (Ary et al., 2019). Additionally, student motivations may be solely driven by academic performance and may not be fully captured by self-report inventory questionnaires. Furthermore, students received extra credit incentives to fill out questionnaires, which could lead to selection bias and an unwillingness to give candid answers, while giving the most socially desirable responses (Ary et al., 2019). Moreover, the sample size was small for each group, leading to limited generalizability to a broader context or external validity (Zohrabi, 2013). Focus groups were conducted by a trained interviewer and coordinated based on the willingness of invited volunteer participants which may have biased the qualitative data. An additional research limitation included potential researcher bias in terms of reliability, as the researcher was both the co-investigator and instructor of the gamified course (Zohrabi, 2013).

Definition of Key Terms

Badge. Badges are a representation of achievement or a mark of completing a task, oftentimes a complex task (Almeida et al., 2023). Badges can be a mark of appreciation and recognition during a goal achievement process (Nah et al., 2014).

Behavioral Engagement. Involvement in academic and learning tasks and includes behaviors such as persistence and effort (Fredricks et al., 2004).

Gamification. The use of game elements in non-game contexts (Deterding et al., 2011).

Leaderboard. A public ranking based on achievements/items in a game or scores. Leaderboards increase competition and can affect how a player behaves (Almeida et al., 2023).

Motivation. Motivation deals with intention and the orientation of one's motives. An intention is defined as something that involves "the desire to attain some future state along with a means to attain that desired end" (Ryan & Deci, 2000, p.3).

Traditional learning. A well-established educational delivery method which includes face-to-face instruction, communal learning, organic student-teacher bonding and pre/post class discussions (Paul & Jefferson, 2019).

Self-determination theory. Self-determination theory is a broad framework of motivation that proposes the degree of support or lack of support within three needs, autonomy, competence, and relatedness, will have an impact on well-being within a setting (Deci & Ryan, 1985).

Summary

Engaging and motivating students is an especially relevant topic with the recent negative impact that the COVID-19 pandemic had on learning. Educators and instructional designers in higher education need relevant and reliable information on the latest technologies that could be implemented in order to aid with motivation, behavioral engagement, and academic performance. More research on the benefits of gamification could lead decision-makers to invest more in gamified software. The purpose of this research paper was to understand more about implementing badging (participation-based and skill-based) within an undergraduate course. Moreover, this study examined different groups by gender.

The best practices of gamification are still being identified and this study sheds light on how applying gamification can impact student motivation, behavioral engagement, and academic performance. This dissertation is organized as follows: Chapter 2 is a review of the literature, Chapter 3 covers the methods of the study, Chapter 4 is the analysis and Chapter 5 the discussion and concluding chapter.

CHAPTER 2. REVIEW OF LITERATURE

Introduction

With the end of the COVID-19 pandemic, more universities have resumed normal operations with variations of masking and vaccination requirements (Knox, 2023). As educational systems recover, student engagement concerns are one of the biggest challenges instructors face today according to Inside Higher Ed (Alonso, 2023) and Harvard business publishing (2022). Student engagement can be defined within behavioral, emotional, and cognitive constructs (Appleton et al., 2008). All three of these student engagement constructs have been negatively affected from the COVID-19 pandemic (Salta et al., 2021; Wester et al., 2021). Moreover, student self-reported perceptions of motivation and engagement have also decreased (Daniels et al., 2021; Wiley, 2022). Students who are motivated and complete self-determined actions produce higher quality behavior (Deci & Ryan, 1994). Self-determined actions and higher quality behavior has been linked to self-regulation, achievement, time on task, and striving for assimilation and mastery of material (Deci & Ryan, 1994). Some have argued that traditional methods may not be enough to fulfill an absence of student motivation (Zainuddin et al., 2020).

Educators are continuously seeking novel instructional approaches to solve this problem (Abadi et al., 2023; Kim & Castelli, 2021). Gamification often makes learning more fun and engaging (Kapp et al., 2014; Legaki et al., 2020). A trending topic to boost and reinforce student motivation, engagement, interest, and user activity is gamification (Abadi et al., 2022; Chugh & Turnbull, 2023; Tahir et al., 2022). Gamification is defined as the use of game design elements in non-game contexts to support users' overall value creation and afford a gameful experience (Albertazzi et al., 2019). Badges, one of the most popular mechanics of gamification, are digital symbols that visibly recognize learner effort, skill or interest, credentials, capabilities, and/or educational achievements (Grijalvo et al., 2022). Leaderboards, another popular mechanic of gamification, are public rankings that create a sense of eagerness or competitiveness (Ntokos, 2019; Rincon-Flores et al., 2022).

Understanding if gamification and more specifically badging and leaderboards really work, and who they work for, is a practical and relevant issue for educators to make wise decisions when delivering content. The research behind the use of badging within higher education contexts is applied heterogeneously (e.g., Abadi et al., 2022; Chugh & Turnbull, 2023;

Oliveira et al., 2023; Tahir et al., 2022) leaving unclear results. Additionally, gamification has been applied in many small-scale educational contexts with insufficient statistical evidence especially regarding learning performance (e.g., Díaz-Ramírez, 2020; Kyewski & Krämer, 2018; Van Roy & Zaman, 2018). Huang et al., (2020) in a meta-analysis of 30 gamification studies confirm that gamification in educational studies has produced mixed results. Abadi et al. (2022) did a meta-analysis of the pros and cons of gamification. Pros included engagement, feedback collaboration and motivation, cons included lack of retention, expensive interventions, cheating, and trouble retaining information. To gain more understanding of this relevant issue, this literature review will examine gamification as a whole, along with the history, definition and uses of badges and leaderboards. Moreover, this literature review will examine the logistics of a badging and leaderboard intervention, as well as the educational affordances and the limitations of badging intervention research.

Gamification

This section will give an overview of the history and definition of gamification. Additionally, it will outline the major game mechanics as well as settings where gamification has been implemented. Finally, this section will describe how gamification has been used within Post-Secondary Education.

History and Definition of Gamification

The term gamification was coined in 2010 when conferences and major industry players popularized the term (Hanus & Fox, 2015). Gamification is the use of game design elements in non-game contexts to support users' overall value creation and afford a gameful experience (Albertazzi et al., 2019; Deterding et al., 2011). Gamification has gained widespread usage since 2010 but more than a decade later, gamification does not have universal adoption, integration, or acceptance (Kapp et al., 2014). Kapp et al. (2014) defines gamification as “using game-based mechanics, aesthetics, and game-thinking to engage people, motivate action, promote learning and solve problems” (p.54). Specific definitions of gamification applied to educational contexts have also been created. Caponetto et al. (2014) described gamification applied to education as the introduction of game design elements in the design of the learning processes. Gamification is a way to support learning in a variety of subject areas and contexts to address activities, attitudes, and to induce desired behaviors (Caponetto et al., 2014). Although recent studies have used the word gamification in the title of their research paper, further investigation has noted that the

authors are likely referring to Game-Based Learning as they implemented fully-fledged games such as Chess, MahJong, Spot the Difference, or Jigsaw Puzzles within educational contexts (Anunpattana et al., 2021; Han et al., 2021).

To clarify, gamification is typically defined as the implemented with the intention to engage and motivate learners (Díaz-Ramírez, 2020; Jagušt et al., 2018; Rachels & Rockinson-Szapkiw, 2018). There are two defined types of gamification including content gamification and structural gamification. Content gamification applies game thinking and game elements to alter course specific content to make it more game-like (Kapp et al., 2014). Examples of content gamification can be listing challenges for learners instead of learning objectives or adding story elements to compliance training courses (Kapp et al., 2014). Structural gamification includes not changing any of the content of the course but changing the structure of the course (O’Sullivan et al., 2021). Structural gamification adds game elements such as points, badges, and leaderboards to boost the learner through content. Other types of structural gamification include role-playing games. Structural gamification takes on a varied scope in education; for example, a teacher could gamify a teaching scenario, micro lecture, or an assessment activity by adding choice, reward, challenge, or story lines (Ntokos, 2019). This tactic is used to engage and motivate learners through a process by issuing rewards. Both types of gamifications can be utilized in a single course and when used together, the two gamification types often create a more impactful interactive learning environment (Kapp et al., 2014).

Game Mechanics

Game mechanics are rewards or feedback that are given based on behaviors. These incentives are mechanisms, principles, or rules of a gamified environment (Abadi et al., 2022; Grijalvo et al., 2022). Gamification mechanics or elements include things such as leaderboards, points, badges/achievements, themes/stories, levels, and challenges (Almeida et al., 2023). See the definition of many of the common game mechanics below.

Avatars and Customization.

Avatars include the use of virtual characters that are an individual’s choice in the gamified environment (Almeida et al., 2023). Customization allows players to tailor their experience and their systems’ settings (Huang et al., 2020).

Badges.

Badges are a representation of achievement or a mark of completing a task, oftentimes a complex task (Almeida et al., 2023). Badges can be a mark of appreciation and recognition during a goal achievement process (Nah et al., 2014).

Countdowns.

Countdowns can be used to pressurize learning or provide tension in order to make learning activities more meaningful (Ntokos, 2019).

Leaderboards.

A public ranking based on achievements/items in a game or scores. Leaderboards increase competition and can affect how a player behaves (Almeida et al., 2023).

Points and Levels.

Points as well as levels/stages serve as an indicator of achievement or success (Nah et al., 2014). Both gamification elements can be used for progression to goals, while points can be used for rewards, or towards credits in an academic environment.

Performance Graphs.

Performance graphs are displayed within the gamified system and are a visual performance of the individuals' performance or the learners progress (Huang et al., 2020).

Prizes and Rewards.

Prizes and rewards have been found to motivate learners if given multiple, small rewards that are distributed evenly over a timeframe. Examples of prizes and rewards include giving character upgrades of virtual characters or using imaginary currencies (Ntokos, 2019).

Progress Bars.

Progress bars are used to show, visualize, and track overall progression of a goal (Denden et al., 2021). Progress bars can motivate individuals who are falling behind while still motivating other individuals who are close to achieving a goal to complete the goal (Kapp et al., 2014). Progress bars can show students the total points that they have earned in comparison to the possible points earned on a quiz or assessment (Sanchez et al., 2020). Sanchez et al. (2020) found that students who were within a gamified course that included multiple-attempt quizzes (with progress bars) retook the quiz significantly fewer times compared to their non-gamified counterparts.

Challenges, Quests, or Missions.

Challenges are situations that require effort from the user to be completed such as a boss battle (Klock et al., 2020).

Storylines.

Storylines refer to the story or narrative in the game that can help students achieve interest. Interest normally peaks around the beginning and ending of the gamified storyline process. Storyline provides problem solving and contexts for learning to illustrate real-life concepts and how content is applied in the real-world. Storylines have been one of the least studied game mechanics (Bai et al., 2020; Howard & Bevins, 2018).

Number of Gamification Components Used in an Intervention

Groening and Binnewies (2021) found that adding more gamification elements into a course, especially having three gamification elements, enabled participants to engage with tasks for longer time periods, maintain motivation, and increase performance on cognitive learning tasks. In recent literature, some of the negative and mixed results reported from gamification have focused on limited features of gamification and often have failed to give participants a choice on which gamification options to try. Additionally, studies that engaged learners with limited game features reported that students would ask for more elements of gamification (Papastergiou, 2009 as cited in Alsawaier, 2018). Rodrigues et al. (2023) note that the most commonly used combination of gamification elements are points, badges, and leaderboards – sometimes refer to as PBL. “The majority of gamification studies feature a subset of the following game elements: points, badges, levels, leaderboards and progress bars” (Dichev & Dicheva, 2017, p. 10). Additionally, Dichev and Dicheva (2015) note that PBL are often the easiest to implement within a classroom setting and somewhat mimic the traditional classroom assessment model. Since students often want more gamification elements than just an individual element and in consideration with regards to faculty workload, the researcher will pair badges with leaderboards.

Denden et al., (2021) and Schöbel et al., (2020) argue that gamification elements should align with the three basic psychological needs of relatedness, competence and autonomy as outlined in self-determination theory (SDT), but multiple features need to be utilized. Employing limited gamification features within a course setting may not produce a measurable or desirable effect. The studied course already had points associated with letter grades and as such, this study

implemented badges and leaderboards. The number of gamification components used in this research paper were the two components of: badges and leaderboards.

Settings where Gamification has Been Implemented

Gamification is becoming more popular as software programs enable the building of simple games in an easy and timely fashion (Kapp et al., 2014). A trend stated by Kapp et al. (2014) is that the average age of individuals who play video games is getting older (Alsawaier, 2018; Clement, 2022) and as these individuals get older and gain management positions within organizations, the stigma of games in academic environments, non-profits, the government and in corporations is waning. With less stigma about the usage of games and gamification in educational settings, games and gamification are becoming more ubiquitous in educational contexts and in our daily lives (Kapp et al., 2014).

Gamification can be found in various environments. In the corporate environment, gamification was found to have positive effects on learner engagement, attention and participation, and minimized the gap between high and low scoring learners when elements like points, badges, and leaderboards were in place (Armstrong & Landers, 2018). The increasing use of gamification elements, especially badges and leaderboards, are especially prevalent in the fitness industry (Allison, 2023; Peloton Member Tips, n.d.). Badges are achieved for exercising based on the number of days exercise goals are completed, when challenges are completed, when new exercises are completed or when previous personal records are surpassed. Leaderboards are often connected with fitness competitions between friends or certain groups (Peloton Support, n.d.). With more industries adopting gamification elements, the gamification market has exponentially increased. In 2019, the global market for gamification was 6.33 billion dollars but is projected to meet 37 billion dollars by the year 2027 (Fortune Business Insight, n.d.). Understanding more about the advantages and disadvantages of gamification and where to invest in gamification is becoming vital as the growth of the gamification market projects significant gains.

Gamification in Post-Secondary Education

Research on gamification in higher education followed a similar trend, with gamification found to be as effective as traditional teaching methods, while also giving learners more control of their grade and individual progress monitoring that catered to their strengths (O'Connor & Cardona, 2019). Huang et al., (2020) in a meta-analysis of 30 gamification studies confirm that

gamification in educational studies has produced mixed results but overall, the gamification condition has produced a small to medium effect size, with $g=.464$ in favor of the gamification condition.

Some studies related to gamification have been conducted in post-secondary educational settings. These studies will be reviewed later in this chapter.

Badging

This section will explain the history of badges and the perceptions of badges including both positive and negative views. Moreover, this section will delve into the logistics of implementing badges and the different types of badges including performance and participation badges.

History of Badges

Symbols were first used as hieroglyphics in ancient language to communicate in abbreviated ways (Ifenthaler et al., 2016). Ifenthaler et al., (2016) posits that an open badge concept is similar to using a hieroglyphic symbol used in ancient language as the symbols represent a more comprehensive meaning to a specific topic or field. Another common connection to badges as symbols is often merit badges earned by participants in Boy Scouts of America (Hintz, 2009). Merit badges are linked with a demonstrated knowledge or skill and awarded with a visual badge sewn to the boy scout's sash (Hintz, 2009). Digital badges have similar purposes of sharing and verifying credentials but are more flexible in nature in terms of design and media delivery (1Edtech, 2023). Badging is expanding worldwide as there has been over 74 billion digital badges that have been issued, a 73% increase from 2020 (1Edtech, 2023).

Although badging has early beginnings, the interest in badges specifically in education, began to grow exponentially in 2010 (Albertazzi et al., 2019). Badges are digital symbols that visibly recognize learner effort, skill or interest, credentials, capabilities and/or educational achievements (Almeida et al., 2023; Dyjur & Lindstrom, 2017). Badges are not used to open other new possibilities in the game such as new levels, but to reward students for accomplishing a challenge or goal or simply displaying a desired behavior within the gamified setting (Hakulinen et al., 2015).

Badge Perceptions and Feedback

Further, Ortega-Arranz et al., (2019) found that over 80% of students had positive perceptions toward badges. Huang and Hew (2018) and Rincon-Flores et al. (2022) reported

positive student comments surrounding badges. Despite the positive findings behind badging, drawbacks and negative perceptions have also been reported including usability issues, increased faculty workload (Abadi et al., 2022), and a lack of understanding of the badges' purpose and value (Stefaniak & Carey, 2019). O'Donovan et al. (2013) estimate that an additional six hours was needed to facilitate a gamification intervention that included badges, puzzles, and quizzes. This extra workload was on top of normal lecture preparation. Additionally, some learners reported negative or mediocre perceptions of digital badges, finding them less prestigious than a certificate of completion (Dyjur & Lindstrom, 2017).

Logistics of Implementing Badging

The basic components of badges include a graphical symbol, a badge name, a badge description, an earning criterion, and an accrediting source and often badges are associated with a learning objective and a learning pathway. Many badges require evidence in order for the user to claim the badge. Badges can be shared on social media sites as well as in digital backpacks or e-portfolios (Alamari et al., 2021).

Game mechanics and dynamics.

Game models often use the model of Mechanics, Dynamics, and Aesthetics (MDA) to describe the effects of a game (Grijalvo et al., 2022). Although gamification is not a fully-fledged game, it still uses elements of a game model as students experience curiosity, challenge, and fantasy. The most common gamification mechanics used are points, badges, and leaderboards, but many other gamification elements have also been studied (Díaz-Ramírez, 2020; Rodrigues et al., 2022). An important logistic that practitioners need to consider is game dynamics. Badges alone acting as rewards may not create an effective gamification system, but game dynamics and theory (described below) must be applied in order to make badging effective. Game dynamics are a players' behavior within the gamified experience (Grijalvo et al., 2022) but they also include what happens within a gamified context (Rincon-Flores et al., 2022). Game dynamics seek to establish knowledge and reinforce behaviors while acquiring skills such as data analysis, teamwork or problem solving (Grijalvo et al., 2022). Game dynamics deal with when the game mechanics (rules/progression) are granted (e.g., when the participant can move up in ranking on a leaderboard). Typically, game mechanics such as badges follow a ratio schedule (e.g., after 10 responses a participant is awarded a badge), a time interval (e.g., badges are awarded weekly) or an extinction rule (e.g., the badges have all been fulfilled and become

extinct) (Tu et al., 2015). Best practices of badges include designing the aesthetics of the badges so that they are visually pleasing (Rincon-Flores et al., 2022).

Performance badges vs. participation badges.

Ortiz-Rojas et al., (2019) details that gamification elements can give individuals feedback about a mastery experience. Huang and Hew (2018) implemented an early-bird participation badge to gamify their statistics courses. They also used points, levels and leaderboards in their intervention. Huang and Hew (2018) found that students gave positive feedback on the badges interview responses around participation badges, but more importantly, students in the treatment group participated significantly more in pre and post class activities. Conversely, previous studies have awarded both participation and skill-based badges in tandem within a course setting making it difficult to see if there are differences between the type of badge (skill-based and participation-based) (Kyewski & Krämer, 2018; Ortega-Arranz et al., 2019; Rincon-Flores et al., 2022; Tahir et al. 2022). Qian et al. (2022) calls for more research on specific gamification elements instead of looking at the concept of gamification as an overarching concept as a positive, efficacious concept. More research is needed to understand the effect of badges on motivation in a higher education context (Bai et al., 2020; Qian et al., 2022)

Leaderboards

Leaderboards are defined as a ranking or list of individuals who have the most points, highest scores, or who have achieved the highest levels (Kapp et al., 2014; Klock et al., 2020). Everyone involved in the gamification environment can see everyone else's score and name on the leaderboard. A leaderboard can provide social capital to individuals who are on the higher levels and can act as a power motivator for individuals to achieve higher levels (Kapp et al., 2014). Equally important is the opportunity for social interaction among individuals. The grouping of individuals can be an influential element of whether the leaderboard can be motivating or demotivating (Kapp et al., 2014). Some of the designing suggestions offered by Kapp et al., (2014) is to not display the lowest scores to everyone and if the participants are using their personal names on a leaderboard, to ensure personalization or that participants can choose their friends to compete against.

Suggestions about the best practices for structural gamification include extra administrative tasks in between teaching sessions. Keeping track of a class leaderboard is often time consuming (Ntokos, 2019). Ntokos (2019) noted leaderboards can be demotivating if every

student in the class is on a leaderboard or lead to jealousy (Bai et al., 2020). The top students often experience enjoyment on the leaderboard; the bottom students may see the leaderboard as unhelpful for their success or progress. A suggested best practice of leaderboard use should be that students should be grouped with 5-6 people and separate leaderboards to show the progress of the group (Ntokos, 2019). Furthermore, aliases should be used to avoid creating a negative environment for students (Ntokos, 2019).

Gender Differences in Gamification

Leaderboards allow students to compare their performance relative to other students in the same class (Almeida et al., 2023). Leaderboards could evoke social comparisons that may have negative results such as jealousy or detrimental upward social comparisons (Bai et al., 2020). Carpenter et al. (2018) found that in a study of 112 college students, that women chose intrapersonal competition at a significantly higher rate (67%) than interpersonal competition (31%). Men did not show significant differences between intrapersonal and interpersonal competition. Intrapersonal competition is when an individual competes against a fixed target or self-referenced point instead of competing against others in a competition (Carpenter et al., 2018).

Differences in gender in terms of academic performance (Legaki et al., 2020; Rodrigues et al., 2022) and types of motivation (Polo-Peña et al., 2021) have been noted in the literature. These findings suggest that a gamified intervention with badges and leaderboards might be perceived differently by males and females. Alternatively, Zahedi et al. (2021) found no major differences in gender between males and female students in their intervention of leaderboards and XP points. Zahedi et al. (2021) suggests that gamification is gender-neutral in terms of self-efficacy and improved performance of all genders. Other studies have found no differences in gender in terms of retention (Sanchez et al., 2020) or motivation (Rincon-Flores et al., 2022).

Motivation, Behavioral Engagement, and Academic Performance

This section will compare the relationship between motivation and academic performance, as well as behavioral engagement and academic performance. Furthermore, this section will compare the relationship between motivation, behavioral engagement, and academic performance.

Relationship Between Motivation and Academic Performance

Motivation has been one of the most discussed outcomes within badging as badges are seen as a reward that could increase extrinsic motivation (Mah, 2016). Motivation involves a spectrum of categories including amotivation, extrinsic motivation (introjected and internalized) and intrinsic motivation (Ryan & Deci, 2000). Rewards offered for achieving a certain level of knowledge or competency, like badges, have the potential to provide useful feedback, but also have been found to have mixed results (Mah, 2016; Ryan & Deci, 2000).

For badging to increase intrinsic motivation, there cannot be any requirement of performance or engagement (Ryan & Deci, 2000). Badges are typically associated with non-compulsory activities to understand the effect of the badge when completing an optional assignment (Ortega-Arranz et al., 2019). Some studies have made a limited number of activities (worth a small portion of the grade) compulsory (Kyewski & Krämer, 2018; Ortega-Arranz et al., 2019), while others have made almost all badging activities compulsory (Abramovich et al., 2013; Zainuddin, 2018). In short, the literature mentions that there have been differences in how the badges have been implemented (compulsory vs. non-compulsory).

Zainuddin (2018) found that students competing for badges in compulsory pre-class quizzes significantly perceived more autonomy and competence within coursework – two of the three factors of intrinsic motivation. Chapman and Rich (2018) found that 67% of 124 students surveyed in an organizational behavior business class felt that gamified courses were more motivating than traditional courses.

Apart from the positive findings about motivation, Mekler et al. (2017) found that points, levels, and leaderboards had no significant impact on intrinsic motivation, while Kyewski and Krämer (2018) found no significant motivational differences between control and experimental badge groups. Facey-Shaw et al. (2020) found inconclusive evidence on the use of badges to increase intrinsic motivation. Van Roy and Zaman (2018) found a decline (from the start of the gamification intervention) in intrinsic motivation at every 5-week interval of a fifteen-week course. Rodrigues et al. (2023) found that personalizing gamification by including multiple gamification elements (missions, extra points, levels, progress bars, leaderboards and badges) vs. standard, one-size-fits all gamification elements (points, badges, and leaderboards) did not result in significant motivation differences. Hanus and Fox (2015) found negative intrinsic motivation in their quasi-experimental study of 72 college students within a college communication course.

They investigated the effects of 22 badges along with an online leaderboard within a gamified course. The gamified group had significantly less intrinsic motivation and learner satisfaction within an ANOVA test during the gamified intervention at data collection point two, or during the middle of the semester. Badges used were tied to compulsory assignments. With a small number of studies conducted within various educational contexts, further empirical research is needed on the effects of badges on motivation.

Relationship Between Behavioral Engagement and Academic Performance

Student engagement is widely researched and recognized by schools and even governments, as an important influence on learning and achievement in higher education (Kahu, 2013; Quintero et al., 2022; Tahir et al., 2022). Although engagement is a multi-faceted construct, the widely accepted view of engagement in higher education revolves around the concepts of teaching practice and student behavior (Kahu, 2013; Quintero et al., 2022). More specifically, student engagement can be seen as the effort and time that students devote on purposeful, educational activities including active/collaborative learning (Kahu, 2013). A significant relationship between behavior engagement and the gamification element of badging has been identified in the literature (Ortega-Arranz et al., 2019; Tahir et al., 2022; Tsay et al., 2018). Students who earned more badges were more active in the course as they submitted more tasks, posted more in discussion forums, logged more activity time, and visited pages more frequently than non-badge earners (Ortega-Arranz et al., 2019; Tahir et al., 2022). The increased amount of behavioral engagement was also found by Tsay et al. (2018) to have a significant impact, with higher overall course performance in the gamified course, based on two assessments.

Haruna et al. (2018) reports successes with statistically higher posttest scores on a sexual health literacy test for the gamified experimental group (leaderboards, badges, and badge counts) compared to the control group. Sanchez et al. (2020) adds that students in a gamified course performed significantly higher on the first subsequent test after the gamification intervention compared to the control group, but no significantly higher test scores were noted for test two or test three.

The variable of academic performance can be seen as directly attributable to the student's inherent intelligence such as IQ (Jensen, 1998; Mayes et al., 2009) and GPA (Geiser & Santelices, 2007). Mayes et al. (2009) found that in elementary school children, IQ was the best

predictor of achievement. Jensen (1998) found that high school students' IQ scores correlated between .50 to .70 with academic achievement scores measured by school grades (As cited in Rohde & Thompson, 2007). Geiser and Santelices (2007) found that high school GPA was a reliable predictor of not only the first-year, college grades but also the fourth-year, cumulative college grades. In short, IQ and GPA seem to have a close tie to academic performance of students not only in K-12, but also as high school students enter college.

To control for pre-existing knowledge (possibly attributed to IQ and GPA) before entering gamified courses, researchers have administered pre-test or initial knowledge assessments (Tahir et al., 2022) and/or controlled for previous course grades within a course taking sequence (Tsay et al., 2018). Hanus and Fox (2015) found that between a control group and gamified online badge and leaderboard experimental group, that when controlling for intrinsic motivation measurements, no significant difference was found between final exam scores. Additionally, Tahir et al., (2022) found no significant differences between control and experimental groups on posttest assessments. Conversely, if behavioral engagement and academic performance can be improved from a gamified course, the likelihood of adoption of gamification for higher education educators may increase.

Relationship between Badging and Motivation, Behavioral Engagement and Academic Performance

Badges can add additional benefits to educational activities in courses. Badges along with leaderboards or points can help a student assess how they are doing relative to the rest of the class and how well they are acquiring skills through their performance (Almeida et al., 2023). Similarly, badges are hypothesized to increase time on tasks, support skill acquisition through performance and motivate continued engagement (Tahir et al. 2022).

Critique of the gamification research

Other researchers have found that points, leaderboards, and badges had no significant effect sizes across multiple gamification studies (Ritzhaupt et al., 2021). Almeida et al. (2023) did a meta-analysis and focus groups and found that badges can either lack credibility especially when displayed online, or when students get hyper-focused on badges, they can be a distraction to course content. In some cases, badging has been used within a content-specific or highly complicated gamified software such as Computer Science Student Network (CS2N) or customized website plug-in (Zahedi et al., 2021) making it hard for instructors to access and

utilize these badging implementations. Much of the gamification research is so diverse that it may be hard to generalize to all students in higher education. Also, the introduction of new gamification elements is often confounded by the introduction into a new environment or a new task (Groening & Binnewies, 2021). Additionally, many of the higher education courses that include badging have been within the limited scope of language courses, math/science courses (Chugh & Turnbull, 2023; Coffland and Huff, 2022) and Information Computer Technology courses (Ortega-Arranz et al., 2019).

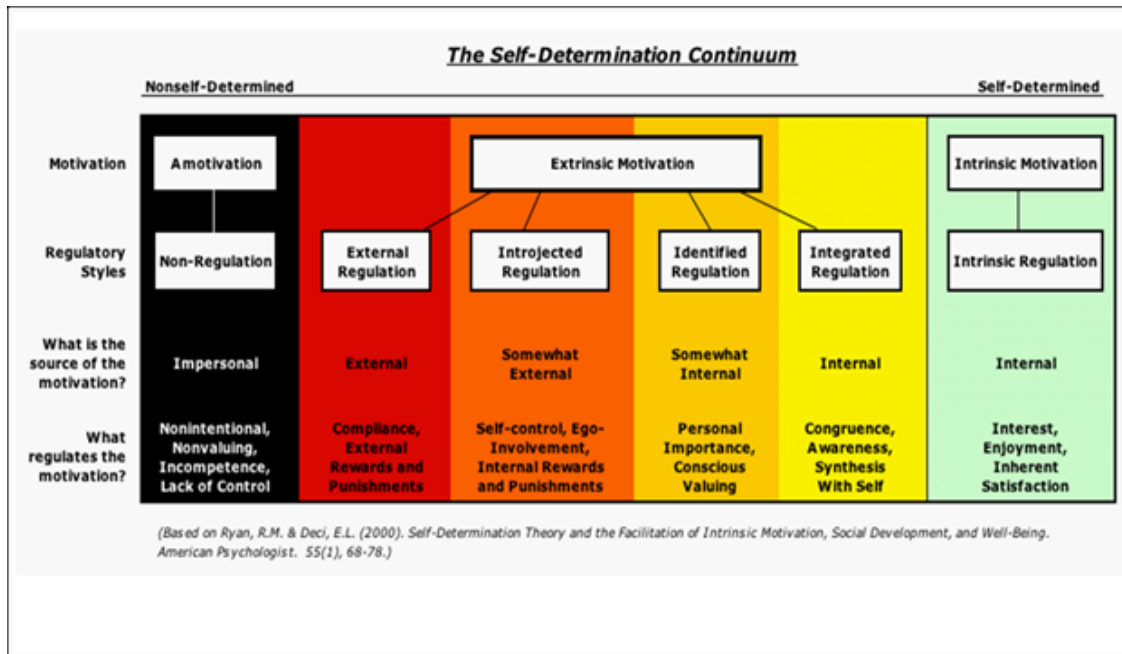
Many of the highlighted studies involve methodological and statistical limitations such as: a lack of a control group, small sample sizes (Díaz-Ramírez, 2020; Kyewski & Krämer, 2018; Tahir et al., 2022; Van Roy & Zaman, 2018) and high student attrition rates resulting in limited data (Ortega-Arranz et al., 2019). Gamification interventions can also have significant cost investments leaving educators to ask: How much incremental value does gamification add (Groening & Binnewies, 2021)? With the presented limitations in badging research, it is imperative for more research to be conducted to address these limitations to understand the impact of badging on students in higher education.

Self-determination theory (SDT)

Self-determination theory is one of the most well-known and influential theories to capture the construct of motivation (Groening & Binnewies, 2021). Motivation deals with intention and the orientation of one's motives. An intention is defined as something that involves "the desire to attain some future state along with a means to attain that desired end" (Deci & Ryan, 1994, p.3). Orientation is tied to attribution theory and the concept of the internal or external perceived locus of causality (deCharms, 1968; Heider, 1958). Initially, motivation was categorized into a binary variable of intrinsic or extrinsic motivation but over time researchers have found that extrinsically motivated behaviors could be self-determined, which creates different aspects of self-determined behavior within extrinsic motivation (Deci & Ryan, 1994). These different aspects of motivation include extrinsic motivation that has become integrated within the self, extrinsic motivation solely regulated by an external force and even amotivation. Self-determination theory encompasses a spectrum of motivation from amotivation to extrinsic motivation and finally to intrinsic motivation (See Figure 2.1).

Figure 2.1

The Self-determination Continuum



This section will describe the two types of motivation including extrinsic and intrinsic motivation. Additionally, this section will describe amotivation or the lack of motivation. Extrinsic motivation includes four aspects in the spectrum that include external regulation, introjected regulation, identified regulation, and integrated regulation. These four aspects will be described below.

Intrinsic Motivation

Intrinsic motivation is the product of self-determined behaviors as it is autotelic in nature, self-initiated or is done out of volition (Deci & Ryan, 1994). Ryan and Deci (2000) go on to explain that intrinsic motivation is done spontaneously, out of interest or by exploration with no intrapsychic promises. No demands, constraints, threats, consequences and no instrumentality are used to provoke action. Individuals who act out of intrinsic motivation do so freely and are sustained by the experience of enjoyment and interest. Interest in the course topic within K-12 settings has been found to provoke higher intrinsic motivation (Grolnick & Ryan, 1987), contextual learning (Grolnick & Ryan, 1987), depth of text processing (Schiefele, 1991), and quality learning (Schiefele, 1991).

Extrinsic Motivation

Extrinsic motivation is intentional but controlled by intrapsychic or internal force (Deci & Ryan, 1994). The individual is coerced or seduced to complete an action (Ryan & Deci, 2000). Extrinsic motivation is performed through instrumentality to receive some separate consequences or contingencies (Ryan & Deci, 2000). Action is motivated and intentional but contingent on overtly external contingencies (Deci & Ryan, 1994). An example could be that a student who does not complete a homework assignment could lead to the consequence of punishment or teacher disapproval. Although the homework may be unpleasant or uninteresting, the individual will perform that task out of reward or punishment (Ryan & Deci, 2000).

Amotivation

Amotivation is the lack of motivation or when an individual does not feel competent in an activity or does not value the activity (Ryan & Deci, 2000). Furthermore, amotivation can be described as learned helplessness or with a state of orientation of nonintentional actions (Guay et al., 2001).

Integrated Regulation

Integrated regulation is the most determined, autonomous and mature regulatory style of extrinsic motivation (Ryan & Deci, 2000). Extrinsic motivation can become internalized, where individuals will integrate the activity within oneself and there is congruence between the individual's goals and the task, even though the regulation was generated externally (Deci et al., 1994). Ryan and Deci (2000) continue to explain that if the task is internalized, the task becomes "integrated regulation" or "identified regulation" and the individual accepts full responsibility for an activity and finds value in the activity.

Regulations and identified values are integrated or coherent to oneself. Behaviors are freely performed though instrumentality is used to create action. The action is performed for an outcome that is valued by oneself (Deci & Ryan, 1994; Ryan & Deci, 2000). An example is that a student would also like to be a rock band member. Although the two identities may initially seem as though they are in conflict, the individual will adjust or creative synthesis so that both identities can co-exist harmoniously (Deci & Ryan, 1994). Integrated extrinsic motivation includes high-quality learning maximized perceived choice and behavioral-self regulation (Deci & Ryan, 1994).

Identified Regulation

Identified regulation is behavior adopted by the individual (Ryan & Deci, 2000). The behavior is incorporated into oneself and is personally valued by the individual (Deci & Ryan, 1994). An example would be that the student thinks the course is not interesting, but still tries to get good grades as good grades are important for their self-selected goal of attending a college or university (Deci & Ryan, 1994). Another example would be if a person identified the importance of exercising regularly to maintain their health and well-being. After seeing the importance, they would exercise more volitionally (Deci & Ryan, 2000). The resulting behavior becomes more autonomous, but the behavior is still extrinsically motivated (Deci & Ryan, 2000).

Introjected Regulation

Introjection Regulation can be referred to as a pressurized control system. Introjected regulation is internally controlled or coerced (Ryan & Deci, 2000). The task has been introjected and has not been truly integrated or has only been partially internalized (Deci et al., 1994). The activity was not created by the individual, although it has entered “within the same skin” as the individual (Deci et al., 1994). The individual has an external locus of causality (Deci & Ryan, 1994). Introjection is often controlled by rules for action and sanctions such as the promise of self-approval or the avoidance of guilt, pressure, or anxiety (Deci & Ryan, 1994). An example of introjected regulation is that a student should go to college or else they may feel worthless (Deci & Ryan, 1994).

External Regulation

External regulation is driven by the fear of punishment or external rewards (Ryan & Deci, 2000). The activity is not initiated by the individual and the motivation is completely external (Ryan & Deci, 2000). External motivation is the least self-determined type of extrinsic motivation (Ackerman, 2021). An example of external regulation would be that parents pressure their daughter to go to college (Ryan & Deci, 2000).

Non-Regulation

Ryan and Deci (2000) explain the far left of the diagram includes non-regulation that falls under amotivation. Amotivation can come from individuals that lack a state of intention to act. Individuals “just go through the motions” with no desired outcome or no expectation of a desired outcome. (Ryan & Deci, 2000, p. 72). Additionally, individuals may not value an activity or do not feel competent to complete the activity (Ryan & Deci, 2000).

Self-determination Theory Applied to Gamification Research

Self-determination theory can be applied to educational contexts with the goal to create high-quality and efficient learning (Deci, 1975). A more recent study by Ryan and Deci (2000) illustrates this conflicting motivational effect as they conducted a meta-analytic review of experiments examining the effect of extrinsic rewards on intrinsic motivation. In college-aged students, positive feedback enhanced self-reported interest and free-choice behavior, while tangible rewards and expected rewards undermined self-reported interest (Ryan & Deci, 2000). Badging can be seen as positive feedback from the instructor but also as a tangible/expected award which, based on Deci and Ryan, (2000) will have conflicting effects on motivation. Badging studies have used Self-determination theory to understand how badges affect motivation (Kyewski & Krämer, 2018; Van Roy & Zaman, 2018). Qian et al. (2022) calls for more research on specific gamification elements instead of looking at the concept of gamification as an overarching concept as a positive, efficacious concept. More research is needed to understand the effect of badges on motivation in a higher education context (Bai et al., 2020; Qian et al., 2022).

Various Measures of Motivation

Various measure of motivation have been created including the Intrinsic Motivation Inventory (IMI), the Academic Motivation Scale (AMS), the Perceived Choice and Awareness of Self Scale (PCASS), and the Motivators' Orientation Questionnaires just to name a few (Ackerman, 2021). Multiple authors have used the IMI scale to measure motivation after gamification interventions, but this instrument may not be robust enough to capture amotivation and all of the elements of extrinsic motivation (Groening & Binnewies, 2021; Hanus & Fox, 2015; Reid et al., 2015) .

Self-determination Theory and the Three Psychological Needs

The theory of Self-determination theory proclaims that humans have the innate psychological needs of relatedness, autonomy, and competence. More specifically, relatedness, competence and autonomy foster intrinsic motivation which represents a self-determined activity (Ryan & Deci, 2000). The self-needs theory identifies three basic human needs for social development, social well-being, and self-regulation (Ryan & Deci, 2000). With these three needs satisfied, an individual is more likely to be intrinsically motivated within a specific task. The intrinsically motivating nature of digital games has been attributed to their ability to modify the

environment and their potential to satisfy the psychological needs for autonomy, competence, and relatedness (Sailer et al., 2017).

Competence

Competence is the perceived extent of one's own actions as the cause of desired consequences in one's environment (Guay et al., 2001). Competence is a sense that one can grow and succeed. Competence involves the feeling of mastery (Ryan & Deci, 2020).

Autonomy

Autonomy is the need for people to experience their behaviors as self-determined. Furthermore, autonomy is a sense of initiative and ownership in one's actions (Ryan & Deci, 2020). The individual is given several options and has a sense of freedom of choice and is free from pressures (Guay et al., 2001). Autonomy can also be seen as self-organizing an experience or having volition (Deci & Ryan, 2000). A mark of autonomy is to have one's behaviors to be congruent or self-endorsed with one's authentic interests (Ryan & Deci, 2017).

Relatedness

Relatedness is the need for people to feel close to others (Mekler et al., 2017). Relatedness can also be an affiliation within a social milieu in order to "function effectively in that milieu, and to feel a sense of personal initiative while doing so" (Deci & Ryan, 1994, p.7). As mentioned previously, leaderboards that are driven by badge earnings can help students assess how they are doing in relation to the rest of their class.

Maximizing Self-determination within Educational Contexts

Teachers often give assignments or assessments to facilitate their class. These act as an external regulatory process to provoke action or behaviors in their students to perform. Tahir et al., (2022) designed badges with the intention to challenge themselves to complete daily problems and to set goals for consistency. Rin-con Flores et al. (2022) awarded badges to increase motivation, promote participation and academic performance. In their study, students experienced enhanced motivation and more time-on-task, but not an increase in academic performance. Ortega-Arranz et al. (2019) designed badges for collaboration with classmates and competency in online quizzes. In their study, a high correlation of was found between badges earned and motivation. To have students have a highly determined form of motivation, the teacher would likely strive to have the task be internalized to provoke integrated or identified

regulation within the student (Ryan & Deci, 2000). Deci and Ryan (1994) suggest that the way to maximize self-determination is to have students internalize and or integrate the task within themselves. As more integration occurs, an external regulatory process becomes an internal regulatory process (Deci et al., 1994).

Social contexts that provide for these three basic needs of autonomy, relatedness and competence to promote intrinsic motivation and self-determined extrinsic motivation. More specifically, social contexts that provide informational feedback, optimal challenge, autonomy support and interpersonal involvement promote self-determined behaviors (Deci & Ryan, 1994). Language use should include supportive language, positive, non-critical, informational feedback that is used to strengthen perceived competence without the pressure to complete an action. Language use should also acknowledge choice/autonomy and feelings (Deci & Ryan, 1994).

Another way to maximize self-determination is to provide an optimal challenge that is “optimally discrepant” from an individual’s skill level (Deci et al., 1994). Furthermore, providing a rationale for the importance of the activity can help the individual to understand the importance of the activity and to facilitate integration and self-determination (Deci et al., 1994). Classroom climates that support autonomy, acknowledge feelings, and provide choice or interpersonal style rather than control are ideal contexts (Deci et al., 1994). Autonomy supportive classrooms within K-12 settings fostered a greater curiosity and self-esteem within students (Ryan & Grolnick, 1986). Other positive benefits included greater intrinsic interest, more independent mastery attempts, and perceived academic competence compared to controlling classroom climates (Deci et al., 1994). The individual will have more self-determination if they feel like they can effectively interact with the environment, control the outcome, and have autonomy (Deci & Ryan, 1994)

Undermining Self-determination within Educational Contexts

In previous research conducted in the early and mid-70’s, studies found that a way to undermine intrinsic motivation included giving money or awards to individuals who have completed a task solely out of intrinsic motivation (Deci, 1971; Deci, 1975; Lepper et al., 1973). Especially when the individual feels that their experience of competence is thwarted (Ryan & Deci, 2020), or they feel like a pawn to extrinsic control (deCharms, 1968). The result can be that the individual is overtly less willing to do the activity solely out of satisfaction (Deci et al., 1994). Later on, Harackiewicz (1979) found that within 93 high school students that

performance-contingent rewards undermined intrinsic motivation but giving them positive feedback enhanced motivation. Ryan et al. (1983) noted that performance-contingent rewards and positive feedback seem to offset each other in results, leaving no significant difference between control and experimental groups. The researchers also note that instead of just having a performance-contingent reward, a skilled performance activity can signify competence for an individual (Deci et al., 1994). These skill-based activities can either be delivered/administered as informational or controlling. When controlling is the way that the activity is communicated, it often undermines students' intrinsic motivation (Deci et al., 1994; Ryan et al., 1983). Some ways to undermine intrinsic motivation include imposed goals, evaluations, threats of punishments, deadlines, and material rewards (Deci & Ryan, 1994). Controlling language has also been found to undermine intrinsic motivation including: "You have to" or "You should" (Ryan et al., 1983). Moreover critical, evaluative feedback has also been found to be detrimental (Ryan et al., 1983).

Conclusion

The "how" and the "where" should educators implement badging/leaderboards questions need to be asked, specifically since there has been a limited amount of badging/leaderboard studies conducted within undergraduate education. The mixed findings make it hard to generalize the effectiveness of these gamification interventions. As such, this study sheds light on badging and leaderboards in higher education to help instructors to develop the best-practices for implementation and to understand to what extent badging and leaderboards affect motivation, behavioral engagement, and academic performance.

CHAPTER 3. METHODOLOGY

The methodology section covers the mixed methods research design, conceptual framework, participants and context, the intervention, instrumentation, data collection procedures, and the data analysis approach.

Research Design

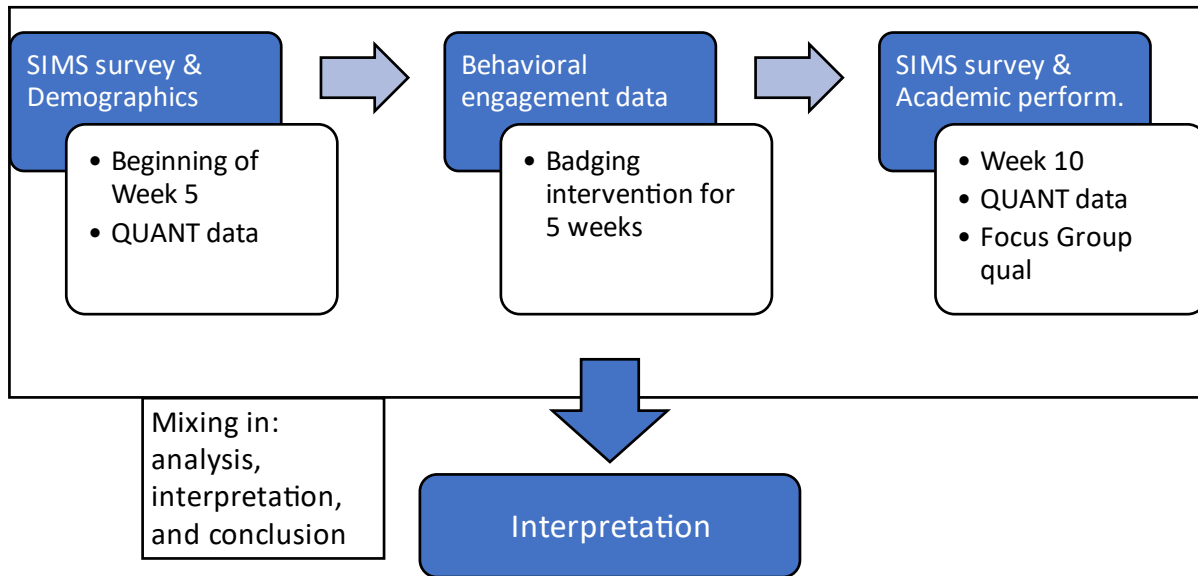
The researcher used an embedded or nested, mixed-method study to measure the effect of badges and leaderboards on motivation, behavioral engagement, and academic performance of students in an undergraduate accounting course. Embedded designs can be conducted either sequentially or concurrently (Creamer, 2018). For this study, the data was collected concurrently or at approximately the same time. Mixed methods research is defined as a method of research that includes both a qualitative and quantitative strand that are mixed at some point in the study (Creswell et al., 2003). The rationale for using a mixed methods approach was to understand if the badging intervention has an impact on outcomes as well as the process and experience of the students experiencing the badging intervention. Mixing can happen in the phases of designing the research questions, data collection, sampling, analysis, interpretations/conclusion or in reporting (Creamer, 2018). This study mixed quantitative and qualitative data in the analysis, interpretation/conclusion, and reporting phases. The reason for collecting the qualitative data was to provide support for the primary purpose and more methods of inquiry are sought to understand the experience of the intervention within the context of an undergraduate classroom. The use of integrating both quantitative and qualitative methods was to examine the effectiveness of badging and leaderboards and to provide contextual understanding about the experience of a gamified intervention. The qualitative data played a smaller role than the quantitative data. Qualitative data was used to understand the process of the badging intervention as well as the impact on outcomes. The Situational Motivation Scale (SIMS) motivation survey was administered at the beginning and end of the intervention to understand changes in motivation (if any).

The data collection period covered two academic semesters. A true experimental study was not feasible as students are free to register for classes based on their time and schedule preferences. The philosophical outlook for this paper is pragmatism or a philosophy that is in favor of doing what works and what is practical within a particular context (Creamer, 2018). Pragmatism is most often associated with the mixed-method research paradigm and as such, was

used for this study (Creamer, 2018). The following visual diagram in Figure 3.1 is based off of a Creswell et al., (2003) visual diagram for concurrent, nested designs. The visual diagram in Figure 3.1 shows how data collection was repeated over two semesters.

Figure 3.1

Visual of Intervention and Data Collection in the Embedded, Mixed Methods Design

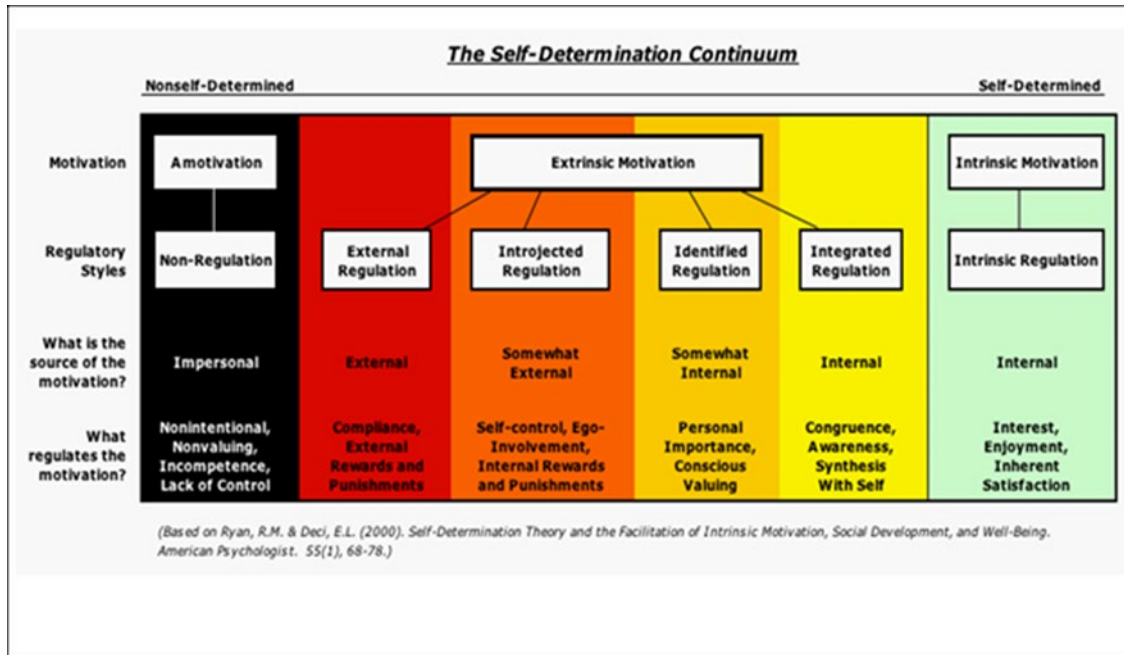


Conceptual Framework

This section covers the conceptual framework of self-determination theory with its three underlying, basic psychological needs of autonomy, competence, and relatedness. With the most commonly used conceptual framework of self-determination theory used in gamification research in education (Alsawaier, 2018), this study connected gamification elements to autonomy, competence, and relatedness to examine the effect (if any) on motivation, behavioral engagement, and academic performance (Dichev & Dicheva, 2017). Figure 3.2 displays the self-determination continuum with different levels of motivation as well as the lack of motivation

Figure 3.2

The Self-Determination Continuum



Applying Self-determination Theory to the Current Study

Ntokos (2019) proposes that all gamification interventions should consider extrinsic motivators such as gaining rewards or placing on the leaderboard. Intrinsic motivation should be considered in tasks that include autonomy such choosing what tasks to complete or selecting a specific character. Ntokos (2019) argues that students are less motivated to complete optional assignments that are not associated with class marks or points. These optional assignments often used as formative assessments are pinpoints in time where students can receive feedback to adjust before summative assessments. These formative assessments are essential for more effective learning (Ntokos, 2019). This study used the self-determination theory as the conceptual framework. Self-determination is the most used conceptual framework for gamification studies, but Alsawaier (2018) notes that many gamification studies lack a connection between theory and practice. This study implemented gamification elements to cater to the three psychological needs of self-determination theory. Leaderboards were used to foster student relatedness (Alsawaier, 2018).

Seven optional quizzes were offered within each chapter of study which allowed for autonomy as students could choose which quiz to complete or which achievement/task to

pursue. More detail is described below in the treatment section. Students could also customize their learning paths which provided a sense of competence through formative assessments as recommended by Alsawaier (2018).

Participants and Context

Participants

The students were undergraduate, introductory financial accounting students who were taking the first required accounting course in a traditional/face-to-face setting. The context for the study was a small, private, university. The course was required by all business majors (accounting, business management, entrepreneurship, and hospitality and tourism management majors) as well as any student on campus seeking to minor in accounting. Studying undergraduate students is accounting is relevant as many of the higher education courses that include badging have been studied within the limited scope of language courses, math/science courses (Chugh & Turnbull, 2023) and Information Computer Technology courses (Ortega-Arranz et al., 2019). Huang et al., (2020) found in their meta-analysis from 2009-2018 that only one gamification study out of thirty (that contained quantitative analysis) was in the discipline of business. Further from 2010-2018, only ten studies had examined gamification in undergraduate education (Bai et al., 2020). Chugh and Turnbull (2023) in their bibliometric, cluster analysis found a total of eight articles within the business education cluster. The eight articles included game-based learning, business simulations, and serious games, but no gamification interventions. In some cases, badging has been used within a content-specific or highly complicated gamified software such as Computer Science Student Network (CS2N) or customized website plug-ins (Tahir et al., 2022) making it hard for instructors to access and utilize these badging implementations. Furthermore, the application of gamification advice has been heterogenous (Bußwolder & Gebhardt, 2017) making it hard to know the best technology and gamification elements to use. Few studies have used gamification for undergraduate business students let alone accounting students based on the limited scope of courses studied above. As such, this dissertation examined students in an undergraduate accounting course.

The purpose of the introduction to financial accounting course is to help students use the language of business: accounting. The course covers vocabulary, transactions, and accounting principles. In the course, students learn to read, prepare, and to some extent, analyze the financial statements. These financial statements include the balance sheet, the statement of stockholder's

equity (part of which is called the statement of retained earnings), the income statement, and the statement of cash flows. The course covers accounting for different aspects of the financial statements including short-term and long-term assets, short-term and long-term liabilities, and equity transactions.

Twenty-seven to thirty-six students were enrolled in each section. Students were informed of the study as well as of qualitative. Onwuegbuzie and Collins (2015) explain that sampling is selecting a segment to represent the whole or the population. All students within the specified accounting courses were used for convenience, cluster, sampling in collecting quantitative data. Convenience, cluster, sampling (Onwuegbuzie & Collins, 2015) was used. To understand student perceptions of how the badging intervention influenced their motivation, behavioral engagement, and academic performance, 30 students were participants in focus groups. Purposive sampling was used to ensure representation by gender for focus groups.

The researcher evaluated qualitative information for saturation or until evidence of redundancy was achieved. Guest et al. (2006) posited that data saturation is possible with 12-15 participants, but more participants can be added if the researcher does not believe they have reached saturation.

Study Setting

At the time of the study, the university demographics included 53% international students from 77 different countries (Brigham Young University – Hawaii [BYUH], 2019). The ethnicity representation of students included approximately Asian 30%, Caucasian 38%, Pacific Islander 25%, and other ethnicities 7% (BYU-H, 2019). The average age of students was 19. The studied class was an introduction to accounting course. This course is the first course in accounting that is required for all business majors. Three sections of the same course were taught in the same semester by the researcher. Each section was a course listed in the university's course registration software. Students were free to register for any section conducive to their schedule. Please see Appendix A for a signed letter of cooperation from the institution.

Instrumentation and Procedures

The Situational Motivation Scale (SIMS) measurement tool was utilized to assess constructs of student intrinsic motivation, identified regulation, amotivation and external regulation (Guay et al., 2001). The SIMS measurement tool was designed to be aligned to Deci and Ryan's (1985) self-determination theory.

The SIMS instrument is a versatile, self-report measure that goes beyond the limitations of solely measuring intrinsic motivation as captured by the Intrinsic Motivation Inventory survey. Ryan and Deci (2000) discovered another level of motivation, called amotivation. Amotivation is a low level of self-determination with no sense of purpose and no expectation of rewards or possibility of changing the course of events (Guay et al., 2001). See Appendix B for the SIMS instrument. The SIMS motivation survey asks a total of sixteen questions with four questions each on the following constructs: Intrinsic Motivation, Integrated Regulation, Extrinsic Regulation and Amotivation. The instrument uses a 7-point Likert scale from 1= corresponds not at all, to 7 corresponds exactly (e.g., Why are you currently engaged in optional quizzes? Because I think that this activity is interesting or because I don't have a choice) (Guay et al., 2001). Scores were averaged and reported. The higher the intrinsic motivation and integrated regulation, the better the likelihood that the student will have positive educational outcomes (Deci & Ryan, 2008). See Table 3.1 for description of constructs of the type of motivation.

Table 3.1

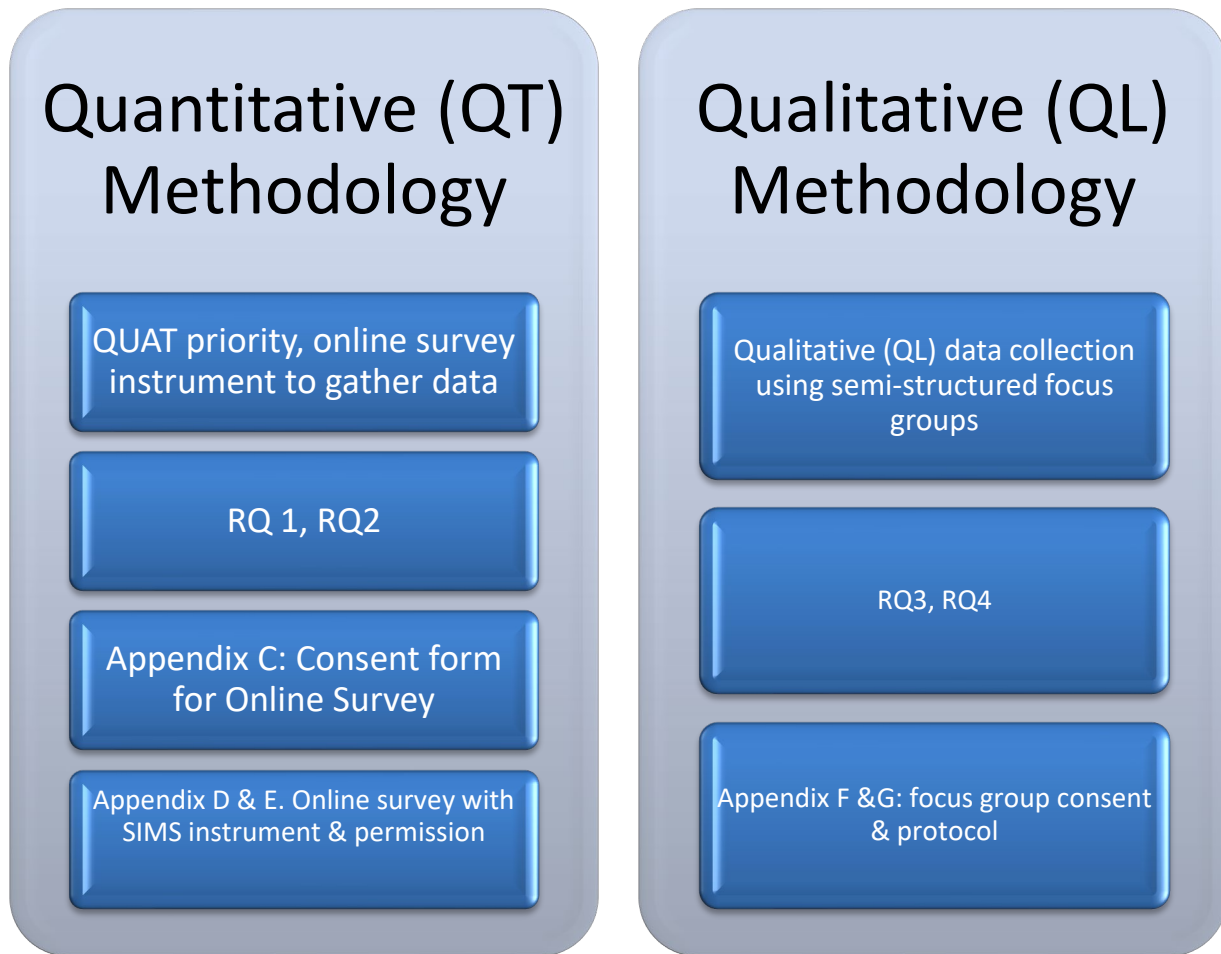
Example of the Situational Motivational Survey

Type of Motivation	Example:
Intrinsic Motivation (IM)	I think that this activity is interesting
Integrated Regulation (IR)	I am doing it for my own good
Extrinsic Motivation (ER)	I am supposed to do it
Amotivation (AM)	There may be good reasons to do this activity, but personally I don't see any

See Figure 3.3 for the alignment of quantitative and qualitative methods to the instruments chosen.

Figure 3.3

The Quantitative and Qualitative Methodology Alignment



The qualitative focus group questions can be found in Appendix G. The focus group protocol included an introduction of the researcher and the purpose of the research. The protocol also included questions to understand the students' experiences, opinions, and perceptions with the gamification intervention. The focus group protocol was reviewed with the research advisor to examine word choice and understandability of questions. The variables studied and measurement of variables for this study are described in Table 3.2 while the treatment of the three groups of accounting courses is shown in Table 3.3.

Table 3.2*Variables Studied and Measurement of Variables for this Study*

Variables studied	Measurements of variables
Motivation	SIMS survey instrument to measure intrinsic motivation, integrated regulation, extrinsic motivation and amotivation
Behavioral engagement Behavioral engagement: which is defined for this study as the involvement in academic and learning tasks and includes behaviors such as persistence and effort (Fredricks et al., 2004).	<ul style="list-style-type: none"> • Number of page views • Number of participations • Activity time
Academic Performance	<ul style="list-style-type: none"> • Exam 2 percentage that cover week 5-10 materials

Table 3.3*Control and Experimental Groups*

Control Group:	Experimental: Participation badges	Experimental: Skill-based badges
No badging intervention but leaderboard system integrated into Canvas based on number of optional quizzes completed (Week 5-Week 10)	Badging and leaderboard system integrated into middle part of class Week 5 to Week 10 with Participation badges	Badging and leaderboard system integrated into middle part of class Week 5 to Week 10 with Skill-based badges

Treatment

All three groups of the course had a leaderboard integrated into Canvas, but one served as a control group in terms of badging (no badges). Two groups of the introduction to accounting course had both the badging and leaderboard system integrated into their Canvas LMS learning course. The chosen software of BADGR was used for the study as it was most aligned with the badge intentions of being an educational badge, awarded for completing tasks. Badges were awarded for completing optional quizzes for experimental groups. The first experimental group had badges awarded on effort or participation (e.g., completing the optional assignment). The

second experimental group had skill-based badges (based on the score received on optional quizzes). Optional quizzes consisted of multiple-choice questions, fill-in-the blank questions, matching the term to the definition questions, and categorization questions to simulate creating accounting journal entries. Optional quizzes were single-level (a task performed once with one level of difficulty) and scored to provide feedback on how proficient students were becoming on learning objectives similar to Barata et al., (2013). Students were not allowed to retake optional quizzes but were given the correct answer and feedback after completing the quizzes.

Aesthetics of Badges and Badge Software Justification

Badges were designed by the researcher using Accredible.com. Accredible.com allows users to “Create a professional digital badge for free with Accredible’s badge creator” (Accredible, n.d.-b). The site allows for multiple badging templates that are easy to create in a matter of clicks (Accredible, n.d.-b). The researcher created the badges to resemble badges similar to Ortega-Arranz et al.’s (2019) BADGR designs. See Appendix H for badge designs. According to Dyjur and Lindstrom (2017), the aesthetics of badge designs can influence the perceptions of the badge’s credibility. Participants in a professional development seminar noted that badges were more pleasing aesthetically if they had a distinguished look, were modern and more professional in appearance (Dyjur & Lindstrom, 2017).

In choosing appropriate badging software, open badges were not aligned to a closed enrollment course at a private university as only students in the course could have access to the badges and as such the researcher did not use Open Badges through IMS Global Learning Consortium. Additionally, other badge platforms catered to employee achievement and employee recognition as well as the reskilling of employees such as Accredible, BadgeCert, and Credly (Accredible, n.d.-a; BadgeCert, n.d.; Credly, n.d.). These platforms illustrate verified skills accumulation to help gain insight about the workforce and are often supported by large trade associations, professionals, and corporations (Accredible, n.d.-a; BadgeCert, n.d.; Credly, n.d.). These badges are not focused on individuals at the student level and as such BADGR was chosen as the platform to award badges, create a leaderboard with pseudonyms and foster badges that were created and modeled after Ortega-Arranz et al. (2019).

Although BADGR was used to generate pseudonyms and send individual emails to students about the badges they were awarded, it was not robust enough to award skill-based badges based on the criteria set out by the researcher. As such, the researcher followed a similar

approach as Rincon-Flores et al, (2022) in that the leaderboard webpage was updated manually based on quiz scores. To draw attention to the manually created leaderboard, students who entered the course in the LMS were directed to a virtual trophy room (See Appendix H) that showed the leaderboard and attainable badges (for experimental groups).

Timing of Implementation

Kim and Castelli (2021) suggest that gamification interventions should be short-term in terms of length to have the most successful implementation. Van Roy and Zaman (2018) found a decline (from the start of the gamification intervention) in intrinsic motivation at every 5-week interval of a fifteen-week course. Rodrigues et al. (2023) found a U-shape effect of motivation where the novelty wears off after about four weeks and then recovered in week 10 (familiarization effect) of a 14-week semester. This strategy was to encourage long-term memory retention (Roediger & Karpicke, 2006). Wilson and Wilson (2019) explained that the beginning of the course is a discovery period for the student. They note that early assignments with results can help students to build an understanding of course requirements (Wilson & Wilson, 2019). Students in their first years of college can affirm their academic identity when they receive the results of their first assignment in a course (Wilson & Wilson, 2019). Students can take time to adjust to course requirements/expectations, as such, this intervention was introduced after the first exam in the middle of the semester (week 5 of a 15-week course).

One method of the timing of implementing badges could be during complex topics or topics that have a large volume of content, which would need students to have good preparation skills (Garnett & Button, 2018). Previous course performance (of the proposed introduction to financial accounting course) has indicated a drop in Exam scores from Exam 1 (at week 4.5) to Exam 2 (Week 10) by an average score of 8% (from a 77.5% average to a 69.5% average). This could possibly be a result of the mid-semester slump as indicated by Bolton (2003). Bolton (2003) noted that at the mid-point in the semester, energies ebb and students experience stagnation, and apathy. Additionally, Bolton (2003) calls the weeks before or after an exam or the weeks after the midterm “the doldrums” where students experience waning enthusiasm, a lack of motivation, or interest. This lack of interest is in stark contrast to the beginning of the semester that can be filled with anticipation, excitement, and doubts with how the individual student can handle the materials competently (Bolton, 2003). Kyewski and Krämer (2018) used a five-week intervention time frame scheduled at the beginning of a fourteen-week course.

Kyewski and Krämer (2018) found that student motivation significantly decreased from the beginning of the class to the end of the class. Reid et al. (2015) found that in an even shorter time frame of 7.5 weeks, students had significantly lost intrinsic motivation, even with badging implementation. As such, the gamification intervention was implemented from week 5 to week 10 in the courses included in this study.

Grading and Ethical Treatment

In the course, approximately 15% of the course grade is allocated to quizzes, 54% to exams, 13% to in-class assignments/worksheets, 13% to homework, and 1% to a single group presentation. As mentioned in the literature (Chapter 2), badges have been implemented based on compulsory assignments, often worth a small portion of the students' grade and non-compulsory assignments. Barata et al. (2013) noted that two distinct grading systems of gamified and non-gamified systems are not ethical to grade students in two different ways that take the same course. This study did not provide any external motivation to pursue the badges similar to Hakulinen et al. (2013). All sections/groups of the class (control and two experimental) received the same optional quiz content to ensure fair and ethical access to learning resources. The instructor reduced the compulsory homework problems from three problems to two problems during the intervention time period (week 5-week 10). The instructor eased the workload of students' normal compulsory homework assignment expectations as optional quizzes or non-compulsory assignments were available during the intervention time period. This was done with the hope to balance student homework time spent in the beginning of the semester to the middle of the semester. Furthermore, gamification and more specifically badges and leaderboards produced mixed results in the literature with no guarantee for higher: motivation, behavioral engagement, or academic performance (Dichev & Dicheva, 2017; Dicheva et al., 2015).

Format of the Course

The course covered one chapter a week. Each week of the semester included three 50-minute class periods. See Appendix I for a breakdown of the alignment of chapter learning objectives, optional quiz sample questions and associated badge name. Quiz questions were created from the textbook, textbook homework, and test bank from the publishers of *Fundamentals of Financial Accounting*, 7th edition. (Phillips et al., 2022).

Before class session 1: Before class session 1, students completed one chapter of reading of the assigned text and completed a compulsory homework assignment covering vocabulary terms and

open-ended guided reading questions. A supplemental optional quiz was given to help students practice matching vocabulary terms to definitions. Students were offered optional Quiz 1 - Matching Key Terms from the chapter (See Table 3.4 with criteria for awarding badges)

In class session 1: The first day of class (on the specific chapter) covered conceptual and quantitative problems based on the chapter's Learning Objectives (LO) 1,2,3 solved with the help of the instructor and classmates.

Before class session 2: Before class session 2, the student completed two compulsory homework problems that reviewed similar problems that were covered in the previous class. Students were offered optional quizzes 2,3, and 4 covering the studied learning objectives.

In class session 2: The second day of class (on the specific chapter) was similar to class session 1 but covered additional learning objectives such as LO-4

Before class session 3: Before class session 3, the same process was followed as with the second-class period but with more advanced learning objectives (e.g., LO-4, LO-6). Students were offered optional quizzes 5,6, and 7 that covered the studied learning objectives.

In class session 3: The third day of class (on the specific chapter) was a review day and a graded, compulsory quiz administered in class on all Learning Objectives covered in that chapter. Seven badges were possible for each chapter. Four chapters were covered before exam 2. The flow of the course introduction to financial accounting course is described in Figure 3.4 while table 3.4 shows the criteria for awarding badges.

Figure 3.4

The Flow of the Gamified Course – Participation Badges Only Displayed

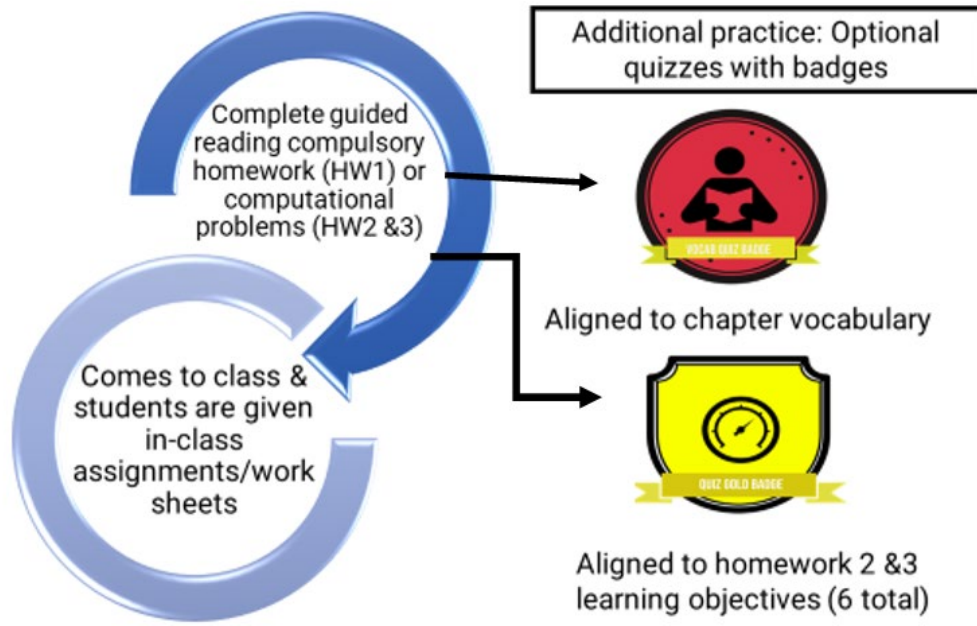










Table 3.4

Criteria for Awarding Badges Including Participation Badges and Skill-Based Badges

Badge Name	Criteria Description		
Participation badges			
Quiz Gold Badge	Completed quiz		
Skill-based Badges			
Quiz Gold Badge (Chapter 6, 7, 8, 9)	90-100% of quiz answers correct		
Quiz Silver badge	70-89% of quiz answers correct		
Quiz bronze badge	50-69% of quiz answers correct		

Data Collection

Demographic Data

Demographic and academic data were collected including gender, cumulative GPA at the beginning of the badging intervention, student preferences/experiences with video games, and perceptions about learning opportunities and video games. Many researchers collect demographic data to frame their research and describe their sample (Cameron & Stinson, 2019). Cameron and Stinson (2019) argue that the variable of gender needs more inclusivity, understanding, and measurement as it has become a changing construct of society. To be more inclusive, or to have survey participants not feel pressure to comply with a gender that does not describe their current status, Cameron and Stinson (2019) suggest the following way to incorporate a non-binary gender variable into surveys with three options. I identify my gender as (please specify): woman, man, open ended response. As such, this gender inclusive approach was utilized in this dissertation. Responses were received in the open-ended response that included “Miss” or “Man” but were recoded under the correlating gender variable.

Koivisto and Hamari (2014) purport that the main demographic differences that explain perceptions of gamification are gender and age. Oliveira et al. (2023) summarize seventeen studies that examine the following important factors to consider to make the gamification intervention most suited to a student. These factors include student traits (learning style, personality trait, gamer type), demographic factors (gender, age) and psychological state (motivational stage, user preference).

Age is not of interest in the current study as many of the enrolled college students were around the mean of age of 19. Abu Dawood (2019) explored the relationship of video game experience as a predictor of university students’ attitudes toward educational gamification and found no significant predicting variables including: gaming frequency, number of games played, gaming hours, gaming experience, player types, or video game liking. Additionally, learning game familiarity and the liking of learning games was not a predictor of students’ attitudes toward educational gamification. Bourgonjon et al. (2010) found that students’ personal experience with, and perceptions of the usefulness, learning opportunities, and ease of use for video games had a direct influence on students’ preference for using video games in class. Although Bourgonjon et al. (2010) created original survey items for preference and experience for video games, the researchers found the following Cronbach alpha with regards to their survey

item exploratory factor analysis. The learning opportunities construct had a Cronbach alpha of 0.875, experience with video games 0.895 and preference for video games 0.925.

To control for some of these personal experiences and perceptions of video games that can influence students' preferences to have video games in class, this study used scaled questions (ranging from 0-100) as a covariate to control for these experiences/perceptions. The questions were scaled on a 0-100 basis because covariates are traditionally measured on a continuous scale instead of a categorical scale (Pituch & Stevens, 2015). Pituch and Stevens (2015) suggest that researchers should consider the three following possibilities as covariates: the measure of general ability, the ability in specific content areas, and one or two relevant non-cognitive measures (e.g., study habits, attitude toward education, etc.). Rodrigues et al. (2022) called for more research on contextual factors including attitudes toward gamification and other pre-determinants that could moderate outcomes.

This study asked students if they strongly disagreed to strongly agreed with the opportunities that video games offer, their experience with video games, as well as their preference for video games in class based on elements of a survey administered by Bourgonjon et al. (2010). See Appendix C for the full survey question descriptions.

Behavioral Engagement and Academic Performance

To ensure validity, the control and the experimental courses had the same materials to use within the course, the only difference was the badging software in the experimental groups. The behavioral engagement variable is captured by the LMS Canvas under their data analytics system. Canvas offers a system to help understand how students are participating and viewing the course with a student profile that tracks activity time, page views and participation.

The page view data point adds a "page view" data point when a student downloads a file, views a page, or submits an assignment (Instructure Community, n.d.). Canvas user guides notes that page views are a good approximation of student activity but not an absolute measure (Instructure Community, n.d.). Activity time tracks how long the student interacts with the course, and it is associated with the page views data point.

Participation is measured by Canvas analytics based on the following actions by students:

- Announcements: posts a new comment to an announcement
- Assignments: submits an assignment
- Collaborations: loads a collaboration to view/edit a document
- Conferences: joins a web conference
- Discussions: posts a new comment to a discussion
- Pages: creates a page
- Quizzes: submits a quiz
- Quizzes: starts taking a quiz” (Instructure Community, n.d.).

As the research was designed to measure differences between control and experimental groups of the class, the researcher captured the raw data of page views and participation to capture a continuous variable as opposed to a categorical variable. Since the badging experimental groups were theorized to have increase behavioral engagement.

Pageviews, activity time and participation were tracked at the beginning and the end of the intervention. Academic performance was measured by the Exam 2 performance through the Canvas gradebook function.

Data Analysis

This study displays the mean and standard deviation of students’ responses to the SIMS instrument which includes Intrinsic Motivation, Integrated Motivation, Extrinsic Motivation and Amotivation in Chapter 4. This study used inferential statistics Analysis of Variance (ANOVA) and Multivariate Analysis of Variance (MANOVA) with covariates or MANCOVA, to see changes (if any) between motivation at the beginning and end of the intervention.

Justification for MANOVA

MANOVA is an extension to ANOVA in that it tests differences between groups on multiple dependent variables simultaneously. MANOVA with covariates or MANCOVA was chosen for motivation because of the spectrum of motivation from intrinsic motivation to amotivation. MANCOVA was also chosen for behavioral engagement outcomes that could be extracted from the LMS which included activity time, pageviews and participations. Gathering multiple data points was chosen to better understand the phenomena of being in a gamified accounting course. Treatments can be expensive to implement while multiple dependent variables collected can be relatively inexpensive but can maximize information gain. Pituch and Stevens (2015) note that any worthwhile treatment is going to affect participants in multiple

ways. Moreover, MANOVA statistics include sensitive measurement techniques to understand how students have been affected.

Additionally, this study ran a two-way MANCOVA analysis to identify possible relationships between multiple independent and dependent variables. Two-way MANCOVA statistics were run to control for a continuous, concomitant, independent variable. One two-way MANCOVA had the covariate of cumulative grade point average (CGPA) before the accounting course was taken. Additional covariates based on research done by Bourgonjon et al. (2010) included video game experience and perceptions of video games. Covariates were chosen because they were variables that should theoretically correlate with the dependent variables (Pituch & Stevens, 2015). The first factor tested with three levels was the section of class (Control vs. Experimental participation vs. Experimental skill-based) and factor two was gender with two levels (male and female). Dependent variables included motivation, behavioral engagement (activity time, page views, activity time), and academic performance (grades at week 10). A G power statistic was not run because sample size was approximately thirty for each group, per semester which can allow for a large enough size for analysis of covariance according to Norman (2010). Data collection ensued for two semesters to ensure a large enough sample size in order to analyze the independent variable of gender. Assumptions of ANCOVA were analyzed to see if all assumptions were met including scale of measurement, normality, and homogeneity of variance (Pituch & Stevens, 2015). The following guidelines for the assumptions are as follows:

- **Scale of Measurement:** The dependent variable should be interval or ratio data (Peter & Bennett, 2010). The measurement of the SIMS instrument used an interval scale, behavioral engagement measures used an interval scale and academic performance was on a ratio scale.
- **Normality:** Each group of scores should be approximately, normally, distributed but moderate violations may be acceptable based on how robust the ANOVA analysis is (Norman, 2010).
- **Homogeneity of variance:** There should be approximately equal amount of variability in each set of scores.

For qualitative data analysis, all focus groups were voice recorded with consent of the participants. Voice recordings were transcribed using the software Otter.ai and then checked for

accuracy by the researcher . The verbatim transcript was sent to focus group participants for review/accuracy as a form of member-checking. The researcher transcribed and reviewed the transcript for accuracy. The focus groups lasted 30 – 57 minutes depending on the group size. With the help of MAXQDA software, data was explored to see if there were codes, categories, or themes that linked to the research questions and self-determination theory.

Validity and Reliability

The researcher used reflexivity and an audit trail by commenting in the MAXQDA software to shape research approaches and evidence as data was analyzed as well as to control bias (Ary et al., 2019). Labels or tags that involved highlighting with different colors were assigned as units of meaning and summarized using the qualitative software. After data was coded, the researcher used member checking to ensure internal validity and used thick, rich description to ensure referential adequacy (Ary et al., 2019; Bazeley, 2009; Zohrabi, 2013). Codes were also analyzed by the researcher’s dissertation advisor to provide consensus (Ary et al., 2019).

The SIMS captured the construct types of motivation mentioned above and was administered at the beginning of the badge intervention and at the ending of the badge intervention. To ensure consistency/reliability, the SIMS instrument was validated by Guay et al. (2001) and has been widely used in educational settings. Guay et al. (2001) state that “the SIMS is composed of four internally consistent factors. The construct validity of the scale is also supported by correlations with other constructs as postulated by current theories” (p.175). Furthermore, Guay et al. (2001) studied the SIMS instrument in five independent studies and found the majority of the studies had acceptable to high Cronbach Alpha’s when looking at the subscales of intrinsic motivation, identified regulation, external regulation and amotivation. For self-reported scale instruments, an acceptable range is .70-.80 for research purposes (Nunnally, 1978). The goal of the five studies was to use exploratory factor analysis and to assess the subscales for reliability and construct validity.

To control for situational differences, the sections of the class were taught by the same instructor for two semesters, with the same materials as suggested by Ary et al., (2019). A pre-made script for all three class sections was made to avoid an emphasis on the intervention During all three sections of the accounting course, students were read a script (See Appendix J). The reminder script was read once approximately a week after the intervention started. McGinn

(2018) warns that although students are reassured that participating in an intervention is not required, students may believe that their choices about participating in the research could affect their course grade, their relationship with the instructor, or affect future educational opportunities. Furthermore, McGinn (2018) warns of putting undue influence on students to participate in interventions, as the students' development and advancement in learning should be the first priority. Additionally, Wong (1995) notes that researchers/teachers often have conflicting motives where the instructor is in place to act or shape the students understanding, while the researcher is to observe and capture data around the phenomenon, without disrupting the phenomenon. When an instructor is also the researcher, their behaviors can change "researcher/teachers themselves change during the research progresses as a result of events and actions" (Wong, 1995, p.28). Also, Wong (1995) states "the environment of the classroom and of schools, in general, is extremely complex and unpredictable" (p.28). To minimize undue influence, optional quizzes were listed under the category titled "practice quizzes" and had the wording "This assignment does not count toward the final grade". The gamified activities happened outside of the classroom activities and only the leaderboard was recited in each of the classes in a similar fashion. These aspects along with the pre-made script helped to minimize the risk of having the researcher/teacher to change behaviors during the intervention.

A quasi-experimental design cannot control for all confounding variables (Ary et al., 2019). Statistical conclusion validity was addressed by testing for the normality of data and having a large enough sample size (approximately 30 per group) to run reliable statistical outcomes (Ary et al., 2019). The quasi-experimental design still had possible threats to validity that included the history effect and maturation - especially exponential growth. (Ary et al., 2019; Pituch & Stevens, 2015). The experimenter effect was also a concern as the researcher was also the instructor. Analysis of Covariance helped to lessen the threats to validity by providing partial statistical control over one or more variables, but covariates are not able to equate intact groups (Ary et al., 2019; Pituch & Stevens, 2015). Despite limitations, Pituch and Stevens (2015) argue that with constant vigilance and sound theoretical reasoning, a researcher can have a thorough understanding of ANCOVA's potential benefits despite its limitations.

Summary

The researcher used an embedded or nested, mixed-method study to measure the effect of badges and leaderboards on motivation, behavioral engagement, and academic performance of

students in an undergraduate accounting course. The purpose of this research paper was to help understand more about implementing badging (participation-based and skill-based) and leaderboards within an undergraduate accounting course. Moreover, this study examined different groups by gender. The best practices of gamification are still being identified and this study could shed light on how applying gamification can impact student motivation, behavioral engagement, and academic performance.

CHAPTER 4. FINDINGS

The purpose of this study was to understand the effect of badging in encouraging students to engage in optional quizzes in an undergraduate accounting course. Self-determination theory predicts that adding autonomy and a sense of competence and relatedness will positively influence motivation (Deci & Ryan, 2008), which could lead to positive outcomes in motivation, behavioral engagement, and academic performance. The findings section will be divided by RQ1 and RQ3 first to understand differences between groups followed by RQ2 and RQ4 to understand differences by groups and genders. The RQ1 and RQ3 section includes demographics and descriptive statistics of the covariates.

RQ1 and RQ3: Differences between Groups

RQ1: Is there a difference in motivation, behavioral engagement, and academic performance between students who were in the control group and the badging experimental groups (participation-based or skills-based badge intervention)? (QT)

RQ3: How do students in the experimental groups (participation-based badges, skill-based badges), perceive that the badging intervention influenced their motivation, behavioral engagement, and academic performance? (QL)

Demographics

This study covers two semesters (Fall 2022 and Spring 2023) of an introduction accounting course. Of the 202 students who were enrolled across the six sections of the course, 177 students (88%) completed the survey at the beginning of the intervention (covariate data gathered). The gender breakdown of the 177 students included 103 female (58%) and 74 male (42%) students. Of these 177 students, 156 (77%) students completed the survey both at the beginning and the end of the intervention (motivation data gathered). The gender breakdown of the 156 students included 92 (59%) female and 64 (41%) male students. For the qualitative data, a total of 30 focus group participants were included in the data collection with 13 students from the participation badge group and 17 students from the skills-based badge group.

Descriptive Statistics for Covariates

The following variables were used as a covariate based on factors that are associated with motivation in a gamified learning experience which include cumulative GPA, game learning

opportunities, game experience, and game preferences. Covariates are used in the analysis to control for pre-existing achievement and game preferences. The mean cumulative GPA was similar for each of the groups ranging from ($M = 3.53$, $SD = .44$) in the control group to ($M = 3.59$, $SD = .44$) in the skills-based badges group. Table 4.1 shows the combined cumulative GPAs for all students in the same groups across both semesters of data collection.

Table 4.1

Cumulative GPA by Group

Group	<i>n</i>	<i>M</i>	<i>SD</i>	Minimum	Maximum
Control	56	3.53	0.44	2.00	4.00
Participation badges	62	3.53	0.48	1.30	4.00
Skill-based badges	59	3.59	0.44	2.05	4.00

Students were surveyed to understand game learning opportunities, game experience, and game preferences. Examples of questions asked included: video games offer opportunities to experiment with knowledge, I describe myself as a gamer, and I would vote in favor of using video games in the classroom. Table 4.2 shows the video game responses by group. This study used scaled questions (ranging from 0-100) as a covariate to control for these experiences/perceptions. The questions were scaled on a 0-100 basis because covariates are traditionally measured on a continuous scale instead of a categorical scale (Pituch & Stevens, 2015). All groups had similar means for: game learning opportunities, game experience, and game preference. The participation badges group had a slightly lower mean in terms of game learning opportunities. The control group had lower means in game experience and game preferences.

Table 4.2*Preference and Experience for Video Games by Group*

Group	Variable	<i>M</i>	<i>SD</i>	Minimum	Maximum
Control	Game Learning Opportunities	69.85	21.39	9.43	100.00
	Game Experience	27.06	26.39	0.00	95.00
	Game Preference	41.48	32.58	0.00	100.00
Participation badges	Game Learning Opportunities	67.62	20.64	9.86	100.00
	Game Experience	34.73	27.12	0.00	99.80
	Game Preference	55.95	27.91	0.00	100.00
Skill-based badges	Game Learning Opportunities	70.97	19.16	27.14	100.00
	Game Experience	35.17	29.54	0.00	100.00
	Game Preference	51.94	32.20	0.00	100.00

Assumptions for Running an ANOVA

Assumptions for ANOVA include the scale of measurement, normality, and homogeneity of variance. The assumption of scale of measurement was met with the SIMS instrument.

Normality: Normality was checked by examining the Kolmogorov-Smirnov test for $n \geq 50$ where the null hypothesis is that data will create a bell-curve shape or will be normally distributed. This study did not test for normality on perception data as perception data is not often normally distributed and because each group had a minimum of 50 observations. ANOVA analysis is also a rigorous test that can overcome the violation of the normality assumption with large enough sample sizes. Norman (2010) argues that ANOVA statistics have a history of being robust enough to overcome normality assumption violations with supporting studies dating back to the 1930s. In short, this study did not test for normality in motivation variables. Moreover, Sainani (2012) notes that there are many types of data that are not normally distributed such as alcohol or coffee consumption. These variables would probably be right skewed instead of bell shape, with a large number of low to moderate consumers while a much smaller number of individuals that would be classified as heavy consumers and outliers in excessive drinking.

Behavioral engagement and academic performance variables were tested for normality. All behavioral engagement variables violated the normality assumption when examining the Kolmogorov–Smirnov test. As such activity time and pageviews were transformed using

logarithmic transformation so that they were normally distributed according to the Kolmogorov–Smirnov test. The number of times a student participates on the LMS was excluded from the analysis as the intervention only allowed for 28 optional quizzes or 28 more times to participate. With only 28 more opportunities to participate, this variable had minimal variability, while pageviews seemed to be a more robust measure of how students interact with the LMS. As such, the participations variable was excluded from inferential statistical analysis, but descriptive statistics will be included.

Homogeneity of variance: Homogeneity of variance was not violated in running the two-way MANCOVA statistics. The Box's Test of Equality of Covariance Matrices and Levene's Test of Equality of Error Variance was reviewed and contained no significant values.

Selection of Covariates

The selection and inclusion of covariates in the statistical procedures were based on previous studies examining their effects on gamified learning experiences. To understand the relationship between covariates and the outcome variables, a Pearson's r correlation was run. Covariates that were significantly correlated ($p < .05$) to the outcome variable were used in subsequent analyses. For example, cumulative GPA and game preferences were not significantly related to motivation, and therefore these covariates were not included in the analyses. Game experience and game preferences were significantly correlated to pageviews (an outcome measure). Game experience was significantly correlated to activity time. Cumulative GPA and game preferences were significantly correlated to Exam 2 percentages. See Table 4.3 for more information about covariates

Table 4.3*Correlation Between Covariates*

Variables	1	2	3	4	5	6	7	8	9	10
1. Cumulative GPA	--									
2. Game Learning Opportunities	0.06	--								
3. Game Experience	0.03	.25**	--							
4. Game Preference	.18*	.33**	.45**	--						
5. Intrinsic Motivation	-0.15	-0.08	0.02	-0.07	--					
6. Integrated Regulation	-0.09	-0.02	0.10	0.02	.35**	--				
7. Extrinsic Regulation	0.00	-0.07	0.09	-0.07	.18*	0.06	--			
8. Amotivation	0.02	-0.06	-0.08	-0.07	0.06	-0.08	.44**	--		
9. Pageviews	0.03	-0.07	-.21**	-.17*	0.00	-0.11	-0.04	0.04	--	
10. Activity Time	0.10	0.09	-.17*	-0.06	-0.11	-0.09	-0.05	-0.07	.70**	--
11. Exam 2 percentage	.44**	0.04	0.01	.20**	-0.14	-0.02	0.00	-0.07	.17*	.21**

* $p < .05$. ** $p < .01$.

Note. Motivation variables (n = 156) all other variables (n = 177)

Motivation by Group

At the beginning of the intervention in week 5, students rated intrinsic motivation and integrated regulation at a high average across all sections with intrinsic motivation at ($M = 4.48$, $SD = 1.61$) and integrated regulation at ($M = 5.78$, $SD = 1.16$). Extrinsic motivation had an average result across all sections with a mean of 3.8 ($SD = 1.58$). Amotivation was rated low with a mean of 2.54 ($SD = 1.39$). See Table 4.4. A preliminary ANOVA analysis was conducted to understand if there were differences between groups at week 5. All groups (Control, Participation badge, Skill-based badge group) had similar means, with no significant differences at that time point. At the end of the intervention in Week 10, the average of across all sections indicated very similar results with an above average score in intrinsic motivation ($M = 4.58$, $SD = 1.57$) and integrated regulation ($M = 5.71$, $SD = 1.20$). Extrinsic motivation had an average result across all sections ($M = 3.52$, $SD = 1.57$) and students reported low amotivation ($M = 2.62$, $SD = 1.44$). An ANOVA analysis was conducted to understand if there were differences between groups at week 10. All groups (Control, Participation badge, Skill-based badge group) had similar means, with no significant differences at that time point. Week 5 scores were also used as a covariate and an ANCOVA analysis was conducted to see if there were significant differences between groups at week 10, but no significant differences were noted.

When calculating the change (Week 10 less Week 5), students maintained much of the same levels of motivation with only minor (not significant) changes across all groups. A multivariate analysis of variance (MANOVA) revealed no significant differences between groups $F(8, 300) = .748$, $p = .649$, Wilks' $\Lambda = .961$. Because MANOVA was not significant, no follow-up univariate ANOVA was necessary. To answer part of RQ1, no difference in motivation was noted between groups.

Table 4.4*Average Motivation Score by Group*

Motivation Construct	Week 10 <i>M (SD)</i>	Week 5 <i>M (SD)</i>	Change IM <i>M (SD)</i>
Intrinsic Motivation			
Control	4.86 (1.54)	4.64 (1.46)	0.22 (0.81)
Participation Badge	4.42 (1.62)	4.27 (1.84)	0.15 (1.14)
Skill-based Badge	4.50 (1.55)	4.54 (1.49)	-0.05 (1.07)
Total Change	4.58 (1.57)	4.48 (1.61)	0.10 (1.02)
Integrated Regulation			
Control	5.74 (1.21)	5.85 (1.08)	-0.11 (0.87)
Participation Badge	5.50 (1.26)	5.63 (1.31)	-0.13 (1.07)
Skill-based Badge	5.89 (1.11)	5.86 (1.08)	0.03 (1.11)
Total Change	5.71 (1.20)	5.78 (1.16)	-0.07 (1.02)
Extrinsic Regulation			
Control	3.52 (1.45)	3.93 (1.58)	-0.41 (1.17)
Participation Badge	3.64 (1.52)	3.76 (1.59)	-0.13 (1.30)
Skill-based Badge	3.41 (1.72)	3.71 (1.59)	-0.30 (1.42)
Total Change	3.52 (1.57)	3.80 (1.58)	-0.28 (1.30)
Amotivation			
Control	2.46 (1.38)	2.52 (1.47)	-0.06 (1.40)
Participation Badge	2.80 (1.41)	2.57 (1.28)	0.23 (1.16)
Skill-based Badge	2.58 (1.52)	2.50 (1.43)	0.08 (1.24)
Total Change	2.62 (1.44)	2.53 (1.39)	0.09 (1.26)

Note. Sample size Control ($n = 48$), Participation Badge ($n = 52$) Skill-based Badge ($n = 56$)

RQ3: How do students in the experimental groups (participation-based badges, skill-based badges), perceive that the badging intervention influenced their motivation, behavioral engagement, and academic performance? (QL)

Information about the experience of receiving badges, that was extracted from focus group participants, was summarized into five themes which included all four types of motivation (intrinsic motivation, integrated regulation, extrinsic regulation, and amotivation) and a change in motivation or a novelty effect. Students experienced a range of different motivations. This wide range of the types of motivation could support why no significant changes were noted with the four motivation constructs from the beginning to the end of the intervention. See Table 4.5 Students from the participation badges and skills-based badge groups had congruent focus group findings around motivation.

Table 4.5

Types of Motivation Experienced by Students

Themes	Categories
Intrinsic motivation	Interesting, creative, entertaining, fun
Integrated regulation	Enjoys challenges and aligns to gamer identity
Extrinsic motivation	Recognition/Positive Feedback
Amotivation	Frustration Confusion/Unfamiliarity
Change in motivation	Novelty effect then discouragement

Intrinsic Motivation (Interesting, Creative, Entertaining, Fun)

Some from both groups (participation badge, skill-based badge) noted that the badges were interesting/creative and entertaining/fun. One student noted that optional quizzes were more rigorous than regular reading assignment homeworks, but entertaining, which could indicate that the task was optimally challenging. Another student found badges more motivating than reading the textbook. Finally, one student commented on the surprise of seeing new elements of badges and leaderboards within the LMS of Canvas.

One way **I want to get a badge, it's a motivation**. Like, I know, it really nothing effects your final grades, but it's interesting, just you get one more badge. I don't know why I, it just like kind of interesting...I'm actually thinking, it's interesting that ultimately, quizzes, those badges, are harder to obtain than, the reading assignments. Because **those are more challenging** and you have to, really read through the reading materials in order to understand the concept of those questions. **I feel like it's actually, well, entertaining**. (Participant 2, Male 2, Participation Badges)

Badges are like, really fun because it's different. Like I have not taken a class that use the same method of doing it and it just makes it more fun. It's kind of what you said like get a little game. **I think playing it as a game is more motivating and attracting than just read the book** (Participant 11, Female 6, Skill-based Badges)

Because I feel like we just go into Canvas. You know we go through Canvas, you know there's nothing new. So I think **I would recommend this to teachers to improve – badges and leaderboard, you just to keep that sense of motivation**. (Participant 23, Male 12, Skill-based Badges)

Integrated regulation (Enjoys Challenges and Aligns to Gamer Identity)

A handful of students expressed that they loved challenges and even identified themselves as “a gamer” (Participant 7, Male 4, Skill-based Badges). This gaming identity seemed to encourage students to complete more optional quizzes. Students seemed to align their

identities to the task which implies integrated regulation. “I love challenges. And so I kind of forced myself to do it” (Participant 5, Female 3, Participation Badges).

Extrinsic Motivation (Recognition/Positive Feedback)

Students commented that they enjoyed the recognition for their efforts via email. Further, the feedback email was more exciting and comforting instead of stressful feedback from a teacher.

I would say it got me motivated, to take to do the exercise. Because not only that, but like, knowing that there there's **some recognition...** Because I would wake up to the alarm, to the notification on my phone from the [badge] emails. I'll be like. Oh, that's early, but then...I was like, Yeah, **somebody saw my work like my effort** (Participant 4, Female 2, Participation Badges)

Looking at other grades are kind of depressing. When I see, “you earned a badge” it’s like, okay, let’s check it out...It’s much more **comforting to check emails and see it says “you earned a badge”** instead of “your assignment has been graded”. It’s kind of hectic looking at it.” (Participant 3, Male 3, Participation Badges)

Amotivation (Frustration)

Both the participation based badge group and the skill-based badge group reported frustration or amotivation, as they felt the leaderboard was more fictional, or not “real-life” and that it had no real impact on the course grade. Other students commented that they did not see the badge often and that it was a digital prize that was only made of pixels instead of tangible substance.

Some sort of reward or credit on the badge ...they **don’t have any effect on your score...** Oh, I got one hundred. I got a good badge first day, then after that I think people got used to it, and they were like “Oh, it's not part of my grade”. I'm not gonna do the optional quiz but at the same time I think if it's part of the grade, they'll be happy if it's like, “Oh, I got a good badge today”. It all depends on if it's **connected to the grade...** “oh, it's just for yourself” (Participant 8, Male 5, Skill-based Badges)

[It] doesn't really affect my grade, and it's just there, we don't really see it. Yeah, it's just there...It's optional. **There's no great value to it.** (Participant 18, Female 9, Participation Badges)

I mean, the badges, I don't think I would use it as much because it's just like, a digital little badge. I mean, does that have any physical meaning or property that it's something it's not something I would go off to show, it's nothing special. It's nothing I actually look at. Like, it's comparing that to like getting an actual trophy, I guess. You know, you show a trophy, but **you don't show a digital prize because it's just pixels.** (Participant 14, Male 6, Participation Badges)

Amotivation (Confusion with Intervention or Unfamiliarity)

A handful of students noted that they felt there was a miscommunication of expectations with the badges and leaderboard. A couple of students could not find their name on the leaderboard, some had never experienced badges or leaderboards before, and a few were unsure of how the leaderboard was created.

It only said, your pseudonym, at least like once, or doesn't say it every time? I'm not, I could be wrong, but like, because I'll do them. And it just doesn't affect me, the badges, or the leaderboard. That's cool. But if I can't, **if I have no idea where I am on the leaderboard, because I don't know my name, why do I really care?** I do it for the practice. (Participant 14, Male 6, Participation Badges)

“The badge? I didn't don't really know, **which one is the badge,** I just receive a badge, okay” (Participant 17, Male 11, Participation Badges).

I may not have been paying attention when [teacher] explained but they, I guess for me, **there was like a miscommunication...** So like I said before, like knowing how it works, kind of where it ends up, where the points go, Yeah, because [teacher] will be like, oh, everyone's 12, or 21 I'm like, what does that mean? How does that line up really? But like, maybe that doesn't need to be like a verbal thing that is on Canvas. (Participant 22, Male 8, Skill-based Badges)

Change in Motivation (Novelty Effect then Discouragement)

Some students, especially from the skills-based badge group, noted they enjoyed competition and challenging themselves, but they had fallen behind on the leaderboard and so they stopped doing the quizzes. Further, they started to focus on compulsory assignments or grades more than optional assignments.

I thought it was fun and interesting, it kind of motivated us in a way to do the quizzes and our assignments, at the beginning of it, I was really motivated to do it. But then kind of towards the end, **I kind of got kind of too busy.** And when I said optional, I was like, oh, I don't really have to do it. **So, it kind of changed over time.** (Participant 12, Female 7, Skill-based Badges)

With my experience, the first one I was kind of excited for because it was like a competition, and I'm someone competitive, you know. But then there was one day when it had like, six of them due all at once. And because they were optional, I was like, it doesn't affect my grade. So, I'll do one of them. But I didn't do the other ones. And then I fell off the leaderboard. **Like I wasn't one of the top spots. So, I was like ah, then motivation left after that...**it didn't affect my grade. So, it wasn't essential, right, (Participant 26, Male 15, Skill-based Badges)

Yeah, I guess the same thing for me. At first, it was really interesting, because you get to **you get to challenge yourself on the next chapter. But just like [participant] said, the beginning part was really exciting.** Then just like bunch of stuff going on the same time for like, you lost track, and then you just decided not to do it anymore. (Participant 27, Male 16, Skill-based Badges)

Overall, heterogenous findings were noted in terms of the motivation outcome.

Behavioral Engagement by Group

The variables for behavioral engagement were participations, activity time, and pageviews as defined in the methods and assumptions section. See descriptive statistics in Table 4.6. The participation badge group had the highest number of quizzes attempted, activity time, and pageviews. A MANCOVA was used with the outlined covariates. Findings showed no significant differences between groups on activity time and pageviews, $F(4, 350) = 1.795, p = .129$, Wilks' $\Lambda = .960$. Because MANOVA was not significant, no follow-up univariate ANOVA was necessary.

Table 4.6

Behavioral Engagement Measures by Group

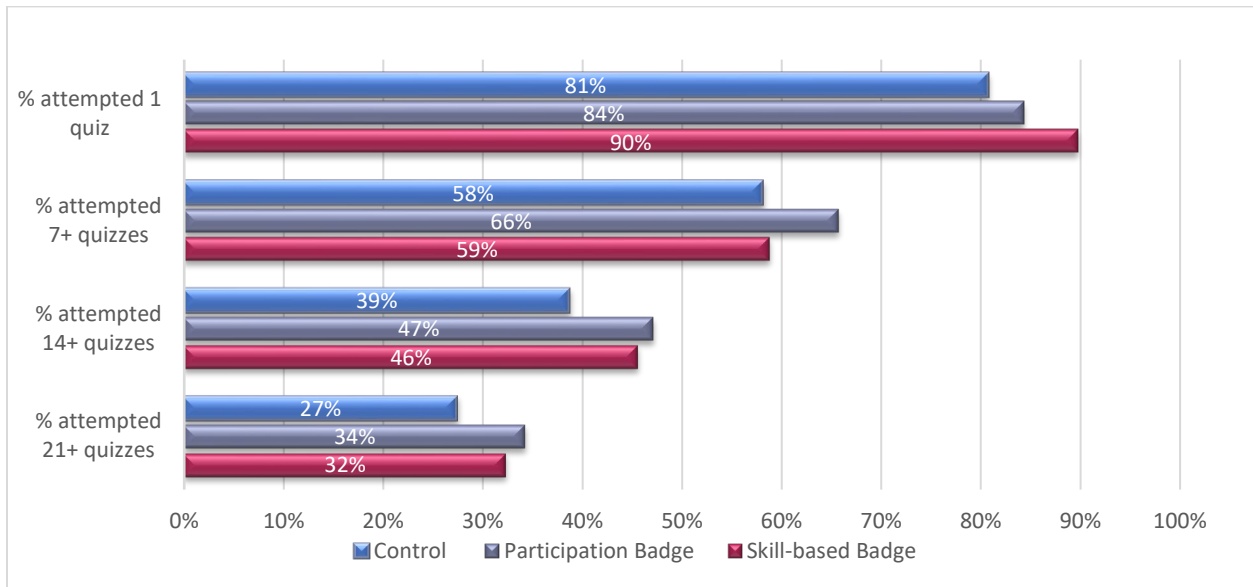
Group	<i>n</i>	Participations (Quiz Attempts) <i>M (SD)</i>	Activity time in hours (h) <i>M (SD)</i>	Pageviews <i>M (SD)</i>
Control Total	56	12.4 (10.4)	11.0h. (11.3h.)	613 (658)
Participation	62	14.4 (10.5)	11.5h. (12.9h.)	717 (765)
Skills-based	59	13.6 (10.6)	9.5h. (6.7h.)	606 (393)
Total	177	13.5 (10.5)	10.7h. (10.6h.)	647 (625)

Note. Maximum Participations (Quiz Attempts) was 28 quizzes

Participations did not meet the normality assumption and so descriptive statistics were calculated. More specifically, participations were broken down to optional quiz taking patterns. The percentage of the number of quizzes attempted by students, by group, was calculated with the maximum number of optional quizzes at 28. See Figure 4.1 for optional quiz participation information.

Figure 4.1

Attempted Quiz Participations by Group



Over 80% of students in all groups attempted at least one optional quiz. Seven quizzes were created for each chapter. Around 60% of students completed seven or more quizzes, 38%-45% of students completed 14 or more quizzes and about 30% of students completed 21 or more quizzes. Students completed fewer quizzes as the weeks went on across all groups. Qualitative findings were mixed around behavioral engagement with students reporting within the two themes of either positive or no effects from the badges. Particularly female students commented more on the leaderboard aspect of the intervention, while male students tended to specifically mention or “hone in” on the badges. See Table 4.7.

Table 4.7

Themes about Behavioral Engagement

Theme	Categories
Positive effect on behavioral engagement	Learning Content Chunking/tracking progress
No effect on behavioral engagement	Did not have time to participate No value of the badge, did not look at badges

Learning Content

Some students reported that the badges helped them to prepare for class as they better understood what was being taught in class and it also helped with accounting equations and learning vocabulary, or accounting jargon.

Having it be in line with what's being taught in class, because **it's kind of like a warm-up** for what you're going to talk about in class about us. So, you don't walk in, like, you don't know what's going on. But if you took the quiz, you do know what's going on? You kind of understand the word she's using. What the vocab like. Yeah, there's, certain words. (Participant 22, Male 9, Skill-based Badges)

The good thing about the badges is that you just had to go look into the textbook, open it up, pull it up to the equations and specific things. You can use other things as a resource, and it just opens up and you can start working on it. **The badges help because it helps familiarize us with what we recall in class and accompanying jargon.** (Participant 3, Male 3, Participation Badges)

Chunking/Tracking Progress

Others mentioned that it helped with chunking material and tracking progress.

There are a lot of steps I have to work on in the accounting class. If you split it up into different parts and the badges, it's actually telling me which part I need to work on more and which parts I am good at. For me, I actually pay attention to those badges. Oh, I know I need to work on my costs of good sold because the name of this badge is learning about how to calculate costs of good sold (Participant 2, Male 2, Participation Badges)

Did not Have Time to Participate

A large number of students lamented the time constraints of being a student. Although they might have wanted to participate in optional quizzes, they got off work late at night and only had a few hours to finish their assignments. They prioritized assignments that had course points over the optional assignments.

I mean, it's not that they are hard. It's just, for example, most of the time, or like people that work fairly often, we don't have too much time to review the assignment because we get off around 7:00, or like people that work at [workplace], we get off around like 9:00. **The due date is always until Midnight, so it's only like three or four hours until the assignment is overdue.** (Participant 8, Male 5, Skill-based Badges)

I'm at work trying to finish some other homework that's crucial compared to an optional quiz. Or a couple of times **I've had to skip it simply because it's 12 o'clock at night and I want to go to bed.** So even if it's optional in the end, so it doesn't matter if I do it, right. (Participant 15, Male 7, Participation Badges)

I don't often do the optional quizzes, but I'm also just like busy - I have a lot of homework on like Tuesdays and Thursdays and it's like, I do everything else first. If I need to do the optional quizzes, I do. (Participant 29, Female 13, Skill based Badges)

No Value of the Badge/Did not Look at Badges

Many students acknowledged the value of having the optional quizzes aligned to graded, in-class quizzes but did not see the value of the badges alone. Others noticed that badges were awarded through email, but they did not view their badges often. Supporting quotes were given in the “amotivation” theme listed above in motivation findings.

Exam 2 Academic performance by group

The control group had exam 2 percentage scores of 64.68 ($SD = 23.46$). Participation badge group scores were 66.29 ($SD = 22.46$) and skill-based badge group scores were 70.00 ($SD = 19.38$). An ANCOVA statistic was performed for exam 2 percentage by group. No significant differences were noted in the dataset between groups $F(2, 174) = .656, p = .520$. A small number of students remarked on the positive effect on academic performance outcomes. Qualitative findings included students explaining that optional quizzes were closely aligned to weekly, graded, in-class quizzes, but only a handful of students brought up the quizzes when preparing them for exam.

My experience with badges was that it really helps. It has really helped me in terms of **answering questions in quizzes** and helps me to help myself through the questions that I am asking and helps me to understand basic concepts about what accounting is really about. (Participant 24, Male 13, Skills-based Badges)

It makes us invest using those optional quizzes to learn more, and we will see that for the upcoming exam. So, if that will work or not... It will help you on the coming exam. It works in the ways because if you for example, last week, if you did the optional quiz. It was in the quiz last Monday, last Monday. So, I feel proud of myself, like, Okay, I know this, I feel comfortable, I feel so easy that I can do this. (Participant 22, Male 9, Skill-based Badges)

To summarize RQ1 findings, badges maintained motivation with no significant increases. Students experienced a range of different motivations. No significant differences were noted between groups for behavioral engagement or academic performance. Qualitative findings from RQ3 support quantitative findings.

RQ2 and RQ4: Differences between Genders

The last two research questions of this study were:

RQ2: Are differences in motivation, behavioral engagement, and academic performance moderated by gender? (QT)

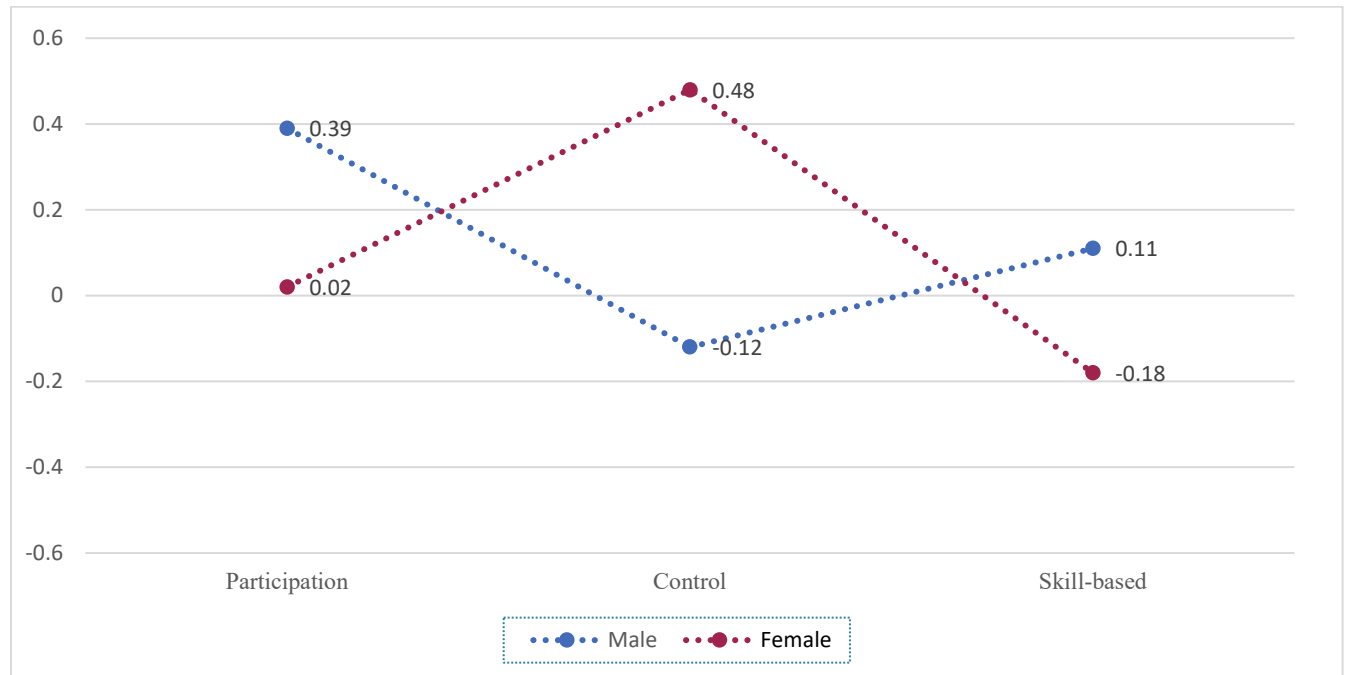
RQ4: How do students with different genders perceive that badging influenced their motivation, behavioral engagement, and academic performance? (QL)

To understand if gender impacted outcomes, a two-way MANOVA was performed on all motivational constructs (IM, IR, ER, AM). No statistically significant results were noted, $F(8, 294) = 1.816, p = .074$, Wilk's $\Lambda = .908$, but the two-way ANOVA of individual constructs indicated that Intrinsic Motivation (IM) and Amotivation (AM) had statistically significant findings. More investigation of the outcome showed a non-significant main effect of independent variables (group and gender), but a significant interaction between independent variables $F(2, 153) = 3.419, p = .035$. For the change in Intrinsic Motivation (captured at the beginning and end of the intervention), a positive change would mean an increase in intrinsic motivation and a desirable result. See Table 4.8 for descriptive statistics. Figure 4.2 depicts the comparative graph for marginal means. The interaction effect (crossing lines) in Figure 4.2 occurs between the participation badge group and the control group and the control group versus the skill-based badge group. An inspection of the mean scores indicated that the participation badge group, males increased in intrinsic motivation ($M = 0.39, SD = 0.94$) and the skills-based badge group males also increased in motivation ($M = 0.11, SD = 1.07$) while the control group males decreased in motivation ($M = -0.12, SD = 0.80$). Alternatively, the control group females increased in intrinsic motivation ($M = 0.48, SD = 0.73$) while experimental groups had smaller, less noticeable changes. Although the interpretation of the interaction of variables may not yield clear conclusions, significant evidence shows that the combined influence of group and gender plays a significant influence on intrinsic motivation within a gamified accounting course. This finding is interpreted as, at the end of the intervention, the males had higher intrinsic motivation in experimental groups compared to males in the control group. Conversely, the control group females had greater intrinsic motivation than experimental group females.

Table 4.8*Intrinsic Motivation by Group and Gender*

Group and Gender	<i>n</i>	Week 10 <i>M (SD)</i>	Week 5 <i>M (SD)</i>	Change <i>M (SD)</i>
Control Total	48	4.86 (1.54)	4.64 (1.46)	0.22 (0.81)
Female	27	5.14 (1.65)	4.66 (1.69)	0.48 (0.73)
Male	21	4.50 (1.33)	4.62 (1.15)	-0.12 (0.80)
Participation Badge Total	52	4.42 (1.62)	4.27 (1.84)	0.15 (1.14)
Female	34	4.47 (1.59)	4.45 (1.83)	0.02 (1.22)
Male	18	4.32 (1.72)	3.93 (1.87)	0.39 (0.94)
Skill-based Badge Total	56	4.50 (1.55)	4.54 (1.49)	-0.05 (1.07)
Female	31	4.27 (1.76)	4.45 (1.64)	-0.18 (1.07)
Male	25	4.77 (1.24)	4.66 (1.30)	0.11 (1.07)
Grand Total	156	4.58 (1.57)	4.48 (1.61)	0.10 (1.02)

Note. Change is calculated by taking the mean at week 10 less the mean at week 5

Figure 4.2*Estimated Marginal Means of the Change in Intrinsic Motivation*

Mixed results in Motivation with the Interaction of Groups and Genders

Control group participants were not interviewed, and so no qualitative data was collected on this group. For the males in the experimental groups, one theory is that competition can bring out intrinsic motivation with immediate, relevant feedback and optimal challenges (Reeve & Ryan, 2021). With the challenges given, males students may have experienced task-orientation behaviors. Task orientation often called “task mastery” is aligned to intrinsic motivation or that individuals describe their efforts in learning as an improvement in an ability or skill (Jagacinski & Strickland, 2000). The extrinsic motivators of the badge and leaderboard seemed to be supplemental or accessorial to the goal of learning, but still nice to see. Many male participants said that taking the optional quizzes was more about learning the content and making sense of the material. Additionally, some male participants noted that the quizzes gave a pattern or example to follow for required homework assignments and that allowed for more confidence in class and more confidence to do the assignment on their own.

It makes me feel that I accomplished the things because I can see my name on the leaderboard. Oh! I did it. There's my name. **But the studying is more like the main focus to do the optional quiz, but also the badges. It's not a main reason** (Participant 1, Male 1, Participation Badges)

Doing a quiz and read the optional quiz, or any exercise during the class and make it for me like make it sense. For my feeling. It's satisfying to me, this is how I know it's rewarding to me. (Participant 17, Male 11, Participation Badges)

But like receiving an email. That's kind of cool. And they're [badges] like, stylish, you know...but **I only really liked the optional quizzes because it helps you with the class...The learning part of it.** Yeah. Just, like **even if there were no badges, and leaderboard, I'd still do the optional quizzes,** because I need help in the class. (Participant 16, Male 10, Participation Badges)

It's just extra practice because while I may not be getting feedback, I won't get feedback on the actual homework until the next class period. **I can get feedback on this immediately and then apply that to the homework** (Participant 14, Male 6, Participation Badges)

It really helps me like, and I know it's an optional quiz, I don't care about grades, it's not already included in the GPA with the grade that we have. **But it helps me create a lot of samples. It gives you a pattern and a sample of how we might be able to do my homework.** Instead of going more often to the TA and ask them. So at least I can see the samples over there and then compare and contrast. Or when I need to do what would I or,

you know, the, you know, **the process of doing the formula**, or a different problem. It's more about for me the sample (Participant, Male 9, Skill-based Badges)

Another significant outcome was the change in amotivation for the interaction between group and gender. A decrease is a positive change as students do not feel helpless or have an apathy towards the activity/assignment. Males in the control group had a large decrease in their amotivation ($M = -2.19, SD = 5.60$) which is a good thing, implicating that students do not feel apathy toward the activity or perceive that the activity is useless.

The results show $F(2, 153) = 3.485, p = .033$ compared to the participation badges male group that had a large increase in amotivation ($M = 2.00, SD = 4.50$). An increase in amotivation is a negative outcome in terms of motivation. Table 4.9 presents and Figure 4.3.

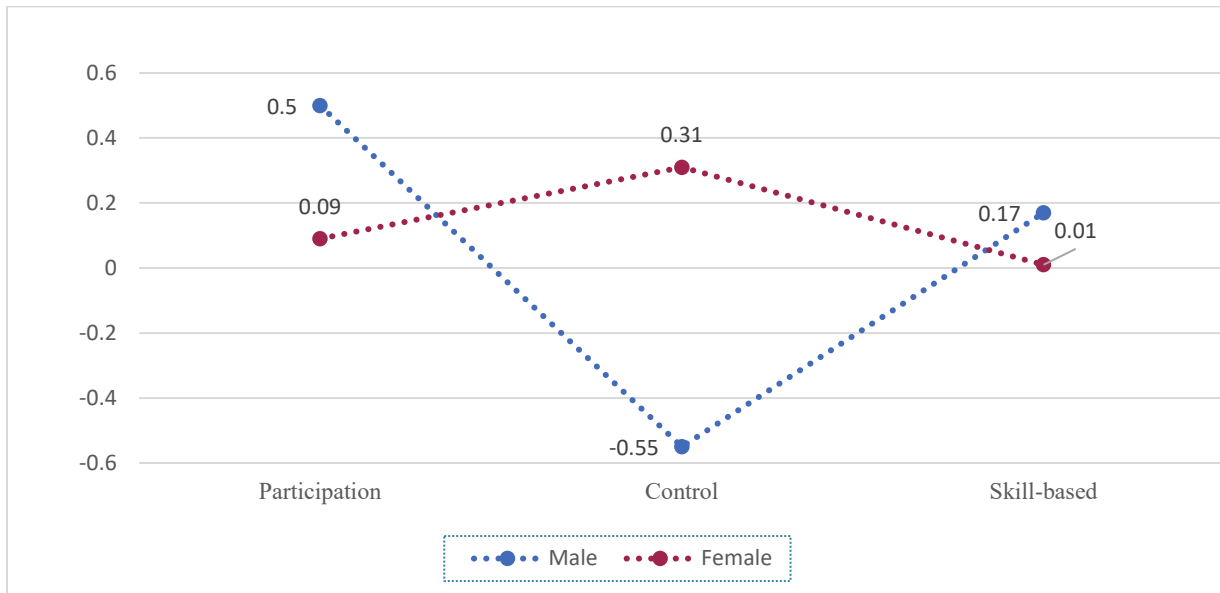
Table 4.9

Change in Amotivation by Group and Gender

Group and Gender	<i>n</i>	Week 10 <i>M (SD)</i>	Week 5 <i>M (SD)</i>	AM <i>M (SD)</i>
Control Total	48	2.46 (1.38)	1.47 (2.52)	-0.06 (1.40)
Female	27	2.23 (1.24)	0.87 (1.92)	0.31 (1.30)
Male	21	2.75 (1.52)	1.72 (3.30)	-0.55 (1.40)
Participation Badge Total	52	2.80 (1.41)	1.28 (2.57)	0.23 (1.16)
Female	34	2.60 (1.42)	1.41 (2.51)	0.09 (1.18)
Male	18	3.17 (1.36)	1.03 (2.67)	0.50 (1.12)
Skill-based Badge Total	56	2.58 (1.52)	1.43 (2.50)	0.08 (1.24)
Female	31	2.18 (1.32)	1.33 (2.17)	0.01 (1.12)
Male	25	3.09 (1.62)	1.46 (2.92)	0.17 (1.40)
Grand Total	156	2.62 (1.44)	1.39 (2.53)	0.09 (1.26)

Figure 4.3

Estimated Marginal Means of Change for Amotivation



This intervention gave students participation badges based on completing optional quizzes. Deci et al. (2001) caution against giving completion-contingent rewards as these rewards can undermine intrinsic motivation. The reward itself carries little to no competence confirmation and so students are not likely to perceive competence. Without the perceived competence of knowing the accounting content and doing well on in-class quizzes, students can feel the negative effects of instructor control that the reward brings which might increase amotivation (Deci et al., 2001). A handful of males, from the participation badges focus group noted that the leaderboard was not a true representation of content knowledge as the number #1 spot was given to all students after completing the optional quizzes without any level of competency. Additionally, students noted that even though they did not get the score they wanted on optional quizzes, students were still rewarded with the leaderboard placement. Some indications of “ego orientation” were expressed. Ego orientation is when students assess their performance based on the rest of the class, which creates social comparison and the desire to win (Jagacinski & Strickland, 2000). This desire includes the feeling of being better than other participants and is often associated with negative behaviors such as lack of effort, persistence, and performance (Jagacinski & Strickland, 2000).

I think the primary purpose of a leaderboard is meant **to compare you to other people in your class**. And I don't want to say like, oh, that sounds negative, I actually think that's a good thing to compare yourself to other people...to the people who maybe are not scoring as well, they look at the leaderboard, and say, I'm not doing as good as the **rest of the people in my class. It gives them an opportunity to self-evaluate**...It just gives you the completion. So, everyone who did the quiz for that chapter, **everyone's in first...As long as you did all of them, you still get all the credit, even if maybe you missed every single one**. So, it may not always be an accurate representation of where you are at in the class. (Participant14, Male 6, Participation badges).

In the sense of, if I was a teacher, I wouldn't use the system at all in its current format. There's no benefit to the student. I guess it's all automated that just automatically sends it so don't waste my time as a teacher but, I don't really see like a large benefits for students except for being able to do **quantitate themselves in a sense of where do I stand with the rest of my class**. But like I said, in its current system, that's really not possible...It just gives you the completion. **So, everyone who did the quiz for that chapter, everyone's in first...There's just no point** (Participant 15, Male 7, Participation badges).

Overall, no significant differences were found between the students' beginning and end of the interventions' Situational Motivation Scale when examining them by group, but when disaggregating the data by group and by gender, differences were displayed with the interaction between group and gender on the constructs of intrinsic motivation and amotivation.

Behavioral Engagement and Academic Performance by Gender

The variable of participations was disaggregated to number of quizzes attempted out of twenty-eight quizzes. Furthermore, behavioral engagement and academic performance measures including activity time, pageviews and exam 2 percentage were examined. See Table 4.10.

Table 4.10*Behavioral Engagement Descriptive Statistics by Group and Gender*

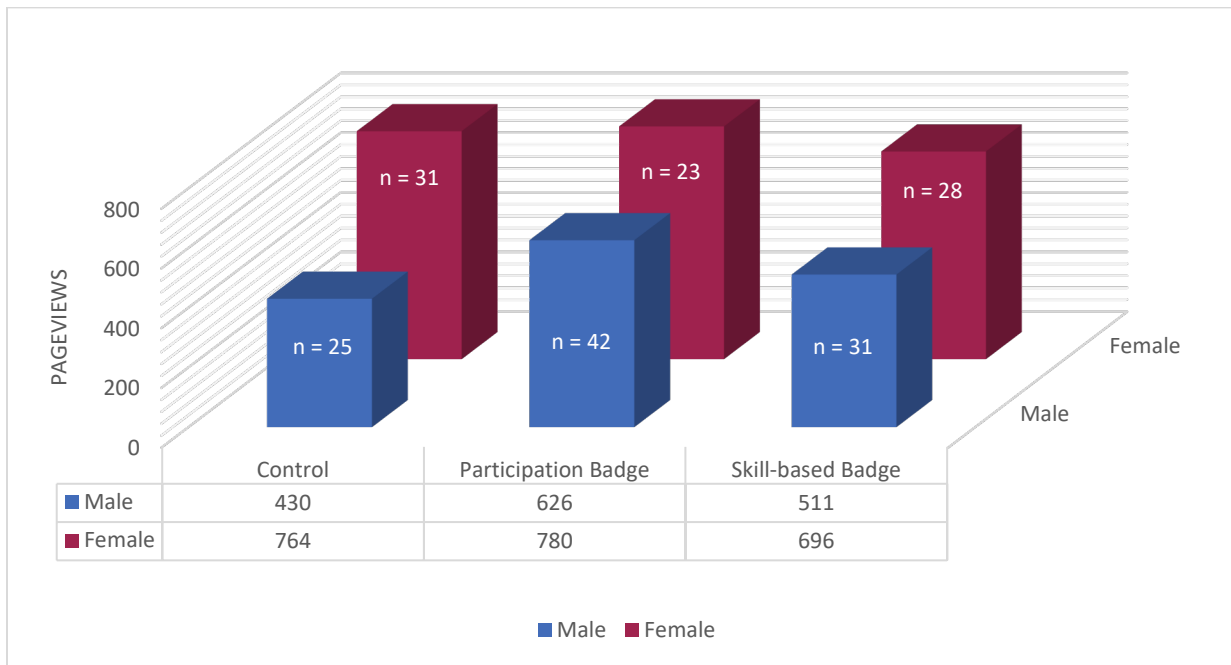
Group	<i>n</i>	Quiz	Activity time in hours (h)	Pageviews	Exam 2 %
		<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Control Total	56	12.4 (10.4)	11.0h. (11.3h.)	613 (658)	66.6 (21.5)
Female	31	14.0 (10.0)	12.9h. (13.9h.)	764 (770)	65.9 (20.9)
Male	25	10.4 (10.6)	8.7h. (6.9h.)	430 (437)	67.3 (22.7)
Participation	62	14.4 (10.5)	11.5h. (12.9h.)	717 (765)	67.4 (20.9)
Female	42	16.5 (10.1)	13.6h. (15.1h.)	780 (769)	69.7 (19.6)
Male	23	11.5 (10.5)	8.7h. (8.3h.)	626 (763)	63.3 (23.0)
Skills-based	59	13.6 (10.6)	9.5h. (6.7h.)	606 (393)	70.9 (17.1)
Female	31	14.1 (11.0)	9.8h. (6.1h.)	696 (420)	69.9 (18.1)
Male	28	13.1 (10.2)	9.5h. (7.3h.)	511 (343)	72.0 (16.2)
Grand Total	177	13.5 (10.5)	9.5h. (6.7h.)	647 (625)	66.6 (21.9)

Note. Maximum Participations (Quiz Attempts) was 28 quizzes

A two-way MANCOVA was used to examine differences between groups and genders. across the behavioral engagement outcome measures. Findings showed no significant differences $F(4, 344) 1.894, p = .111$, Wilks' $\Lambda .957$. Because MANOVA was approaching significance, univariate ANCOVA results were conducted. Females showed significantly higher behavioral engagement in terms of pageviews $F(2, 174) = 4.10, p = .044$. Female pageviews were in the range of 105-3,981 pageviews while males had a range of 44-1,194 across the groups. See Figure 4.4 for average pageviews by gender.

Figure 4.4

Average Pageviews by Gender and Group



Some females in the participation badge group and skill-based badge group described a clicking behavior without putting in excessive effort to solve the problem. This seems to support the quantitative finding that female pageviews were significantly higher compared to their male counterparts.

Especially when you're having low grades you need to take it seriously, but if it's no pressure at all. **It's like to just pick something you don't really learn at all or for the sake of taking it, or just seeing the answer after? So, it depends like, what is your motivation** on answering the quiz, optional quiz (Participant 28, Female 12, Skill-based Badges)

So, me personally, **I just like used whatever question and then just like, read the question with the explanation with the correct answer** together because sometimes that way, it's like more helping me to understand to solving the like calculating or sometimes other stuff. (Participant 19, Female 10, Participation Badges)

No significant differences were noted in Exam 2 percentages between groups, genders, or the interaction (group x gender). Overall, female participants tended to interact more with the LMS in terms of pageviews or clicking on the content. Descriptive statistics highlighted that the clicking behavior seems congruent with the other behavioral engagement measures of females having more activity time and more quizzes attempted than males.

Summary of Findings

For RQ1, no significant differences in motivation, behavioral engagement, or academic performance were noted between groups. The intervention of awarding participation badges and skill-based badges did not seem to affect any of the studied outcomes. Qualitative findings from RQ3 support quantitative findings from RQ1. Qualitative themes showed a large range of motivation including intrinsic motivation, integrated regulation, extrinsic regulation, and amotivation. Behavioral engagement also produced mixed themes including positive effects on behavioral engagement and no effects on behavioral engagement. Only a handful of students discussed the positive effects of the intervention on their academic performance, while many others did not discuss this topic. Overall, the gamification intervention had mixed results. The intervention was enjoyable, fun, and interesting to some while others found frustration or no value within the intervention. With two varying experiences, the average of those outcomes may have contributed to average, non-significant results for the gamification intervention.

For RQ2, the interaction effect between groups and genders, specifically for intrinsic motivation and amotivation, produced interesting insight on the complexity of students' motivation throughout the semester. At the end of the intervention, the males had higher intrinsic motivation in experimental groups compared to males in the control group. Conversely, the control group females had greater intrinsic motivation than experimental group females. Similar patterns were observed for amotivation. RQ4 qualitative findings seemed to indicate different learning goals for male students with either task orientation or ego orientation, which seemed to drive their motivations. For behavioral engagement, female students had more pageviews on average than male students, which appeared to be from clicking behaviors within optional quizzes. No differences were noted between groups and genders for academic performance. Overall, evidence shows that the combined influence of group and gender plays a significant influence on intrinsic motivation and amotivation within a gamified accounting course. Additionally, gender had significant findings on behavioral engagement in terms of pageviews. The following chapter, Chapter 5, describes the overarching themes of the connections between the findings and the literature. Additionally, it explains how this study contributes to theory.

CHAPTER 5. DISCUSSION

In this section, I review the major findings from this study and indicate how those findings connect to the literature that was covered in Chapter 2. This study included quantitative and qualitative data to provide a holistic approach. The reason for collecting the qualitative data was to provide support for the primary purpose and more methods of inquiry were sought to understand the experience of the intervention within the context of an undergraduate classroom. This study contributes to the literature by testing different badging merit systems while holding a classic feature of gamification fixed, namely the leaderboard. Results from the quasi-experimental study revealed that there were no significant differences in student motivation, behavioral engagement, and academic performance across all three groups even after controlling for pre-existing factors that are known to be associated with gamified learning experiences.

Discussion of RQ1 and RQ3

No significant differences were noted by group for motivation, behavioral engagement, or academic performance for the quantitative data. Students reported high intrinsic motivation and integrated regulation at the beginning of the intervention, which may make it difficult to increase in motivation at the end of the intervention. This high motivation reported seemed incongruent to their quiz taking behaviors because students completed fewer quizzes as the weeks went on across all groups with approximately 30% of students completing 21 or more quizzes. The amount of quizzes given could have affected their participation in the intervention as some reported that the extra content was overwhelming at first, while others indicated that they did not have time to participate in quizzes. Teachers should be aware that student perceptions may be incongruent to actual behaviors. Meyer et al. (2018) found that students often overestimate their contribution to a class. Although students said they had high motivation around the quizzes, their quiz taking behaviors didn't seem to align to that high motivation. With the lack of statistical quantitative findings, I relied on the qualitative data to glean the lessons learned around the gamification intervention. There were negative aspects of the intervention including: the lack of meaningful rewards and a lack of understanding around the intervention. Positive aspects of badging included receiving feedback and gaining recognition. These positive aspects could be more efficiently integrated into a classroom with the use of AI.

Lack of Meaningful Rewards

Students expressed a need for more tangible rewards. Badges lacked credibility especially through the medium of being displayed online. This finding is congruent with Almeida et al. (2023) that found that online badges lacked credibility compared to a more tangible badge. Further, having an instructor award the badge on a single learning objective (e.g., Badge awarded on the skill: Calculating Cost of Goods Sold) could take away from the badge's credibility. Students in this study expressed displeasure with receiving rewards that were not meaningful to them. Without more tangible rewards such as extra credit or swag, students can lose interest. This is a pitfall that Abadi et al. (2022) highlighted, in that instructors trying to motivate adult learners may be difficult as collecting stars or points may not be enough. In-game prizes and tokens must hold meaning to the student or motivation around the gamification may be low (Abadi et al., 2022). Students did not seem to maintain interest in the badge as the attrition of students completing optional quizzes was evident. Approximately 30% of students across all groups had completed at least 21 optional quizzes. Tahir et al. (2022) reported that 46% of their student participants never viewed the badge page indicating a lack of continual engagement with the badge.

Lack of Understanding Around the Intervention

Students reported more uncertainty in terms of understanding how the intervention worked including how they earned the badge and how to receive a spot on the leaderboard. A study by Deci et al. (1994) suggested that when integrating educational activities, especially uninteresting activities, instructors should provide a meaningful rationale to promote intrinsic motivation. Although a pre-made script explaining the rationale for the optional quizzes was made, a lack of clarity or meaningful rationale for the activity was reported. Qian et al. (2022) noted that gamification can create tedious check-ins or burdensome leveling up processes. Dos Santos et al. (2020) emphasized that students may not be interested or motivated to learn new pedagogical techniques, which may hinder a gamification intervention.

Positive Aspects from Badging (Feedback/Recognition) and How AI Can Help

Bai et al. (2020) that reports that gamification can foster enthusiasm, provide performance feedback, and fulfill students' needs for recognition. Furthermore, interviewees reported positive feelings about receiving feedback about their performance. Even though the

badge seemed supplemental or accessorial to the goal of learning participants, they were still nice to see. Tahir et al. (2022) noted in their study that badges were not very impactful based on the number of assignments that students completed, but 74% of students were still in favor of seeing badges or held a neutral opinion about badges.

Awarding badges and creating a leaderboard was done manually by the instructor, which can be demanding on the instructors' time. Dos Santos et al. (2020) found that teachers can lack technical competence to implement gamification strategies. Using AI to facilitate gamification could allow for more personalized and effective learning for undergraduate students (Tan & Cheah, 2021). Adaptive gamification approaches instead of a one-size-fits all approach could foster more streamlined feedback and personalized learning for instruction (Bennani et al., 2021). Furthermore, AI could reduce the workload of teachers by providing feedback, giving hints on problems, and overseeing supplemental learning opportunities (Etellium, n.d.; Spinify, n.d.). AI can encourage time-on-task by supplying awards for continuous or "streaks" of learning to sustain students' continual engagement (Tan & Cheah, 2021). AI can also look for accuracy and reward correct answers while asking for students to retry or reattempt problems that are incorrect (Spinify, n.d.). Drawbacks to AI enabled gamification included for Tan and Cheah (2021) too many hints too quickly and withholding the correct answer which can lead to frustration and multiple incorrect answers. Other drawbacks noted were that the interface was not aesthetically pleasing. Moreover, disadvantages include data privacy problems and the possibility of losing control of the gaming experience with increasingly sophisticated algorithms making unregulated decisions (Spinify, n.d.).

Discussion of RQ2 and RQ4

There were gender and group interaction effects identified during the analyses. That is, females experienced differential motivation and behavioral patterns between groups compared to males. This finding is consistent with Carpenter et al., (2018) findings showing females have different motivation orientation to competition compared to males. This finding may be helpful for instructional designers to tailor curriculum that uses gamification elements to appeal to different genders. With gamification producing mixed results (e.g., Huang et al., 2020), other researchers have stressed the importance of understanding key contextual factors.

Contextual Factors

Understanding the context for gamification has been highly emphasized by those implementing gamification interventions. More studies are looking into the variables/factors that could affect the intervention including age, socio-economic conditions, personality traits, game preferences and gender (Rodrigues et al., 2022). This study investigated game preferences and gender and found that females interacted significantly more with the LMS compared to males but that did not significantly improve their academic performance. Similarly, Sanchez et al., (2020) and Putz et al., (2020) found no differences in retention between genders. In short, instructors need to have a sound understanding of the contextual factors before implementing gamification.

Implications for Theory

Self-determination theory predicts that adding the three psychological needs of autonomy, competence, and relatedness will foster intrinsic motivation which could lead to positive behavioral engagement and academic performance. Autonomy is the need for people to experience their behaviors as self-determined. Competence is the need to feel a sense of mastery or the sense that one can succeed. Relatedness is the need for people to feel close to others. Optional quizzes were added to foster autonomy (Sailer et al., 2017; Seaborn & Fels, 2015), badges and a leaderboard were added to foster competence (Baard et al., 2004), and leaderboards were added to foster relatedness (Alsawaier, 2018). Students maintained motivation across all groups but no gains in terms of motivation occurred with the badging experimental groups. In the qualitative findings some students, but not all students, reported feeling the three basic psychological needs of autonomy, competence, and relatedness contained within self-determination theory.

Sense of Autonomy Reported

Allowing for optional quizzes was intended so that students could customize their learning pathways. Many students liked how the quizzes were optional, but the instructions around quizzes emphasized that participating in them would be beneficial for the students. Students expounded that a sense of autonomy or freedom was felt as they could choose if they wanted to complete the optional assignments without the fear of punishment. Customizable paths can help students to feel that they are in charge of their learning (Rodrigues et al., 2023). A large

quantity of female participants in the focus group reported that they knew that the quizzes were optional and that the quizzes would not affect their grade. Participant 2 (Male 2, Participation badges) noted that it is up to college students to take charge of their learning by realizing that although they are completing compulsory assignments for a grade, they may be lacking in their understanding of the content and so it is up to them to choose to complete optional assignments or seek supplemental materials. The same student noted that there is freedom in optional assignments and that the quizzes could be a formative assessment to learn from.

Lack of Autonomy Reported

When “controlling” is the way that the activity is communicated, it often undermines students’ intrinsic motivation (Deci et al., 1994; Ryan et al., 1983). Some ways to undermine intrinsic motivation include imposed goals, evaluations, threats of punishments, deadlines, and material rewards (Deci & Ryan, 1994). Controlling language has also been found to undermine intrinsic motivation including: “You have to” or “You should” (Ryan et al., 1983). The badges were awarded based on completing optional quizzes by the set deadline of twelve midnight the night before class. Students expressed a lack of time, work commitments, and a demanding class schedule that did not allow for much time to do optional quizzes. In this study, the instructor announced the rankings of the leaderboards and the badges earned. This may have put pressure on the students to complete the optional quizzes or may have been perceived as “controlling”. One student referenced feeling pressure from in-class announcements.

It's actually **drawing attention** to the point that “oh, shoot, I actually should work more on that”...**if the teacher actually mentions in the class, it brings another impact. Maybe a little bit pressure though, but I think it's a reasonable pressure** because, yeah, the badges is the optional. (Participant 2, Male 2, Participation Badge)

Without the underlying need of “autonomy” students may not increase their intrinsic motivation or integrated regulation. Van Roy and Zaman (2018) argue that true autonomy can never really happen within an educational setting. “Students in a university setting are accustomed to being told what to do in exchange for grades (which serves as controlled motivation). Therefore, they might potentially be socialised to interpret every assignment from this controlling perspective” (Van Roy & Zaman, 2018, p. 293). Furthermore, this finding is congruent with Kyewski and Krämer (2018) and Mekler et al., (2017) who found no difference in motivation after their gamification intervention.

Sense of Competency Reported

Students noted a sense of competency as the optional quizzes helped them feel confident with the material when coming to class. Students enjoyed having immediate and detailed feedback to know why they got the answer wrong, so that they would not make the same mistake again. “Feedback, it helps me with the things that I'm lacking” (Participant 9, Female 1, Skills-based badges). One female student noted that the quizzes were “a really good practice, because you get extra other types of questions that will help you to understand the concept better.” (Participant 11, Female 6, Skills-based badges). Social contexts that provide informational feedback and optimal challenge promote self-determined behaviors (Deci & Ryan, 1994).

Male students enjoyed the competency aspect of the optional quizzes because they could assess knowledge before attempting the compulsory homework and they could learn from their mistakes. The badges helped students to understand accounting, and to identify what they needed to study more. The badges were a signal of tracking progress and a display of how many quizzes were completed. Participant 1, (Male 1, Participation Badges) noted a sense of accomplishment to see their name on the leaderboard. “It makes me feel that I accomplished the things because I can see my name on the leaderboard. Oh! I did it. There's my name”.

Lack of Competence Reported

As mentioned in the literature review, a way to undermine intrinsic motivation included giving money or awards to individuals who have completed a task solely out of intrinsic motivation (Deci, 1971; Deci, 1975; Lepper et al., 1973). Especially when the individual feels that their experience of competence is thwarted (Ryan & Deci, 2020), or they feel like a pawn to extrinsic control (deCharms, 1968). The result can be that the individual is overtly less willing to do the activity solely out of satisfaction (Deci et al., 1994). As illustrated in the Chapter 4 findings, awarding participation badges that did not have competency tied to the badges seemed to increase amotivation or undermine motivation. This study found that many male students reported having their intrinsic motivation undermined. Deci et al., (1994) also noted that a skilled performance activity can signify competence for an individual and counteract the undermined motivation. Within the skills-based badge group, less amotivation or “undermined motivation” was reported from quantitative results.

Relatedness

As mentioned in the literature review, leaderboards that are driven by badge earnings can help students assess how they are doing in relation to the rest of their class. Students reported relatedness as they shared their success stories with their fellow classmates and as they sought out recognition for being the number one spot on the leaderboard. More female students than male students commented on the leaderboard bringing excitement and celebrations within class. Some shared their pseudonym with friends (Participant 6, Female 4, Participation Badges), others took pictures with their personal devices of the leaderboard (Participant 28, Female 12, Skills-based Badges). Some of the responses from male students were mixed with either shame from the leaderboard or positive comparison. Participant 2 (Male 2, Participation badges) expressed relief that the leaderboard was created with quizzes taken instead of quiz scores because of the fear of being seen as a “fool”. If it was based on the score there could be more “shame” with seeing the leaderboard. While other male students enjoyed comparing themselves to the “model student”. This aspect of social comparison was made possible in a face-to-face setting while an online or Massive Open Online Course (MOOC) setting may not facilitate these types of interactions. These findings seemed to be aligned with ego orientation versus task orientation as discussed in Chapter 4.

Summary

Overall, the gamification intervention had positive and negative outcomes reported. Multiple prior studies have tried to integrate rewards based on Self-determination theory into educational contexts, which has resulted in mixed findings. This study had similar outcomes including the positive outcomes of feedback and recognition and the negative outcomes which were the lack of a meaningful reward and the lack of understanding around the intervention. The findings from this study support prior research in that leaderboards meet the psychological need of relatedness (Alsawaier, 2018) and competence (Baard et al., 2004). Skill-based badges but not participation based badges support the need of competence (Baard et al., 2004). Participation badges did not relay a sense of competence for students and at times it seemed to undermine self-determination as the theory predicted. The skill-based badge group, although they had gamification elements that supported competence and relatedness, did not experience full autonomy, which could explain the lack of statistically significant differences in motivation

levels among the three groups. Full autonomy was not achieved through optional quizzes as autonomy is difficult to foster within an educational setting (Van Roy & Zaman, 2018). Although students expressed excitement about the intervention, this did not result in long-term, optional quiz taking behaviors. Findings indicate that badging may not be as impactful on motivation, behavioral engagement, and academic performance of students in an introductory accounting course. This study contributes to the literature by isolating one gamification element (badging) while holding the leaderboard fixed. To partial out pre-existing factors, cumulative GPA and game preferences were used as covariates. Finally, limited research has been done on gamification in undergraduate accounting education.

Implications for practice

In this section, implications for practice are discussed for students, instructional designers, teachers, and decision-makers. Although this gamification intervention did not increase motivation, motivation did not significantly decrease, suggesting that motivation was sustained throughout the intervention. From qualitative focus groups, students reported positive effects of the gamification intervention including novelty, fun, engagement, and interest. Students that have a choice to take a gamified course may experience more satisfaction in their learning or more academic success. Motivating students and sustaining motivation is a difficult problem facing all instructors, especially after the waning of the COVID-19 Pandemic (Alonso, 2023). Taking small steps such as using technology to present novel types of learning activities seems to have maintained intrinsic motivation and integrated regulation for students.

This study highlights strategies for instructional designers that are creating a gamification intervention. The chosen software for this intervention was the standard LMS used at the studied university to create optional quizzes. The intervention seemed to offer a different modality to receive content as students explained that the textbook was difficult or filled with jargon while the optional quizzes were a step-by-step guide or a pattern to follow along with the content. Different approaches/tools to learning can allow for more students to understand content and engage with course material.

This study highlights how a teacher can implement a gamification intervention and outlines the rationale for choosing how, where, and why each gamification element was implemented.

Instructor/Research Observations

The gamification intervention took approximately six additional hours of the instructor's time to set up the leaderboard and award badges to students using free software including BADGR basic, Accredible Badge designer, and Edit.org. Free software was used to ensure access to all educators that are interested in gamification interventions. Other software to use in educational gamification settings has been researched by Suresh Babu and Dhakshina Moorthy (2023). They conducted a recent literature review and listed over forty gamification tools that are specifically designed for education. When investigating these tools, several of the tools are catered to K-12 (Classcraft, Class Realm, Gimkit, Pear Deck, Toovari). Others are for in-class activities with student response systems such as Kahoot or Quizziz, which did not meet this current study's functional needs. While others are discipline-specific: Coding/IT (CodeCombat, Grasshopper, keySkillset, Skillrack, Sololearn), Math (Arcademics, Knowre, Prodigy), English (Blinkist, Book Widget), Music (Yousician), Language learning (Duolingo, Memrise). Only one was listed as a business economics, simulation game titled Virtonomics, which also didn't fit the needs of this study.

More investment in gamification software or the recruitment of AI could lead to less instructor preparation of the intervention. Suresh Babu and Dhakshina Moorthy (2023) explain the AI Algorithms can be used to customize students' paths in learning. Some of the AI algorithms include using a decision tree algorithm, an Adaptive Neuro-Fuzzy Inference System (ANFIS) which learns from data and makes predictions, or an Artificial Neural Network (ANN) that involves mathematics and computations to simulate the processes of a human-brain. Many other AI algorithms are summarized by Suresh Babu and Dhakshina Moorthy (2023), but more development and collaboration with a coding or IT expert would need to be recruited in order to implement adaptive gamification. Gamification software often has high barriers of entry (Groening & Binnewies, 2021). With high barriers of entry, more key stakeholders may need to "buy-in" in terms of the benefits of gamification in order to invest more funds into gamification software.

Limitations

This research study was not without limitations. Although cumulative GPA and other game preferences were controlled for by using a two-way MANCOVA analysis, quasi-experimental designs do not provide full control over the study as students are not randomly

assigned to treatment groups (Ary et al., 2019). Additionally, student motivations may be solely driven by academic performance and may not be fully captured by self-report inventory questionnaires. Furthermore, students received extra credit incentives to fill out questionnaires, which could lead to selection bias and an unwillingness to give candid answers, while giving the most socially desirable responses (Ary et al., 2019). Moreover, the sample size was small for each group, leading to limited generalizability to a broader context or external validity (Zohrabi, 2013). Overall, 202 students were enrolled in the class, but only 177 students completed the initial survey with 156 students completing the survey at both week 5 and week 10. With attrition in survey respondents, results could be skewed. Focus groups were conducted by a trained interviewer and coordinated based on the willingness of invited volunteer participants which may have biased the qualitative data. An additional research limitation included potential researcher bias in terms of reliability, as the researcher was both the co-investigator and instructor of the gamified course (Zohrabi, 2013).

Recommendations for future research

There are multiple recommendations for future research for gamification in higher education. The first recommendation would be to test the intervention on a larger sample size or to test the intervention on other topics within business education. Future research could incorporate a more robust software such as H5P. Coffland and Huff (2022), noted that H5P could be a more robust approach rather than using Canvas or Moodle as the sole gamification software but that H5P or other systems that integrate AI algorithms could be embedded into each LMS learning module.

Quizzes designed in this research were divided into 4-6 chapter learning objectives, but questions were not separated by difficulty of the question to create levels. Future research could include levels of difficulty or “leveling up tasks” to allow students to practice higher-level instructional objectives. Coffland and Huff (2022) suggested that an ideal technology in gamification would incorporate a branching technology while students are practicing course material. The branching technology could allow students meeting competency to move on while the students not meeting competency levels would be referred to a remedial video and subsequently be reassessed. The branching technology could be supported by AI. Oliveira et al. (2023) and Klock (2020) further emphasize the need to make the gamification intervention individually personalized to the student. Factors to consider with establishing a player profile for

gamification include personal traits (cognitive abilities/prior learning, self-regulated behaviors), learning style (e.g., visual, kinesthetic), mental state/emotions, or personality traits (e.g., extroverted) (Afini Normadhi et al., 2019). Although these technology advances with AI are astonishing, instructors should weigh the pitfalls of AI systems which includes bias and ethical concerns. Biased algorithms in a gamified intervention could unintentionally facilitate an unequal or biased experience for students (Suresh Babu & Dhakshina Moorthy, 2023). Further, by giving up player profile information, there are ethical concerns such as data privacy and security concerns. More research is needed on how to create ethical, personalized gamification interventions.

Conclusion

The purpose of this study was to understand the effect of badging (if any) in an undergraduate accounting course. There are few studies that study gamification in accounting education. This study tests different badging merit systems while holding a classic feature of gamification fixed, namely the leaderboard. Results from the quasi-experimental study revealed that there were no significant differences in student motivation, behavioral engagement, and academic performance across all three groups even after controlling for pre-existing factors that are known to be associated with gamified learning experiences. In examining gender differences, females and males experienced the gamification differently in terms of intrinsic motivation and amotivation across groups. Additionally, females had more pageviews than male participants. No differences by gender were noted in terms of academic performance. Insight gained can help instructors assess the best practices of gamification implementation with regards to motivation, behavioral engagement, and academic performance in higher education.

APPENDICIES

APPENDIX A. Letter of Cooperation



FACULTY OF BUSINESS & GOVERNMENT

March 29, 2022

To whom it may concern:

This letter serves as acknowledgement of support of Tialei Scanlan’s proposed research at Brigham Young University- Hawaii. We are interested in learning from her research of “Applying gamification to undergraduate accounting education: A mixed-method study” and will do what we can to support her research.

We are eager and willing to oversee the administration of Professor Tialei Scanlan’s survey instrument to our students as well as support the individual qualitative data collection of her students while ensuring all appropriate steps are taken to protect them as the IRB would require.

We hope you can look favorably on her IRB application so that she can progress with her research in Fall 2022 and Spring 2023.

If you have any questions, please do not hesitate to contact me.

Mahalo,



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APPENDIX B. SIMS Instrument

The Situational Motivation Scale (SIMS)

Directions: Read each item carefully. Using the scale below, please circle the number that best describes the reason why you are currently engaged in this activity. Answer each item according to the following scale: 1: *corresponds not at all*; 2: *corresponds a very little*; 3: *corresponds a little*; 4: *corresponds moderately*; 5: *corresponds enough*; 6: *corresponds a lot*; 7: *corresponds exactly*.

Why are you currently engaged in this activity?

1. Because I think that this activity is interesting	1	2	3	4	5	6	7
2. Because I am doing it for my own good	1	2	3	4	5	6	7
3. Because I am supposed to do it	1	2	3	4	5	6	7
4. There may be good reasons to do this activity, but personally I don't see any	1	2	3	4	5	6	7
5. Because I think that this activity is pleasant	1	2	3	4	5	6	7
6. Because I think that this activity is good for me	1	2	3	4	5	6	7
7. Because it is something that I have to do	1	2	3	4	5	6	7
8. I do this activity but I am not sure if it is worth it	1	2	3	4	5	6	7
9. Because this activity is fun	1	2	3	4	5	6	7
10. By personal decision	1	2	3	4	5	6	7
11. Because I don't have any choice	1	2	3	4	5	6	7
12. I don't know; I don't see what this activity brings me	1	2	3	4	5	6	7
13. Because I feel good when doing this activity	1	2	3	4	5	6	7
14. Because I believe that this activity is important for me	1	2	3	4	5	6	7
15. Because I feel that I have to do it	1	2	3	4	5	6	7
16. I do this activity, but I am not sure it is a good thing to pursue it	1	2	3	4	5	6	7

Codification key: Intrinsic motivation: Items 1, 5, 9, 13; Identified regulation: Items 2, 6, 10, 14; External regulation: Items 3, 7, 11, 15; Amotivation: Items 4, 8, 12, 16.

APPENDIX C. Consent Form for Online Survey



University of Hawai'i

Consent to Participate in a Research Project

Tialei Scanlan, Principal Investigator

*Project title: Applying gamification to undergraduate accounting education:
A mixed-method study*

Aloha! My name is Tialei Scanlan and you are invited to take part in a research study. I am a graduate student at the University of Hawai'i at Mānoa in the Department of Learning Design and Technology. As part of the requirements for earning my graduate degree, I am doing a research project.

What am I being asked to do?

If you participate in this project, you will be asked to fill out a survey.

Taking part in this study is your choice.

Your participation in this project is completely voluntary. You may stop participating at any time. If you stop being in the study, there will be no penalty or loss to you. Your choice to participate or not participate will not affect you in an adverse way.

Why is this study being done?

The purpose of my project is to learn about the experiences, opinions, and perceptions of students within an undergraduate financial accounting course. I am asking you to participate because you are currently enrolled in an undergraduate financial accounting course.

What will happen if I decide to take part in this study?

The survey will consist of eleven multiple-choice questions, and one matrix question. It will take approximately 10-15 minutes. The survey questions will include questions like, "Why are you currently engaged in optional quizzes for ACCT 201?" and "Please answer the following questions about learning opportunities and video games". The survey is accessed on a website to which I will provide you a link.

What are the risks and benefits of taking part in this study?

I believe there is little risk to you for participating in this research project. You may become stressed or uncomfortable answering any of the survey questions. If you do become stressed or uncomfortable, you can skip the question or take a break. You can also stop taking the survey or you can withdraw from the project altogether.

There will be no direct benefit to you for participating in this research project other than learning the content of the course. The results of this project may help to improve the delivery of the introduction to financial accounting courses.

Confidentiality and Privacy:

I will not ask you for any personal information, such as your name or address. Please do not include any personal information in your survey responses. Your response will be linked to a unique identifier. The data in this study will be confidential, no identifying information will be shared in publications. I will keep all study data secure in a locked filing cabinet in a locked office/encrypted on a password protected computer. Only my University of Hawai'i advisor and I will have access to the information. Other agencies that have legal permission have the right to review research records. The University of Hawai'i Human Studies Program has the right to review research records for this study.

Compensation:

You will receive three points of extra credit added to your introduction to financial accounting course grade after completing the survey and taking a quiz that states: True or False: I completed the online survey about ACCT 201 optional quizzes. Extra credit will be awarded for your time and effort in participating in this research project.

Future Research Studies:

Even after removing identifiers, the data from this study will not be used or distributed for future research studies.

Questions: If you have any questions about this study, please call or email me at [808.675.4583 & tialei@hawaii.edu]. You may also contact my faculty advisor, Dr. Michael Menchaca, at [808.956.5664 & mikepm@hawaii.edu]. You may contact the UH Human Studies Program at 808.956.5007 or uhirb@hawaii.edu to discuss problems, concerns, and questions, obtain information, or offer input with an informed individual who is unaffiliated with the specific research protocol. Please visit <http://go.hawaii.edu/jRd> for more information on your rights as a research participant.

To Access the Survey: I will email you with the survey link. In the email, you should find a link and instructions for completing the survey. Going to the first page of the survey implies your consent to participate in this study.

Please print or save a copy of this page for your reference.

Mahalo!

APPENDIX D. SIMS Qualtrics Badging Survey

SIMS Qualtrics Badging Survey – Introduction to Financial Accounting

Start of Block: Block 1

University of Hawai'i Consent to Participate in a Research Project

Tialei Scanlan, Principal Investigator

Project title: Applying gamification to undergraduate accounting education: A mixed-method study

Aloha! My name is Tialei Scanlan and you are invited to take part in a research study. I am a graduate student at the University of Hawai'i at Mānoa in the Department of Learning Design and Technology. As part of the requirements for earning my graduate degree, I am doing a research project.

What am I being asked to do?

If you participate in this project, you will be asked to fill out a survey. Taking part in this study is your choice. Your participation in this project is completely voluntary. You may stop participating at any time. If you stop being in the study, there will be no penalty or loss to you. Your choice to participate or not participate will not affect you in an adverse way.

Why is this study being done? The purpose of my project is to learn about the experiences, opinions, and perceptions of students within an undergraduate financial accounting course. I am asking you to participate because you are currently enrolled in an undergraduate financial accounting course.

What will happen if I decide to take part in this study?

The survey will consist of eleven multiple-choice questions, one matrix question, and one open-ended question. It will take approximately 10-15 minutes. The survey questions will include questions like, “Why are you currently engaged in optional quizzes for ACCT 201?” and “Please answer the following questions about learning opportunities and video games”. The survey is accessed on a website to which I will provide you a link.

What are the risks and benefits of taking part in this study?

I believe there is little risk to you for participating in this research project. You may become stressed or uncomfortable answering any of the survey questions. If you do become stressed or uncomfortable, you can skip the question or take a break. You can also stop taking the survey or you can withdraw from the project altogether. There will be no direct benefit to you for participating in this research project. The results of this project may help to improve the delivery of the introduction to financial accounting course.

Confidentiality and Privacy:

I will not ask you for any personal information, such as your name or address. Please do not include any personal information in your survey responses. Your response will be linked to a unique identifier. The data in this study will be confidential, no identifying information will be shared in publications. I will keep all study data secure in a locked filing cabinet in a locked office/encrypted on a password protected computer. Only my University of Hawai'i advisor and I will have access to the information. Other agencies that have legal permission have the right to review research records. The University of Hawai'i Human Studies Program has the right to review research records for this study.

Compensation:

You will receive three points of extra credit added to your introduction to financial accounting course grade after completing the survey and taking a quiz that states: True or False: I completed the online survey about ACCT 201 optional quizzes. Extra credit will be awarded for your time and effort in participating in this research project.

Future Research Studies:

Even after removing identifiers, the data from this study will not be used or distributed for future research studies.

Questions:

If you have any questions about this study, please call or email me at [808.675.4583 &

tialei@hawaii.edu]. You may also contact my faculty advisor, Dr. Michael Menchaca, at [808.956.5664 & mikepm@hawaii.edu]. You may contact the UH Human Studies Program at 808.956.5007 or uhirb@hawaii.edu to discuss problems, concerns, and questions, obtain information, or offer input with an informed individual who is unaffiliated with the specific research protocol. Please visit <http://go.hawaii.edu/jRd> for more information on your rights as a research participant.

To Access the Survey:

I will email you with the survey link. In the email, you should find a link and instructions for completing the survey. Going to the first page of the survey implies your consent to participate in this study.

Mahalo!

End of Block: Block 1

Start of Block: Directions: Read each item carefully. Using the scale below, please circle the n

Directions: Read each item carefully. Using the scale below, please circle the number that best describes the reason why you are currently engaged in this activity.

Why are you currently engaged in **optional quizzes** for ACCT 201?

	Corresponds not at all (1)	Corresponds very little (2)	Corresponds a little (3)	Corresponds moderately (4)	Corresponds enough (5)	Corresponds a lot (6)	Corresponds exactly (7)
1. Because I think that this activity is interesting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Because I am doing it for my own good	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Because I am supposed to do it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. There may be good reasons to do this activity, but personally I don't see any	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Because I think that this activity is pleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Because I think that this activity is good for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Because it is something that I have to do	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I do this activity but I am not sure if it is worth it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Because this activity is fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. By personal decision	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Because I don't have any choice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I don't know; I don't see what this activity brings me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Because I feel good when doing this activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Because I believe that this activity is important for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Because I feel that I have to do it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I do this activity, but I am not sure it is a good thing to pursue it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Directions: Read each item carefully. Using the scale below, please circle the n

Start of Block: Block 2

With 0 meaning strongly disagree and 100 meaning strongly agree. Please answer the following questions about learning opportunities and video games.

Video games offer opportunities to:

strongly disagree 0 10 20 30 40 50 60 70 80 90 100 strongly agree

take control over the learning process.



motivate students.



interact with other students.



experiment with knowledge.



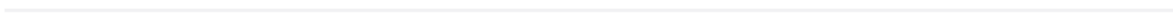
experience things you learn about.



stimulate transfer between various subjects.



think critically.



With 0 meaning strongly disagree and 100 meaning strongly agree. Please answer the following questions about your experience with games.

strongly disagree 0 10 20 30 40 50 60 70 80 90 100 strongly agree

I like playing video games.



I often play video games.



I would describe myself as a gamer.



Compared to people of my age, I play a lot of video games.



I play different types of video games



With 0 meaning strongly disagree and 100 meaning strongly agree. Please answer the following questions about your preference for video games.

strongly disagree 0 10 20 30 40 50 60 70 80 90 100 strongly agree

If I had the choice, I would choose to follow courses in which video games are used.



If I had to vote, I would vote in favor of using video games in the classroom.



I am enthusiastic about using video games in the classroom.



What is your gender?

Woman

Man

I identify my gender as: (please specify)

What is your current cumulative GPA?

APPENDIX E. Permission to use SIMS Instrument

Tialei Wesley Scanlan

From: Frédéric Guay <Frederic.Guay@fse.ulaval.ca>
Sent: Tuesday, March 1, 2022 1:56 AM
To: Tialei Wesley Scanlan
Subject: Re: Request for permission of SIMS instrument

Yes, you can use it. Good success with your project! Sincerely,

Frédéric Guay

De : Tialei Wesley Scanlan <tialei.scanlan@byuh.edu>

Envoyé : Tuesday, March 1, 2022 12:38:11 AM

À : Frédéric Guay <Frederic.Guay@fse.ulaval.ca>

Objet : Request for permission of SIMS instrument

Aloha Professor Guay,

My name is Tialei Scanlan, I am an assistant professor at Brigham Young University-Hawaii in accounting and a PhD student in education at the University of Hawaii at Manoa. I am currently studying gamification in higher education and am looking to measure amotivation, extrinsic motivation, and intrinsic motivation before and after a gamification intervention (badges and leaderboards in undergraduate education). I really enjoy how robust the SIMS instrument is in measuring different types of motivation.

Please if I could have your permission to use your SIMS instrument with adjustments to cater to the gamification intervention for use in my dissertation.

Please let me know. Thank you for your time. Tialei Scanlan.

Tialei Scanlan, CPA, MBA

Assistant Professor of Accounting
Faculty of Business & Government
Brigham Young University – Hawaii
55-220 Kulanui St. #1956

APPENDIX F. Consent Form for Focus Group



University of Hawai'i

Consent to Participate in a Research Project

Tialei Scanlan, Principal Investigator

*Project title: Applying gamification to undergraduate accounting education:
A mixed-method study*

Aloha, you are invited to take part in a research study. The co-investigator Tialei Scanlan is a graduate student at the University of Hawai'i at Mānoa in the Department of Learning Design and Technology. As part of the requirements for her earning her graduate degree, she is doing a research project.

What am I being asked to do?

If you participate in this project, I will meet with you for a focus group at a location and time convenient for you.

Taking part in this study is your choice.

Your participation in this project is completely voluntary. You may stop participating at any time. If you stop being in the study, there will be no penalty or loss to you. Your choice to participate or not participate will not affect you in an adverse way.

Why is this study being done?

The purpose of my project is to learn about the experiences, opinions, and perceptions of students within an undergraduate financial accounting course. I am asking you to participate because you are currently enrolled in an undergraduate financial accounting course.

What will happen if I decide to take part in this study?

The focus group will consist of 10 open ended questions. It will take 45 minutes to an hour. The focus group questions will include questions like, “How would you describe your experience with badges and leaderboards during an introduction to accounting course?” and “Can you describe your most memorable experience in the introduction to accounting course?”

With your permission, I will audio-record the focus group so that I can later transcribe the focus group and analyze the responses.

What are the risks and benefits of taking part in this study?

I believe there is little risk to you for participating in this research project. You may become stressed or uncomfortable answering any of the focus group questions or discussing topics with me during the focus group. If you do become stressed or uncomfortable, you can skip the question or take a break. You can also stop the focus group or you can withdraw from the project altogether. There will be no direct benefit to you for participating in this focus group. The results of this project may help improve the experience of undergraduates in an introductory accounting course.

Privacy and Confidentiality:

I will keep all study data secure in a locked filing cabinet in a locked office/encrypted on a password protected computer. Only my University of Hawai'i advisor and I will have access to the information. Other agencies that have legal permission have the right to review research records. The University of Hawai'i Human Studies Program has the right to review research records for this study.

After I write a copy of the focus group, I will erase or destroy the audio-recordings. When I report the results of my research project, I will not use your name. I will not use any other personal identifying information that can identify you. I will use pseudonyms (fake names) and report my findings in a way that protects your privacy and confidentiality to the extent allowed by law.

Compensation:

You will receive a \$10 gift card to either Foodland or Amazon for your time and effort in participating in this research project.

Future Research Studies:

Even after removing identifiers, the data from this study will not be used or distributed for future research studies.

Questions:

If you have any questions about this study, please call or email the co-investigator at [808.675.4583 & tialei@hawaii.edu]. You may also contact the faculty advisor, Dr. Michael Menchaca, at [808.956.5664 & sorens@hawaii.edu]. You may contact the UH Human Studies Program at 808.956.5007 or uhirb@hawaii.edu to discuss problems, concerns, and questions, obtain information, or offer input with an informed individual who is unaffiliated with the specific research protocol. Please visit <http://go.hawaii.edu/jRd> for more information on your rights as a research participant.

If you agree to participate in this project, please sign and date this signature page and return it to: Tialei Scanlan (tialei@hawaii.edu)

Keep a copy of the informed consent for your records and reference.

Signature(s) for Consent:

I give permission to join the research project entitled, “*Applying gamification to undergraduate accounting education: A mixed-method study.*”

Please initial next to either “Yes” or “No” to the following:

_____ Yes _____ No I consent to be audio-recorded for the focus group portion of this research.

Name of Participant (Print): _____

Participant’s Signature: _____

Signature of the Person Obtaining Consent: _____

Date: _____

APPENDIX G. Recruitment Email & Semi-Structured Focus Group Protocol

Recruitment Email:

Aloha,

My name is Tialei Scanlan and I am a student researcher at the University of Hawai'i at Mānoa. The purpose of this study is to conduct a research study about the experiences of students who were enrolled in accounting 201 with a gamification software integrated into the course. I am emailing you to ask if you would like to participate in this research project. Participation is completely voluntary, and your answers will be anonymous. The focus group **will be conducted by a trained interviewer** and will consist of 13 open-ended questions. It will take 45 minutes to an hour. Participants will receive a \$10 gift card to either Foodland or Amazon for your time and effort in participating in this research project.

If you are interested in participating, please email or call me for additional information and to set-up a date and time that is convenient for you.

If you have any questions, please do not hesitate to contact me at tialei@hawaii.edu or (808) 371-6288.

Thank you for your time.

Sincerely,
Tialei Scanlan
PhD Candidate
Learning Design & Technology
College of Education
University of Hawai'i at Mānoa

Semi-Structured Focus Group Protocol:

Introduction

• **Thank you for coming today. I really appreciate you taking the time out of your day to meet with me.**

• **I want to start by introducing myself**

- Interviewer will introduce themselves
- In case of problems or concerns you can contact the principal investigator of this research: Dr. Michael Menchaca at mikepm@hawaii.edu

• **Purpose of the discussion:**

The purpose of today's discussion is to better understand your experience, opinions, and perceptions with the use of badges and leaderboards in your introduction to financial accounting course.

I would like to go over **Informed consent with you**

Key points:

1. The purpose of the study is to understand your perceptions and experience with the use of badges and leaderboards in your introduction to financial accounting course.
2. This focus group is designed to pose no risks to you.
3. Your identity will not be linked to your responses. That is, I will not report any information that could potentially make you identifiable, like your name or personal characteristics.
4. The data I collect will remain confidential. Only members involved directly with this research will have access.
5. You have the right to review the focus group transcript, the material that is collected, and the data that has been gathered as the result of this session.
6. You have the right to withdraw from the study at any time without prejudice. You can choose to leave or not answer any questions asked should you feel uncomfortable at any time during our discussion of your experiences.
7. Findings from this focus group will be coded to identify themes about the research topic

• **Check for understanding and obtain consent:**

- Are there any questions about the informed consent information?
- (pause)
- Do I have your consent to proceed with this focus group?
- (wait for agreement)

• **Confirm permission to record the focus group**

- To help me in my analysis I would like to record our session.
- Only the researcher will access recordings. Transcripts will only be available to members involved directly with the research.
- Instead of names I will use descriptors in the transcripts.
- As I reflect, summarize, and report on what we have discussed, I will never share information that would allow you to be identified.

• **Check for Understanding and obtain consent:**

- Are there any questions about the intent to record our session?
- (pause)
- Do I have your consent to record our session?
- (pause)

• **Ground rules:**

- There are no right or wrong answers—I am interested in your experiences and perceptions
- Please let me know if you wish to stop or take a break at any time

• **Check for Understanding:**

- Are there any questions regarding the ground rules that were just shared?

Questions:

Rapport:

1. How long have you been studying at BYU-Hawaii?
2. Where are you from?
3. What is your major?

Experience and opinion questions

1. How would you describe your experience with badges during an introduction to accounting course?
2. What is your opinion about the cadence (how often)/frequency of badges awarded?
3. What is your opinion on the volume or number of badges awarded?
 - a. Can you give me an example?
 - b. Can you tell me more about that?
4. What did you find to be the most rewarding part of your introduction to accounting course ?
 - a. Can you give me an example?
 - b. Can you tell me more about that?
 - c. Why does that stand out in your memory?
 - d. Why was that important to you?
5. What did you find to be the most challenging part of your introduction to accounting course ?
 - a. Use probes as needed.
6. Can you describe your most memorable experience in the introduction to accounting course?
 - a. Why does that stand out in your memory?
 - b. Why was that important to you?

7. If you were talking to another student who was considering enrolling in ACCT 201, what would you tell them about the class?
 - a. Why does that stand out in your memory?
 - b. Why was that important to you?
8. What is your opinion about the use of badges and leaderboards in accounting courses?
 - a. Can you tell me more about that?
9. If you were a teacher, would you or would you not want to use badges and leaderboards in accounting courses and why?
10. If you were giving advice to an instructor considering implementing badges and leaderboards in their courses, what would you say?

Wrap-Up

9. Is there anything else you would like to tell me that I didn't ask you about?
 10. Do you have any questions for me?
- Thank you again for allowing me to have you in this focus group.
 - Remember that the thoughts you shared with me today will be used to understand your experiences, opinions, and perceptions of the use of badges and leaderboards in your introduction to financial accounting course.
 - Remember that your identity will remain private. What was said during this focus group will remain confidential
 - Confirm contact information—for further contact, questions, and/or concerns
 - You can reach the principal investigator at mikepm@hawaii.edu if you have any questions or concerns.

APPENDIX H. Control vs. Experimental Group Views of Canvas LMS

Control group course view:

ACCT 201 - Trophy Room & Leaderboard

welcome

To Introduction to financial accounting



LEADERBOARD		
Introduction to Financial Accounting		
1	🏆 PLAYER NAME	58
2	🥈 PLAYER NAME	56
3	🥉 PLAYER NAME	55
4	PLAYER NAME	50
5	PLAYER NAME	49
6	PLAYER NAME	46
7	PLAYER NAME	44
8	PLAYER NAME	42
9	PLAYER NAME	40
10	PLAYER NAME	38

YOUR LOGO
www.yourwebhere.com



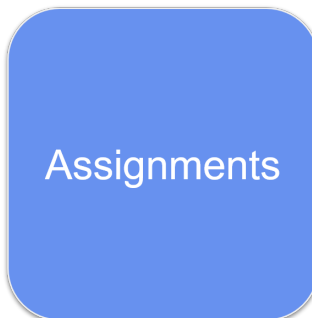
<https://byuh.instructure.com/courses/1473570/assignments/syllabus>



<https://byuh.instructure.com/courses/1473570/pages/psydonym>





<https://byuh.instructure.com/courses/1473570/modules>



<https://byuh.instructure.com/courses/1473570/assignments>

Experimental: Canvas Trophy Room & Leaderboard (Same as control) with Participation badges at the bottom of the page

Chapter 6 Badges
Possible

	<p>Vocabulary Badge awarded when the following is completed:</p> <p><u>Optional Quiz 1 - Matching Key Terms from Chapter 6</u> (https://by.uh.instructure.com/courses/1473570/assignments/8446240)</p>		<p>Quiz Gold Badge awarded when the following is completed:</p> <p>Rookie Operations analyzer: <u>Optional Quiz 2 - LO1 Distinguish between service and merchandising operations.</u> (https://by.uh.instructure.com/courses/1473570/quizzes/2470664)</p> <p>Novice inventory analyzer: <u>Optional Quiz 3 - LO2 Cost of Goods Sold Equation</u> (https://by.uh.instructure.com/courses/1473570/quizzes/2470665)</p> <p>Intermediate perpetual inventory accountant: <u>Optional Quiz 4 - LO4 Analyze sales transactions under a perpetual inventory system.</u> (https://by.uh.instructure.com/courses/1473570/assignments/8446244)</p> <p>Advanced inventory cost controller: <u>Optional Quiz 5 - LO3 FOB shipping point, FOB destination</u> (https://by.uh.instructure.com/courses/1473570/quizzes/2470666)</p> <p>Top inventory accountant: <u>Optional Quiz 6 - LO4 and LO6-S1 Analyze sales transactions under a perpetual inventory system</u> (https://by.uh.instructure.com/courses/1473570/quizzes/2470667)</p> <p>Expert inventory accountant: <u>Optional Quiz 7 - LO 4 and LO 6-S1 Record purchase discounts under a perpetual inventory system.</u> (https://by.uh.instructure.com/courses/1473570/assignments/8446265)</p>
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Experimental: Canvas Trophy Room & Leaderboard (Same as control)– with skill-based badges at the bottom of the page

Chapter 6 Badges Possible

Skill Based Badges	Vocabulary		Work-out Problems	Chapter 6 Badges
Quiz Gold Badge (Chapter 6, 7, 8, 9)	Vocabulary Badge awarded when the following skill/achievement level is attained: 90-100% of quiz answers correct			Quiz Badge awarded when the following skill/achievement level is attained Rookie Operations analyzer: Optional Quiz 2 - LO1 Distinguish between service and merchandising operations. Novice inventory analyzer: Optional Quiz 3 - LO2 Cost of Goods Sold Equation
Quiz Silver badge (Chapter 6, 7, 8, 9)	70-89% of quiz answers correct		Optional Quiz 1 - Matching Key Terms from Chapter 6	 Intermediate perpetual inventory accountant: Optional Quiz 4 - LO4 Analyze sales transactions under a perpetual inventory system. Advanced inventory cost controller: Optional Quiz 5 - LO3 FOB shipping point, FOB destination Top inventory accountant: Optional Quiz 6 - LO4 and LO6-S1 Analyze sales transactions under a perpetual inventory system.
Quiz bronze badge (Chapter 6, 7, 8, 9)	50-69% of quiz answers correct			Expert inventory accountant: Optional Quiz 7 - LO 4 and LO 6-S1 Record purchase discounts under a perpetual inventory system.

APPENDIX I: Chapter Learning Objectives, Optional Quiz, and Badge Name

Questions from textbook, homework, and test bank from the publishers of the Fundamentals of Financial Accounting, 7th edition textbook. (Phillips et al.,2022).

<p>Chapter 6 Learning Objectives:</p>	<p>Sample Quiz Questions:</p>
<p>Vocabulary – Covering all learning objectives</p> <p><u>Vocabulary Quiz Master:</u></p> <p>Optional Quiz 1 - Matching Key Terms from Chapter 6</p>	<p>Fill in the Blank 2 points</p> <p>If the terms are <input type="text" value="FOB destination"/> , ownership transfers at the destination, so the supplier incurs the transportation cost.</p> <p><input type="text" value="FOB shipping point"/> <input type="text" value="Shipping with Freight"/></p>
<p>LO 6-1 Distinguish between service and merchandising operations.</p> <p><u>Rookie Operations analyzer:</u></p> <p>Optional Quiz 2 - LO1 Distinguish between service and merchandising operations.</p>	<p>Question 2 1 pts</p> <p>For each of the following, indicate whether the item would be reported on the balance sheet (B/S) or reported on the income statement (I/S).</p> <p>Also indicate whether it relates to a service company (SC) or merchandising company (MC).</p> <p>Inventory <input type="text" value="[Choose]"/></p> <p>Sales Revenue & Cost of Goods Sold <input type="text" value="[Choose]"/></p> <p>Service Revenue <input type="text" value="[Choose]"/></p>

<p>LO 6-2 Explain the differences between periodic and perpetual inventory systems.</p> <p><u>Novice inventory analyzer:</u></p> <p>Optional Quiz 3 - LO2 Cost of Goods Sold Equation</p>	<p>Question 4 2 pts</p> <p>Broad, Incorporated had a beginning inventory of \$50,000 and an ending inventory of \$80,000. Its cost of goods sold for the year was \$980,695. What was the amount of purchases that it made for the year?</p> <div style="border: 1px solid gray; width: 150px; height: 20px; margin: 10px auto;"></div>
<p>LO 6-3 Analyze purchase transactions under a perpetual inventory system.</p> <p><u>Advanced inventory cost controller:</u></p> <p>Optional Quiz 5 - LO3 FOB shipping point, FOB destination</p>	<p>Question 4 2 pts</p> <p>Alpha Company bought inventory from Omega Company, FOB shipping point. On December 31, the last day of the accounting year, the goods were on a truck owned by Theta, Incorporated, exactly halfway between Alpha and Omega. Which company should include these goods in its December 31 inventory?</p> <p><input type="radio"/> Omega Company</p> <p><input type="radio"/> Alpha Company</p> <p><input type="radio"/> Theta, Incorporated</p> <p><input type="radio"/> Alpha and Omega should each include half of the goods in inventory.</p>

<p>LO 6-S1</p> <p>Record purchase and sales discounts under a perpetual inventory system.</p> <p><u>Expert inventory accountant:</u></p> <p>Optional Quiz 7 - LO 4 and LO 6-S1 Record purchase discounts under a perpetual inventory system.</p>	<p>Sort the following into the debit or credit side category to represent the correct journal entry</p> <p>Assume Walmart purchases merchandise at a cost of \$3,500, with terms 1/30, n/60, offered by its supplier.</p> <p>Walmart returned \$1,200 of defective units and received full credit.</p> <p>Walmart plays its supplier within the discount period. Prepare the entry for the PAYMENT to the supplier within the discount period.</p> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="border: 1px solid gray; padding: 5px; width: 45%;"> <p>Debit</p> <div style="border: 1px solid gray; padding: 2px; margin-bottom: 5px;"> ⋮ Accounts Payable \$2,300 </div> </div> <div style="border: 1px solid gray; padding: 5px; width: 45%;"> <p>Credit</p> <div style="display: flex; justify-content: space-between; margin-bottom: 5px;"> <div style="border: 1px solid gray; padding: 2px; width: 45%;"> ⋮ Cash \$2,277 </div> <div style="border: 1px solid gray; padding: 2px; width: 45%;"> ⋮ Inventory \$23 </div> </div> </div> </div> <div style="margin-top: 10px;"> <p>Incorrect Answers</p> <div style="border: 1px solid gray; padding: 5px; display: flex; justify-content: space-between; margin-bottom: 5px;"> <div style="border: 1px solid gray; padding: 2px; width: 45%;"> ⋮ Accounts Payable \$3,500 </div> <div style="border: 1px solid gray; padding: 2px; width: 45%;"> ⋮ Cash \$3,500 </div> </div> </div>
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LO 6-4 Analyze sales transactions under a perpetual inventory system.

Intermediate perpetual inventory accountant:

Optional Quiz 4 - LO4
Analyze sales transactions under a perpetual inventory system.

Top inventory accountant:

Optional Quiz 6 - LO4 and LO6-S1
Analyze sales transactions under a perpetual inventory system.

1 Categorization 2.5 points Sort the following into the debit or credit side category to represent the correct journal entry

Mitchell uses a perpetual inventory system. Mitchell sells a computer from inventory for \$1,198 on credit. Mitchell originally bought the computer for \$790. What journal entry (entries) will Mitchell prepare to record the sale?

Debit

⋮ Accounts Receivable \$1,198

⋮ Cost of Goods Sold \$790

Credit

⋮ Sales Revenue \$1,198

⋮ Inventory \$790

Incorrect answer

⋮ Cost of Goods Sold \$408

⋮ Cash \$1,198

⋮ Cost of Goods Sold \$1,198

On July 1, MJay Company sold inventory costing \$5,000 to Dee Company for \$6,000, with terms of 3/10, n/30.

MJay made the appropriate journal entry on July 1 as follows:

Account	Account	Debit	Credit
Accounts Receivable (+A)		6,000	
	Sales Revenue (+R, +SE)		6,000
Cost of Goods Sold (+E,-SE)		5,000	
	Inventory (-A)		5,000

Both companies use a perpetual inventory system. Dee Company pays the invoice on July 8 and takes the appropriate discount. Record the appropriate journal entries for MJay Company by filling in the blanks.

Debit: [Select] for [Select]

Debit: the contra-revenue account of [Select] for [Select]

Credit: Accounts Receivable for \$6,000

APPENDIX J. Pre-made Script for all Three Class Sections

Introductory script – To Avoid Emphasis on Intervention

Aloha Class,

Accounting education required substantial practice and exercises to learn the material (Fong & Law, 2019). In order to give you formative feedback and give you step by step guidance, I have created optional practice quizzes. These quizzes MIMIC the expectations of Exam 2. Mastering these quizzes will increase your chances of doing well on Exam 2. Additionally, in the past, students have gotten lower exam scores on Exam 2 and so to help you with your weekly quizzes and your Exam 2, I have created these optional quizzes for you to do. The quizzes are located on Canvas.

Reminder Script

Aloha Class,

Recall stats of how many have participated in the weekly optional exercises.

I would encourage you all to complete the optional quizzes located on Canvas. In case you need a refresher, I will show you where the quizzes are located on Canvas.

(show where quizzes are located on Canvas)

I want to reiterate that accounting education requires substantial practice and exercises to learn the material (Fong & Law, 2019). These quizzes MIMIC the expectations of Exam 2. Mastering these quizzes will increase your chances of doing well on Exam 2. Additionally, in the past, students have gotten lower exam scores on Exam 2 and so to help you with your weekly quizzes and Your Exam 2, I have created these optional quizzes for you to do.

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