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LEVEL-UP LEARNING: A QUASI-EXPERIMENTAL STUDY OF GAMIFICATION AND ACCOUNTING STUDENT PERFORMANCE

Master's thesis

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Abstract

Traditional accounting pedagogy often struggles with student engagement. This thesis investigates the impact of a gamified learning approach by utilizing the EdApp quiz platform within an Intermediate Accounting course. Using a quasi-experimental design with 194 students across a gamified (n=49) and control group, the study evaluated the effects on behavioral (attendance) and psychological engagement, final exam performance and student perceptions. The results demonstrated that the gamified intervention was associated with a positive trend in attendance, high self-reported psychological engagement and significantly higher final exam scores after controlling for covariates. In addition, there are predominantly positive student perceptions of the experience. This research provides empirical evidence that well-designed gamification can effectively enhance student learning outcomes and engagement in accounting education.

Key words: Gamification; Accounting education; Student engagement; Quasi-experimental study

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1. Introduction

1.1 Background to the Study

Accounting higher education is vital for developing professionals who manage financial information (Tavares et al., 2023). Traditionally, the field has prioritized technical skills such as ledger management, financial statement analysis and regulatory compliance (Queiro-Ameijeiras et al., 2022). While these competencies are essential, technical competencies require a balance with pedagogical approaches to foster broader skills, such as engagement, critical thinking and problem-solving, among learners (Silva et al., 2021). However, many accounting courses continue to rely on didactic lectures and rote memorization. These can diminish student engagement and lead to suboptimal learning outcomes (Tavares et al., 2023).

To revitalize traditional pedagogy, gamification, which is the strategic use of game design elements in non-game contexts is increasingly explored (Deterding et al., 2011). Educational gamification often incorporates features such as points, badges, levels and leaderboards to stimulate student motivation and active participation (Kapp, 2012). As a result, its interactive and immersive nature aligns with current calls for more constructivist and student-centered learning environments. Moreover, it has been suggested by proponents that a well-designed gamified intervention can foster deeper cognitive processing, greater collaboration and sustained engagement. These are elements which are particularly crucial in fields such as accounting which demand conceptual clarity and practical problem-solving (Hamari et al., 2014; Ortiz-Martínez et al., 2022).

While research on gamification in general education shows promising results (Hamari et al., 2014). Empirical evidence specific to accounting education remains comparatively sparse (Queiro-Ameijeiras et al., 2022). Similarly, disciplines such as computer science, language learning and mathematics have reported benefits including higher completion rates and enhanced conceptual understanding from gamification (Ortiz-Martínez et al., 2022). However, the specific complexities of accounting courses, especially those that require the rigorous application of abstract concepts have necessitated a targeted investigation in order to determine how gamification might yield benefits (Silva et al., 2021). The importance of empirical studies which are rigorous in their design, implementation and impact of gamified interventions within the accounting domain has been a result of this.

1.2 Problem Statement

Researchers have emphasized the importance of robust engagement and in-depth learning in

accounting education. Many programs frequently face student disengagement, high drop-out or failure rates in foundational courses and suboptimal retention of key concepts (Silva et al., 2021). Moreover, students often perceive the learning environment in many accounting classrooms as monotonous, heavily focused on formulae and rote practice with limited opportunities for meaningful interaction and real-world application (Tavares et al., 2023). As a result, these challenges are concerning both academically and professionally, as disengaged students are less likely to develop the well-rounded skill sets and ethical decision-making frameworks that are vital for contemporary accounting roles (Queiro-Ameijeiras et al., 2022).

Concurrently, existing literature suggests that gamification can be an effective catalyst for enhancing learner motivation and performance in higher education (Deterding et al., 2011; Kapp, 2012). However, research in this area remains fragmented, particularly in accounting-specific contexts, with many studies limited to single-course pilot interventions or relying on anecdotal evidence (Hamari et al., 2014; Ortiz-Martínez et al., 2022). To date, comparatively few studies have systematically measured the impact of specific gamified tools, particularly mobile or web-based solutions like EdApp, on key outcomes such as knowledge retention, application of principles, or real-time engagement metrics in accounting education (Queiro-Ameijeiras et al., 2022).

As a result, this thesis addresses this gap by conducting a quasi-experimental study that investigates the impact of integrating gamified platforms in an intermediate accounting course. Therefore, by evaluating engagement metrics and test performance alongside exploring students' perceptions of the gamified environment. This research aims to provide empirical clarity on whether gamification can enrich accounting education and if so, by what mechanisms (Silva et al., 2021). Consequently, the findings are intended to inform pedagogical strategies, curriculum development and potentially advise on how key accounting modules are structured.

1.3 Research Questions and Objectives

The study's main objective is to evaluate whether integrating gamified learning tools, specifically the EdApp quiz platform improves student engagement and academic success in Intermediate Accounting. The study focuses on three research questions (RQs):

- **RQ1 (Student Engagement):** Does the gamified learning approach affect student engagement in an Intermediate Accounting course, considering both behavioral engagement (class attendance) and self-reported psychological engagement (interest, flow, energy and motivation)?

- **RQ2 (Academic Performance):** How does the gamified learning approach influence students' academic performance, specifically their final exam scores, in an Intermediate Accounting course?
- **RQ3 (Student Perceptions of the Gamified Learning Experience):** What are students' comprehensive perceptions of the multifaceted gamified learning experience which encompasses its motivating and challenging aspects, its impact on learning processes (such as feedback, study habits, and self-efficacy), their reactions to specific design features (like competition and workload) and their overall satisfaction and attitudes toward its future use?

2. Theoretical Framework

2.1 Gamification Theory and Motivation

Gamification is "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 10). Common elements include points, badges, levels, challenges, leaderboards, narrative themes and instant feedback. The underlying premise is that integrating these elements into educational settings can stimulate both intrinsic and extrinsic motivators. These elements are similar to those found in games. Moreover, this also enhances participation and interest of students in tasks that they perceive as routine or complicated (Kapp, 2012). Motivational theories, such as Self-Determination Theory (SDT), suggest that game elements can enhance perceived competence (through rewards and feedback), offer autonomy (via choices in challenges and pacing), and foster relatedness (through team activities). These increase the students' intrinsic motivation and engagement when these psychological needs are met (Deci & Ryan, 2000).

Crucially, effective gamification transcends superficial additions of points. The design and alignment of game mechanics with specific learning objectives are important (Hamari et al., 2014). Therefore, awarding points for attendance or badges for minimal effort might generate fleeting interest but often fail to yield meaningful learning gains if not linked to genuine skill development (Deterding et al., 2011). Conversely, well-constructed challenges that require the application of course concepts can make learning more interactive and cognitively stimulating. Therefore, gamification should be a pedagogical instrument which is strategic with its efficacy being contingent upon curriculum integration which is thoughtful.

2.2 Educational Psychology: Self-Determination Theory

In order to understand how gamification will influence student motivation, a robust analysis framework is provided by the Self-Determination Theory (SDT). SDT posits that supporting three innate psychological needs including autonomy, competence and relatedness. This is key to enhancing intrinsic motivation and engagement (Deci & Ryan, 2000). While some other motivational theories provide valuable insights, including behaviorist approaches which focus on reinforcing schedules (Skinner, 1953) or goal-setting theory which emphasizes specific and challenging goals (Locke & Latham, 2002). SDT offers a more comprehensive explanation of why specific game mechanics can lead to sustained engagement. Specifically, SDT's emphasis on fostering intrinsic motivation through the satisfaction of these basic psychological needs aligns closely with the educational goal of promoting deeper, more sustained engagement rather than transient, extrinsically motivated behaviors that might be the primary outcome if gamification design overly relies on external rewards (Deci et al., 2001). As a result, this focus on the quality of motivation in contrast to its quantity makes SDT especially relevant for designing gamified learning experiences which aim for meaningful and long-lasting learning.

Moreover, these fundamental needs can be used effectively by utilizing gamified learning environments. Autonomy is supported by providing choices or optional activities, like self-paced quizzes or narrative content exploration. Similarly, competence is fostered through clear goals, progressive challenges, and immediate feedback (e.g., points, scores), which enable students to monitor their improvement and experience a sense of achievement. Additionally, relatedness is fostered through social elements such as team-based challenges or leaderboards, which connect students in a shared learning experience. For example, a digital badge for mastering a topic can reinforce competence. Whereas at the same time, a class leaderboard may be able to foster a sense of belonging or healthy competition which can promote a sense of relatedness. Furthermore, SDT suggests satisfying these needs inclines students to find intrinsic enjoyment and invest greater effort as opposed to acting solely for extrinsic rewards. In this study, the chosen gamified platform was designed to activate these motivational levers by offering autonomy (voluntary, self-paced quizzes), competence cues (scores, feedback, progression) and relatedness (team events, public recognition). The study's findings will be partly interpreted through the lens of SDT needs' satisfaction.

2.3 Gamification in Education: Empirical Evidence

Considerable research indicates that gamification can positively influence student engagement

and learning outcomes. Hamari et al.'s (2014) meta-analysis found that gamified interventions on average can lead to moderate learning performance improvements across diverse fields. Similarly, Ortiz-Martínez et al. (2022) reported that students in gamified courses often show greater enthusiasm, higher participation and increased interactivity. These reviews suggest that thoughtfully implemented game elements, such as immediate feedback and progress tracking, heighten student involvement, which often increases time-on-task and voluntary use of learning materials.

However, the literature presents mixed results on formal learning outcomes. Whereas, some experiments have documented significant gains in test scores (Hamari et al., 2014). Others have reported no substantial differences when compared to non-gamified control groups (Seaborn & Fels, 2015). As a result, these inconsistencies are often attributed to variations in design quality and context. Similarly, poorly aligned gamification may foster only superficial engagement failing to improve understanding (Kapp, 2012; Deterding et al., 2011). Conversely, when educational games incorporate mechanics that reward iterative problem-solving, they consistently foster a deeper conceptual understanding among learners (Clark et al., 2016; Byusa et al., 2022). Thus, the effectiveness of gamification is context-dependent which is best complemented by robust pedagogical strategies.

Furthermore, recent reviews have emphasized the need for domain-specific investigations. These are especially true for complex domains such as accounting (Kapp, 2012). Comprehensive reviews in accounting education (Almuntsr et al., 2024; Anwar & Mulyadi, 2025) indicate generally favorable effects on motivation and performance. However, some negative or insignificant findings have also emerged which are often linked to design flaws or resource constraints (Sailer & Sailer, 2021; Anwar & Mulyadi, 2025). While these studies suggest gamification in accounting can boost engagement, clear evidence of improved exam performance is less definitive. Moreover, this is often confounded by methodological limitations, such as short interventions or the lack of control groups (Queiro-Ameijeiras et al., 2022). These points highlight the need for more rigorous research which can accurately assess the impact of gamification in accounting courses.

2.4 Active Learning in Accounting and the Role of Gamification

In accounting education literature, active learning strategies have been advocated in order to improve student outcomes. Traditional instructional methods are often perceived as struggling to connect theory to practice, which can lead to disengagement (Queiro-Ameijeiras et al., 2022).

Similarly, active learning approaches (e.g., case studies, simulations, group problem-solving) have demonstrated efficacy in enhancing understanding and retention in accounting. As they engage students to apply concepts and foster technical knowledge alongside soft skills directly (Silva et al., 2021; Tavares et al., 2023).

Furthermore, gamification can be conceptualized as an extension of this active learning paradigm. For example, a points-based quiz competition adds excitement and immediate feedback to an interactive exercise which can potentially improve participation. Moreover, a gamified application with scenario-based accounting challenges functions as an engaging simulation (Ortiz-Martínez et al., 2022). As a result, these activities require students to interact with content, reducing passivity and typically provide instant performance feedback, which is invaluable for learning (Kapp, 2012). Additionally, many gamified platforms also offer analytical tools for instructors. Therefore, a thoughtfully implemented gamification structure can complement active learning by increasing practice frequency, adding incentives and delivering timely feedback. Consequently, this can transform accounting courses into more student-centered and dynamic environments.

2.5 Research Hypotheses

Based on the theoretical and empirical insights discussed, we are able to formulate the following hypotheses:

- **H1 (Student Engagement):** Students in the gamified class will demonstrate higher behavioral engagement (reflected by higher attendance) and report higher psychological engagement (reflected by the Engagement and attendance motivation section of the survey) compared to students in non-gamified classes.
- **H2 (Academic Performance):** Students in the gamified condition will achieve significantly higher average final exam scores compared to students in a traditional, non-gamified condition, after controlling for relevant covariates (prior academic achievement and instructor).
- **H3 (Student Perceptions of the Gamified Learning Experience):** Students will report an overall positive perception of the multifaceted gamified learning experience. This positivity will manifest through their appreciation of motivating game elements, recognition of benefits to their learning processes, including improved study habits, feedback reception, and self-efficacy, as well as nuanced perspectives on design aspects such as competition and workload. This will result in strong overall satisfaction and broader

use recommendations.

These hypotheses directly align with the research questions. H1 and H2 correspond to RQ1 and RQ2, respectively. The expectation here is that this will result in improvements in engagement and performance. Whereas, H3 corresponds to RQ3 where we anticipate that subjective experiences will corroborate the objective outcomes.

3. Methodology

3.1 Research Design and Participants

This study occurred in a second-year undergraduate Intermediate Accounting (IA) course at a university which focuses on financial reporting standards and complex problem-solving. A quasi-experimental with non-equivalent groups was used due to the practical inability to randomly assign students to different instructors or semesters. The design involved natural course offerings across two sequential semesters and two instructors. The structuring comparisons are as follows:

- **Gamified Group (Teacher 1 – Current Semester):** One IA section (n = 49) taught by Teacher 1 with the gamified quiz intervention implemented throughout the semester.
- **Baseline Control (Teacher 1 – Previous Semester):** Teacher 1's prior IA cohort (n = 51) taught in the semester immediately preceding gamification using traditional methods. This comparison aimed to isolate the gamification effect with other factors (course content, instructor style, assessment difficulty) held constant.
- **External Control A (Teacher 2 – Current Semester):** A parallel IA section (n = 47) in the same current semester taught by Teacher 2 without gamification. This controlled for semester-specific influences.
- **External Control B (Teacher 2 – Previous Semester):** Teacher 2's IA section (n = 47) from the previous semester without gamification. This provides additional baseline data and checks for unusual performance shifts in Teacher 2's classes.

All four groups utilized the same curriculum, textbook, syllabus and a common final exam. Moreover, the students sit the same final exam and the final exams are cross graded together by both the teachers as this is the university policy to ensure similar grading standards. The primary independent variable was the presence or absence of the gamified quizzes in Teacher

1’s current class. Whereas Teacher 2’s classes served as controls for general trends. As a result, this multi-group between-subjects comparison across different semesters and instructors strengthens causal inference regarding the intervention's impact.

To ensure baseline equivalence, prior academic indicators including cumulative GPA (Pre-GPA) and grades from the pre-requisite course Principles of Accounting (POA) were assessed and used as control variables. Moreover, no significant differences were found between the cumulative GPA and pre-requisite subject score in the gamified and baseline classes of Teacher 1, nor between Teacher 1's gamified class and Teacher 2's control class which mitigates selection bias. Given the homogenous student age (19-20) and predominantly female (over 80%) enrollment in accounting courses, detailed demographics were not utilized. Student enrollment patterns are random (students are randomly assigned sections by the school) and multiple comparison groups were employed to reduce major confounds.

Moreover, internal validity threats in the quasi-experimental design were also addressed. Teacher 2's non-gamified classes were used to control for any historical effects. In addition, the absence of any significant prior academic differences also offered some assurance against selection bias despite the non-random assignment. Similarly, consistent teaching style and grading were maintained by Teacher 1 who instructed both the experimental and baseline groups. In addition, differential attrition was not a factor as every student completed the course. Furthermore, appropriate statistical controls and a multi-group comparison design enhanced inferential capability which further isolated the intervention's effect.

Ethical approval was obtained, and informed consent procedures were followed. Current semester students consented to the anonymized use of their data. Moreover, the gamified activities were offered as a non-graded course enhancement with participation being voluntary. Anonymized historical data from previous semesters were used in aggregate form which adhered to the institutional guidelines.

3.2 Gamified Quiz Intervention (EdApp Platform)

The study used an intervention by integrating the weekly digital quizzes into Teacher 1’s current IA class using the EdApp microlearning platform. EdApp was selected for its comprehensive gamification features and its accessibility via web and mobile devices. These features included interactive quiz formats, instant feedback, points, achievement badges, leaderboards, progress-tracking streaks and occasional team-based challenges. Critically, the implementation focused on applying these game elements specifically to the quiz and practice

activities. Whereas lectures, assignments and exams remained consistent with the previous non-gamified semesters. This targeted approach helped isolate the effect of gamification on the learning process.

3.2.1 Frequency, Integration, and Content

Students in the gamified group were assigned short, formative EdApp quizzes weekly, aligned with lecture topics e.g., a 10-question quiz on "Property, Plant, and Equipment" followed that lecture. Some quiz activities were used to offer early point-earning opportunities. These quizzes were ungraded but highly encouraged as study tools for completion outside class time, aiming to increase practice opportunities without assessment pressure. Students engaged voluntarily and were motivated by learning feedback and game-based rewards such as points and maintaining streaks rather than course credit. Other course components (lectures, homework, exams) for Teacher 1's gamified class remained identical to the previous semester to ensure the gamified quizzes were the primary differentiating element.

In addition, quiz questions mirrored the format and difficulty of exam problems and targeted weekly learning outcomes. Immediate feedback was provided for each question where incorrect answers were followed by the correct solution and an explanation which facilitated on-the-spot learning. Moreover, students could attempt each quiz multiple times with only the highest score counting as game points. This design when coupled with the desire to level up encouraged a mastery-oriented approach and sustained engagement. As a result, quizzes served as learning reinforcement tools which align with principles of retrieval practice and immediate feedback and fostering more proactive and self-regulated learning habits.

3.2.2 Instructor Involvement

Teacher 1 introduced the EdApp platform and its gamified elements, including features like team competition and occasional in-class polls for bonus points in the first week. Although an initial demonstration was provided, some students later suggested a more detailed tutorial could have accelerated the understanding of all mechanics. In addition, throughout the semester the instructor acted as a facilitator by reminding students about quizzes, highlighting achievements and using aggregate quiz data to inform teaching. These practices signaled the tool's value despite being ungraded by reinforcing intrinsic motivation and as students reported made class attendance more compelling to maintain streaks or gain points from in-class activities.

The instructor also managed aspects like make-up opportunities for missed team competitions

and addressing some coordination challenges inherent in collaborative tasks. In addition, identical exam and homework structures were maintained for the gamified class relative to its baseline to ensure a fair comparison. While the instructor's enthusiasm for the intervention likely contributed to student uptake, Teacher 1's previous class received a similar level of general encouragement for participation, although without a gamified system. The design aimed to enhance engagement through frequent, low-stakes practice and motivate students through game-based rewards and feedback and hypothesized to improve attendance and exam performance.

3.3 Data Collection and Measures

Data were collected to address the three primary research questions, focusing on: (1) Student Engagement, (2) Learning Outcomes and (3) Student Perceptions of the gamified experience. Multiple measures were employed for each dimension which were primarily drawn from the course records, the EdApp quiz platform and an end-of-semester survey administered to the gamified group.

1. Student Engagement (RQ1, H1)

Engagement was operationalized through both behavioral and psychological indicators:

a) Behavioral Engagement: A common measure across all sections (gamified and control) was class attendance which was recorded as the percentage of sessions attended. Attendance not only formed a minor component of the final grade for all students but also served as a key behavioral engagement indicator potentially influenced by the gamification intervention (Silva et al., 2021). For control classes, attendance was the primary available measure of behavioral engagement.

b) Psychological Engagement: Self-reported psychological engagement encompassed interest, enthusiasm and effort and was assessed for the gamified group using the engagement scale in Section B of the end-of-semester survey (Appendix A). This scale was adapted from established instruments, namely the Student Course Engagement Questionnaire (SCEQ) and the Utrecht Work Engagement Scale (UWES) - student version. Students rated four statements on a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree) regarding their cognitive and affective involvement. Moreover, an overall psychological engagement score was computed from these items which demonstrated good internal consistency (Cronbach's α=.85, see Appendix B, Table B2 for all scale reliabilities). In addition, an open-ended response from

Section A of the survey (specifically Q3) also provided qualitative insights into how gamification influenced attendance decisions. Therefore, H1 which was concerned about student engagement which was tested using both the comparative attendance data and the psychological engagement measures from the gamified group.

2. Learning Outcome Measures (RQ2, H2)

The primary measure for learning outcomes was student academic performance on the final examination. A common comprehensive final exam which was collaboratively designed by all course instructors to ensure content validity across all sections was administered to both gamified and control groups. This exam accounts for 50% of the total course grade and comprises a mix of problem-solving and conceptual questions which provides a standardized summative assessment of student learning. Each student's final exam score was used as the main dependent variable for RQ2. This focus on the uniform final exam aimed to minimize variability that might arise from other course components which differs by instructor. Moreover, for H2, predicting differential performance for the gamified group was tested using appropriate statistical methods including t-tests and multiple regression after controlling for covariates such as prior GPA (Pre-GPA), performance in the pre-requisite course Principles of Accounting (POA) and attendance.

Moreover, analyses assumptions were checked for normality of exam scores and variance similarity for t-tests. In addition, for regressions Variance Inflation Factors (VIFs < 2.4) indicated no multicollinearity concerns.

3. Student Perceptions of the Gamified Experience (RQ3, H3)

To address RQ3 and test H3, which posits an overall positive student perception of the multifaceted gamified learning experience, a mixed-methods approach was employed by collecting both qualitative and quantitative data from the gamified group through an end-of-semester survey (see Appendix A).

a) Qualitative Perceptions: Section A of the survey featured five open-ended questions which were designed to capture the students' subjective experiences. These questions explored are as follows:

- The specific aspects of the gamified quizzes that boosted motivation or engagement (Q1).
- Any demotivating aspects or challenges that they encountered (Q2).
- Any ways in which the gamified approach changed study habits (Q4).

- The overall impact of gamification on learning, along with suggestions for improvement (Q5).

Responses from 40 of 49 students were thematically coded by two researchers. A collaborative process was used to develop a coding scheme and identify common themes which allowed for the summarization of the prevailing sentiments and the selection of illustrative quotes.

b) Quantitative Perceptions: Section B of the survey included several multi-item scales using a 5-point Likert format (1 = Strongly disagree, 5 = Strongly agree) to quantify specific facets of student perceptions. Composite scores were computed for each scale, all demonstrating good internal consistency (see Appendix B, Table B2 for all Cronbach's α values). These scales assessed:

- Competitive Dynamics: There were four items on perceptions of competition (α =.87).
- Formative Feedback: Additionally, two items on the perceived usefulness of feedback from gamified activities (α=.78).
- Self-Efficacy: Another, two items on students' confidence in applying course concepts (α=.80).
- Workload and Stress: There were four items on the fit of gamified tasks with study schedules and additionally perceived stress (α=.82).
- Satisfaction: In addition, two items which measured the overall satisfaction with the gamified experience were used (α=.86).
- Adoption Intent: Similarly, two items related to willingness of the students' in recommending the approach (α=.81).

These quantitative scales which were complemented by the qualitative themes provided a comprehensive basis for evaluating H3.

4. Results

4.1 Descriptive Statistics

Through the combined sample of all sections (N = 194) in Table 1, the overall class attendance averaged 78.57% (SD = 13.21%) and final exam scores averaged 75.52% (SD = 9.41%). Further descriptive statistics for the entire sample are also provided which includes behavioral engagement metrics for the gamified group using EdApp (Average Quiz Score and Completion

Rate) and prior academic indicators (POA, Pre-GPA, Attendance).

Table 1. Descriptive Statistics of Key Variables Across All Participants

	Count	Mean	SD	min	25%	50%	75%	max
Attendance	194	78.57	13.21	34.3	69.5	80.3	87.48	100
Final Exam Score	194	75.52	9.41	43	69.5	77.5	82.5	96.5
Average Score	49	64.69	11.9	33.2	55.7	67	73	86
Completion	49	57.88	15.86	22.9	47.7	58.1	70.4	86.4
POA	194	76.39	12.91	31.3	70.12	77.6	85.1	100
Pre-GPA	194	3.15	0.27	2.4	2.98	3.18	3.32	3.8

Notes. N=194 for the total sample. "Average Score" (average EdApp quiz score) and "Completion" (EdApp quiz completion rate) are reported for the gamified group (n=49). SD = standard deviation; min = minimum value; max = maximum value; POA = final grade in the Principles of Accounting prerequisite course (%); Pre-GPA = cumulative Grade Point Average prior to the course. Attendance and Final Exam Score are expressed as percentages (%).

Group-specific means, presented in Table 2, provide initial comparisons. Notably, Teacher 1's gamified class showed a higher average attendance of 80.51% compared to their previous non-gamified class (76.7%). A higher mean final exam score was also observed for Teacher 1's gamified class (78.58%) versus their non-gamified cohort (74.87%). In contrast, Teacher 2's non-gamified classes showed stable attendance (77.01% current vs. 76.8% previous) and final exam averages (73.87% current vs. 74.66% previous) across semesters. These descriptive data suggest the gamified class achieved approximately 3.7–4.7 percentage points higher on final exam averages and 3.5–3.8 percentage points higher in attendance compared to other groups.

Table 2. Descriptive Statistics for Key Study Variables by Group

Group	Count	Attendance	Final Exam Score	POA	Pre-GPA
T1 Current (gamified)	49	80.51 (10.3)	78.58 (8.72)	75.38 (13.94)	3.10 (0.26)
T1 Previous	51	76.7 (11.1)	74.87 (9.23)	77.74 (15.43)	3.15 (0.31)
T2 Current	47	77.01 (10.9)	73.87 (9.78)	76.14 (12.85)	3.12 (0.21)
T2 Previous	47	76.8 (10.8)	74.66 (9.01)	76.21 (13)	3.08 (0.29)

Notes. Values for Attendance, Final Exam Score, POA, and Pre-GPA are presented as Mean (Standard Deviation). T1 = Teacher 1; T2 = Teacher 2. "Current (gamified)" refers to Teacher 1's class in the semester the gamification intervention was implemented. "Previous" refers to the respective teacher's class from a prior semester without the gamification intervention (control/baseline). "T2 Current" and "T2 Previous" represent non-gamified control

groups taught by Teacher 2 in the current and a prior semester, respectively. POA = final grade in the Principles of Accounting prerequisite course (%); Pre-GPA = cumulative Grade Point Average prior to the course. Attendance and Final Exam Score are expressed as percentages (%).

4.2 Student Engagement (RQ1/H1)

H1 was assessed through quantitative attendance data and quantitative psychological engagement scores from the "Engagement" survey scale and qualitative feedback on attendance influences.

4.2.1 Behavioral Engagement (Attendance)

A positive trend in attendance emerged for Teacher 1's gamified class (M = 80.51%, SD = 10.3) compared to the prior non-gamified class (M = 76.7%, SD = 11.1). As shown in Table 3, this difference of +3.81 percentage points was marginally significant (t (98) = 1.83, p = .070, Cohen's d = 0.37) which suggests a tendency towards improved attendance with gamification. Conversely, no significant change in attendance was observed in Teacher 2's non-gamified classes between the latest and previous semesters (M = 77.0% vs. M = 76.8%; t (92) = 0.10, p = .923, Cohen's d = 0.02).

Table 3. Two independent-samples t-tests on Attendance

Comparison	Δ Mean	t	p	Cohen's d
Teacher 1: Gamified vs Non-gamified	+3.81	1.83	.07	0.37
Teacher 2: Latest vs Previous (no game)	+0.21	0.10	.923	0.02

Notes. This table compares mean class attendance percentages between groups. "Teacher 1: Gamified vs non-gamified" compares Teacher 1's current gamified class (T1 Current from Table 2) with Teacher 1's previous non-gamified class (T1 Previous from Table 2). "Teacher 2: Latest vs Previous (no game)" compares Teacher 2's current non-gamified class (T2 Current from Table 2) with Teacher 2's previous non-gamified class (T2 Previous from Table 2). Δ Mean = Difference in mean attendance percentages; t = t-statistic from the independent samples t-test; p = p-value (significance level); Cohen's d = effect size.

4.2.2 Psychological and Perceived Behavioral Engagement

Psychological engagement for the gamified group (N=40 who completed the survey) was assessed using the "Engagement " scale from Section B of the survey (see Appendix A for survey instrument; Appendix B, Table B2 for scale descriptives). This 4-item scale demonstrated good internal consistency (Cronbach's α=.85). The mean score for Engagement was notably high at 4.31 (SD = 0.47) on a 5-point Likert scale which signifies substantial intrinsic interest and absorption during gamified activities. This strong composite finding is

mirrored at the item level (see Appendix B, Table B1 for item-level descriptives). For instance, item E1, "The game elements made the course material more interesting," received a mean score of 4.32 (SD = 0.57). Similarly, students reported feeling energized (item E4: "I felt energized while working on the game activities," M = 4.28, SD = 0.61) and focused (item E3: "The challenges kept me fully focused on the task," M = 4.22, SD = 0.52).

In addition to these scale measures, qualitative feedback from the open-ended survey question Q3 ("Has the game influenced your decision to attend or miss class? If yes, how?") provided direct insights into the perceived impact of gamification on class attendance decisions for the gamified group. Nearly all students who responded to this question reported that gamification positively influenced their attendance. Key themes indicated that gamified elements made attendance more compelling even for typically diligent students. Motivators included the prospect of earning in-class points, the desire to maintain leaderboard positions or streaks (which leveraged loss aversion) and a general feeling that these features reinforced both intrinsic and extrinsic reasons to attend. Importantly, no respondents reported a negative impact of gamification on their attendance. (A full thematic analysis of Q3 is presented in Section 4.4.2).

Summary for H1: H1 was partially supported regarding behavioral attendance and strongly supported regarding psychological engagement and perceived attendance influence within the gamified group. While the observed increase in quantitative attendance for the gamified class showed a positive trend that was marginally significant (p = .07), the self-reported psychological engagement (interest, flow, absorption) from this group was very high. Furthermore, qualitative data also indicated that students perceived the gamification as a positive influence on their motivation and resulted in the decision to attend class.

4.3 Academic Performance (RQ2/H2)

H2 was assessed by comparing the gamified class with the traditional classes and it was expected that the gamified class will exhibit significantly better learning outcomes measured by higher average final exam scores

4.3.1 Comparative Analysis of Exam Scores

As indicated descriptively in Table 2, Teacher 1's gamified class achieved a mean final exam score of 78.58% (SD = 8.72), which was 3.71 percentage points higher than their prior non-gamified cohort (M = 74.87%, SD = 9.23). Table 4 shows this difference was statistically

significant (t (98) = 2.04, p = .044, Cohen's d = 0.41) which represented a moderate effect size. Conversely, Teacher 2's non-gamified classes showed no significant performance difference between semesters (M = 73.87% vs. M = 74.66%; t (92) = -0.49, p = .627, Cohen's d = -0.10). This stability in the control condition suggests the improvement in Teacher 1's class may be associated with gamification.

Table 4. Two independent-samples t-tests on Final exam scores

Comparison	Δ Mean	t	p	Cohen's d
Teacher 1: Gamified vs Non-gamified	+3.71	2.04	.044	0.41
Teacher 2: Latest vs Previous (no game)	-0.79	-0.49	.63	-0.06

Notes. This table compares mean final exam scores (percentages) between groups. "Teacher 1: Gamified vs non-gamified" compares Teacher 1's current gamified class (T1 Current from Table 2) with Teacher 1's previous non-gamified class (T1 Previous from Table 2). "Teacher 2: Latest vs Previous (no game)" compares Teacher 2's current non-gamified class (T2 Current from Table 2) with Teacher 2's previous non-gamified class (T2 Previous from Table 2). Δ Mean = Difference in mean final exam scores; t = t-statistic from the independent samples t-test; p = p-value (significance level); Cohen's d = effect size.

4.3.2 Regression Analyses of Exam Scores

To further test H2 while controlling for potential confounding variables, multiple regression analyses were also conducted.

Model 1 (Teacher 1 Comparison): This model predicted final exam scores for students taught by Teacher 1 and comparing the gamified semester against the non-gamified semester. While controlling for attendance, POA (Principles of Accounting performance) and Pre-GPA.

$$Final\ Exam_{it} = \beta_0 + \beta_1 Gamified_{it} + \beta_2 Attendance_{it} + \beta_3 POA_{it} + \beta_4 PreGPA_{it}$$

where i indexes the individual student and t indexes the semester during which the student was taught by Teacher 1. $Gamified_{it}$ *is a dummy variable.*

The overall model was statistically significant (F (4, 95) = 92.88, p < .001 which explained a substantial portion of variance (Adj. $R^2 = 0.788$). As shown in Table 5, the Gamified condition was a significant positive predictor (β = +3.55, SE = 0.95, p = .0002) which indicates that gamification was associated with approximately a 3.5-point higher exam score while holding other factors constant. Similarly, attendance, POA and Pre-GPA also significantly predicted higher exam scores.

Table 5. Model 1 Results: Multiple Regression Predicting Final Exam Scores for Teacher 1 Students

	β	**SE**	***z***	***p***
Intercept	6.1205	6.0734	1.0078	.3136
Gamified	3.5488	.9523	3.7265	.0002
Attendance	.2954	.078	3.7883	.0002
POA	.3323	.0679	4.8948	.0001
Pre-GPA	6.3572	2.9014	2.1911	0.0284
Adjusted-R^2 = 0.788; N =100; F (4, 95) = 92.88				

Notes. Dependent variable is Final Exam Score (%). N = 100 students taught by Teacher 1 across two semesters. β = unstandardized regression coefficient; SE = standard error of the coefficient; z = z-statistic; *p* = p-value. Predictor variables: "Gamified" is a dummy variable (1 = gamified semester, 0 = non-gamified semester); "Attendance" is class attendance (%); "POA" = final grade in the Principles of Accounting prerequisite course (%); "Pre-GPA" = cumulative Grade Point Average prior to the course.

Model 2 (Within Gamified Class): This model explored predictors of exam performance specifically within Teacher 1's gamified class.

$$Final\ Exam_i = \beta_0 + \beta_1 Attendance_i + \beta_2 AverageScore_i + \beta_3 Completion_i + \beta_4 POA_i + \beta_5 PreGPA_i$$

where i indexes the individual student.

As reported in Table 6, higher average EdApp quiz scores (β = +0.21, SE = 0.10, p = .043) and a tendency for higher attendance (β = +0.14, SE = 0.07, p = .051) were associated with higher exam scores. The completion rate of quizzes was not a significant predictor once average quiz score was considered which suggests that the quality of quiz engagement (mastery) was more critical than quantity. In addition, POA also remained a significant predictor. However, these within-group results should be interpreted cautiously due to a smaller sample size which imply gamification's benefit may have stemmed from encouraging consistent study and effective practice.

Table 6. Model 2 Results: Multiple Regression Predicting Final Exam Scores within Teacher 1's Gamified Class

	β	**SE**	***z***	***p***
Intercept	2.1141	14.0906	0.15	.8807
Attendance	.1369	.0703	1.9478	.0514
Average Score	.2071	.1023	2.0241	.043
Completion	.1046	.0713	1.4681	.1421
POA	.2837	.0967	2.9345	.0033
Pre-GPA	7.7938	5.7293	1.3603	.1737
Adjusted-R^2 = 0.713; N = 49; F (5, 43) = 24.81				

Notes. Dependent variable is Final Exam Score (%). Results are for students within Teacher 1's gamified class only (N = 49). β = unstandardized regression coefficient; SE = standard error of the coefficient; z = z-statistic; *p* = p-value. Predictor variables: "Attendance" is class attendance (%); "Average Score" is the average EdApp quiz score (%); "Completion" is the EdApp quiz completion rate (%); "POA" = final grade in the Principles of Accounting prerequisite course (%); "Pre-GPA" = cumulative Grade Point Average prior to the course.

Model 3 (Comprehensive Comparison): This model included students from both teachers and all relevant semesters and evaluated the gamification effect while controlling for teacher differences and student baseline factors.

$$Final\ Exam_{ijt} = \beta_0 + \beta_1(Gamified)_{ijt} + \beta_2(Teacher2)_j + \beta_3(Attendance)_{ijt} + \beta_4(POA)_{ijt} + \beta_5(PreGPA)_{ijt}$$

Where i indexes the individual student, j indexes the teacher (where j=1 for Teacher 1 and j=2 for Teacher 2) and t indexes the semester (Current = 1 and Previous = 2) for student i under teacher j. $Gamified_{ijt}$ *is a dummy variable.*

This model demonstrated an excellent fit (F (5, 188) = 166.63, p < .001; Adj-R^2 = 0.811), as detailed in Table 7. The Gamified condition was a statistically significant positive predictor (β = +4.22, SE = 0.91, p < .0001), which was associated with an approximate 4.22-point increase in exam scores compared to non-gamified conditions while controlling for other variables. Moreover, there was no significant main effect for Teacher 2 (p = .265), which suggests that teacher variation once covariates were included did not primarily explain the gamification effect. Moreover, attendance, POA and Pre-GPA were also highly significant positive predictors.

Table 7. Model 3 Results: Comprehensive Multiple Regression Model Predicting Final Exam Scores Across All Groups

	β	**SE**	***z***	***p***
Intercept	-2.4293	3.9438	-.616	.5379
C (Teacher)[T2]	0.6707	.6016	1.1147	.265
Gamified	4.2151	.9141	4.611	.0001
Attendance	0.1734	.0377	4.6017	.0001
POA	0.3579	.0378	9.4738	.0001
Pre-GPA	11.3527	1.6687	6.8035	.0001
Adjusted-R^2 = 0.811; N = 194; F (5, 188) = 166.63				

Notes. Dependent variable is Final Exam Score (%). Results are for the comprehensive sample of all students (N = 194). β = unstandardized regression coefficient; SE = standard error of the coefficient; z = z-statistic; *p* = p-value. Predictor variables: "C (Teacher)[T2]" is a dummy variable (1 = student taught by Teacher 2, 0 = student taught by Teacher 1 [reference group]); "Gamified" is a dummy variable (1 = student was in Teacher 1's current gamified class, 0 = student was in any of the non-gamified classes); "Attendance" is class attendance (%); "POA" = final grade in the Principles of Accounting prerequisite course (%); "Pre-GPA" = cumulative Grade Point Average prior to the course.

Summary for H2: H2 was supported. The gamified class consistently outperformed non-gamified sections on the final exam, both in direct comparisons and after controlling for significant covariates like prior academic achievement, attendance and instructor effects.

4.4 Student Perceptions of the Gamified Experience (RQ3/H3)

H3 proposed that students would have an overall positive perception of the multifaceted gamified learning experience. This was assessed through quantitative scales from Section B of the survey and qualitative feedback from Section A (Appendix A). All multi-item quantitative scales demonstrated good to excellent internal consistency (Cronbach's α coefficients ranging from .78 to .87, see Appendix B, Table B2 for all scale descriptive statistics and reliabilities). Item-level descriptive statistics are available in Appendix B, Table B1. Negatively worded items were reverse-scored so higher scores uniformly indicate more favorable perceptions or lower perceived problems.

The analysis of 40 students' open-ended responses revealed clear themes for each question (Q1-Q5) and summarized below with representative quotes. Overall, the qualitative feedback was largely positive and corroborated the quantitative findings. In addition, it also offered constructive suggestions.

4.4.1 Quantitative Survey Perceptions

- **Competitive Dynamics:** The Competition scale yielded a mean of 4.06 (SD = 0.58, α=.87) which suggests that these aspects were generally perceived as motivating with low associated anxiety. This is supported by strong agreement with item C1 ("Competing with classmates on the leaderboard motivated me to improve," M = 4.12, SD = 0.52) and a high mean on the reverse-scored item C4(R) ("Comparing my leaderboard score with others made me anxious," M = 4.00, SD = 0.55 after recoding) which indicates low anxiety.
- **Formative Feedback:** The utility of formative feedback was highly rated with the Feedback Usefulness scale showing a mean of 4.38 (SD = 0.49, α=.78). This confirms students valued the immediate feedback for guiding their learning (F1: "The immediate feedback from the game helped me identify what I had mastered," M=4.35, SD=0.48).
- **Self-Efficacy:** Students reported enhanced confidence which is reflected by the Self-Efficacy scale mean of 4.2 (SD = 0.46, α=.80). This indicates the gamified experience contributed to increased confidence in applying accounting concepts (L1, M=4.25, SD=0.49) and tackling unfamiliar problems (L2, M=4.10, SD=0.50).
- **Workload and Stress:** The Workload/Stress scale produced a mean of 3.98 (SD = 0.55, α=.82). This score supported by high means on reverse-scored items like W2(R) ("The game elements added extra stress to the course," M = 3.93, SD = 0.55, after recoding) and W4(R) ("I sacrificed other coursework because of the game tasks," M = 4.02, SD = 0.58, after recoding) signifies that the workload was generally considered manageable and did not induce undue stress for most.
- **Satisfaction and Adoption Intent:** Outcome variables indicated strong approval. The Satisfaction scale achieved a very high mean of 4.54 (SD = 0.41, α=.86), denoting very high global satisfaction. Similarly, the Adoption Intent scale recorded a mean of 4.35 (SD = 0.45, α=.81) which indicates a strong student support for wider use of such gamified approaches.

4.4.2 Qualitative Perceptions (Student Feedback Themes)

The thematic analysis of open-ended responses from 40 students in the gamified group (Appendix A, Section A of the survey) provided deeper insights into their experiences which largely corroborated and enriched the quantitative findings.

Q1. Most Motivating Game Elements

Competitive and progress-related elements were overwhelmingly cited as primary motivators. A majority highlighted leaderboards and points. Moreover, one student wrote that climbing the leaderboard weekly "turned routine practice questions into activities I actually looked forward to," which attributes the increased effort to friendly competition. Similarly, team-based challenges were also motivating with one student remarking that it "fueled my competitive spirit and prompted me to review my notes even on days I felt tired," which suggests that these features tapped into desires to outperform or contribute to the team.

In addition, alongside competition many students also valued the sense of progress being made. Many students mentioned the points system and streaks with quotes that: "Earning bonus points for maintaining a streak kept me coming back each week," illustrating how accumulating points motivated consistent engagement. Moreover, badges and progress bars also provided tangible goals and continuous incentives with one student describing "a progress bar nearing a badge as a quiet coach...reminding me I could always earn one more point."

In summary, competition (leaderboards, team challenges), recognition (points, badges) and progression (streaks, levels, progress bars) were the dominant motivating factors which align with gamification theory.

Q2. Demotivating Aspects or Challenges

Students' feedback on downsides converged on two main issues. One related to technical difficulties and another related to group work coordination. Several respondents also mentioned that the EdApp application occasionally froze or lagged. This was true especially during peak use. One student noted that, "There were times that the app froze...it disrupted my momentum… But a quick refresh always got things back on track." Although generally described as minor annoyances, these glitches momentarily broke the learning flow. The consensus was that the mobile interface needed more polishing.

Regarding collaborative tasks, a common challenge was member absence or non-participation. As one student explained, "Working on group quests was tricky when partners didn't attend, but fortunately we had a make-up opportunity to handle that." This quote indicates that although group gamification is able to foster collaboration. It also introduces a dependency that can be frustrating. At the same time, the provision of make-up assignments for missed group missions was appreciated. However, it did not fully resolve the cited frustration.

It is important to note that no student indicated that competitive elements or game rewards as inherently demotivating. Moreover, concerns about undue competition or anxiety were also absent which aligns with the survey data. Similarly, negative feedback primarily focused on the implementation issues which included the technical stability and teamwork logistics as opposed to flaws in the gamification concept itself. These practical issues are addressable and provide valuable feedback for refinement.

Q3. Impact on Class Attendance (RQ1/H1)

Nearly all respondents reported gamification positively influenced their attendance. Many admitted that while usually diligent, the gamified elements made attendance more compelling. A representative comment about "I already tended to attend class regularly, but knowing I could earn bonus points from the in-class polls made it non-negotiable to show up every time." The prospect of gaining points from occasional in-class polls/quizzes and not falling behind on leaderboards incentivized attendance.

Another student confessed gamification overcame barriers like bad weather or low energy by quoting that "If I missed a class, I would lose my streak points, so I dragged myself to class even if the weather was bad." The desire to earn rewards was a powerful motivator. Others echoed that "imagining my rank dropping on the leaderboard was enough motivation to get me out of bed and into class," which indicates that leaderboard and streak mechanics leveraged loss aversion. Even previously diligent students noted an effect stating that the in-class point opportunities "ensured I wouldn't miss a single session." As a result, gamification added extrinsic motivation that reinforced intrinsic or habitual attendance. Moreover, no respondents reported a negative impact on attendance. This qualitative feedback aligns with quantitative findings of a positive attendance trend and provides narrative confirmation for H1.

Q4. Changes in Study Habits

An interesting finding was how gamification altered study approaches. A large majority reported shifting from last-minute studying to more continuous and spaced practice. Many explicitly mentioned overcoming procrastinations, "Rather than cramming at the last minute, I spread my practice out over the week so I could keep my activity streak going." The streak mechanism effectively incentivized regular study. Another similarly noted, "I stopped cramming...and instead practiced a bit each day...to maintain my streak," a positive outcome aligning with known benefits of distributed practice.

Moreover, some students also reported more thorough class preparation. Several students reviewed lecture materials in advance as they knew that the quiz questions offered early point-earning opportunities. One student explained that, “By pre-reading the slides before class. I was able to answer those quiz questions more quickly.” This proactive behavior likely enhanced lecture comprehension.

A few also highlighted using the system's feedback and analytics to guide studying. One wrote, “I took advantage of the real-time analytics to zero in on the accounting topics I struggled with.” Immediate quiz feedback helped them identify weak areas for more efficient study time allocation. Overall, gamification promoted more consistent, proactive and self-regulated learning habits. Students effectively adopted learning best practices, supporting H1 (engagement) and suggesting a mechanism for H2 (performance gains). Many credited the gamified system for these changes with one student summing up, “Rather than cramming, I studied in small chunks regularly because I wanted to keep my streak...and it even helped me learn more effectively.”

Q5. Overall Impact and Suggestions for Improvement

Most students described gamification’s overall impact as positive by using terms like engaging, motivating and fun. Many noted that it also changed their attitude towards the course. One student wrote that, “Overall, gamification turned the course from a mere requirement into a puzzle that I was excited to solve”. This was a sentiment which was echoed by others who found the course had become an intrinsically interesting challenge. Students also reported increased confidence: “The gamification elevated both my engagement and my confidence in the material.” They appreciated that it was not burdensome, as one student put it, “I stayed motivated throughout and it never became burdensome.”

Constructive suggestions for improvement included:

- Improve technical interface: About a quarter of respondents felt a smoother mobile app without minor bugs would make the experience nearly perfect.
- Provide a brief tutorial: Several students suggested that a short orientation in the first week to help students understand the gamification mechanics faster would have been more helpful. Even though an in-class demo was provided which seemed to be insufficient.
- Adjust certain game elements: Some students also suggested rotating team compositions in group challenges for variety and to mitigate dependency issues.

Summary for H3: H3 was strongly supported. Both quantitative survey data and qualitative feedback indicated a positive student perception of the multifaceted gamified learning experience. Students found it motivating and enjoyable, and reported benefits to their learning processes (feedback, study habits, self-efficacy). Moreover, students generally managed the workload and competitive aspects well and expressed a high satisfaction and willingness to recommend the approach. Students also mentioned that the problems with gamification were largely practical (technical, group logistics) as opposed to being conceptual flaws.

4.5 Summary of Results

Overall, the results indicate that the gamified learning approach had a positive impact. For H1 (Enhanced Engagement) there was a marginally significant trend towards improved attendance and a high self-reported psychological engagement in the gamified group. For H2 (Improved Performance) students in the gamified class demonstrated significantly higher final exam scores even after controlling for covariates. Finally, for H3 (Student Perceptions and Effective Elements) both quantitative and qualitative data revealed that students in the gamified group held positive perceptions of the experience, finding it motivating, beneficial for learning and satisfying.

5. Discussion

The findings from this study indicate that the implementation of a gamified learning approach in an Intermediate Accounting course had a predominantly positive impact on student engagement, academic performance and student perceptions. This section interprets these results against the research questions and hypotheses by linking them to theoretical frameworks and existing literature. At the same time, the studies limitations and implications will also be considered.

5.1 Interpretation of Key Findings

Enhanced Student Engagement (RQ1, H1):

Evidence suggests that gamification enhanced student engagement which partially supports H1. Quantitatively, Teacher 1's gamified class had a trend towards improved attendance with an increase of 3.81 percentage points ($p=.070$, Cohen's $d=0.37$) compared to their non-gamified cohort (Table 3). Moreover, students in the gamified group reported high psychological

engagement (mean = 4.31/5, SD = 0.47; α=.85) which indicates substantial interest and focused effort (Section 4.2.2). In addition, the qualitative feedback corroborated these findings, with students describing gamified elements as energizing and motivating regular class attendance leading to more consistent study habits (Section 4.4.2, Q3).

These findings align with Self-Determination Theory (SDT) which suggests that satisfying needs for competence, relatedness and autonomy boosts engagement (Deci & Ryan, 2000). Furthermore, game features fostered competence (points, badges, progress feedback indicating mastery), relatedness (leaderboards, team challenges creating a social context) and autonomy (voluntary, self-paced, ungraded quizzes). As predicted by SDT these conditions appeared to enhance intrinsic motivation. Moreover, students also expressed a desire for behavioral and psychological engagement by attending class to earn points or maintain streaks as opposed to acting solely on requirements. This shift helps in providing evidence of the improvements made due to gamification. Similarly, the engagement was not just higher but also healthier as students now studied more frequently and also found the learning to be more enjoyable. In addition, the competition was perceived as motivating without inducing significant anxiety. This result mirrors general education findings that gamification increases behavioral and emotional engagement (Hamari et al., 2014; Ortiz-Martínez et al., 2022) and extends them to accounting education.

Improved Performance (RQ2, H2):

The study found significant support for H2 by demonstrating improved academic performance in the gamified section. The gamified class achieved final exam scores 3.71 percentage points higher than the non-gamified cohort (p=.044, Cohen's d=0.41; Table 4). Crucially, after controlling for covariates like prior GPA(Pre-GPA), performance in Principles of Accounting (POA) and attendance. The regression analyses showed that gamification was associated with a statistically significant exam score advantage of approximately 3.55 points (Model 1, Table 5) to 4.22 points (Model 3, Table 7).

Moreover, several interconnected mechanisms likely contributed to this outcome:

- **i.** Distributed study and practice: Gamification, particularly streak mechanics encouraged regular study over cramming (Section 4.4.2, Q4) which is a practice known to enhance retention (Roediger & Karpicke, 2006).
- **ii.** Increased engagement and attendance: Higher attendance in the gamified section (Section 4.2.1) which is itself a significant predictor of exam scores (Tables 5, 7) also ensured

greater exposure to course.

iii. Mastery through timely feedback: Immediate quiz feedback (rated highly useful, M=4.38; Section 4.4.1) enabled students to correct misunderstandings and target weak areas (Butler, 2010) with higher quiz mastery (Average Score) predicting better exam performance within the gamified group (Model 2, Table 6).

iv. Enhanced motivation and self-efficacy: In addition, increased motivation where engagement (M=4.31) and self-efficacy (M=4.20) also likely translated into greater effort and confidence.

These mechanisms also resonate with SDT. By fostering competence, the students were emboldened to practice more. Moreover, relatedness (competition/teamwork) likely added social motivation to study and attend. Similarly, autonomy via voluntary participation, paradoxically increased engagement which resonates with SDT's emphasis on autonomous motivation leading to better learning outcomes.

Our performance findings align with studies showing that gamification can improve grades (da Rocha Seixas et al., 2016; Buckley & Doyle, 2017) but contrast with others finding that find no difference or negative effects (Hanus & Fox, 2015). We attribute our positive results to careful implementation whereby game elements were tightly coupled with learning and common pitfalls like rewarding trivial actions were avoided. Consistent positive feedback suggests no dissatisfaction over time. However, a novelty effect must be considered. The freshness of the gamified approach likely contributed to engagement and performance. While research by Rodrigues et al. (2022) showed engagement might dip post-novelty before recovering, our single-semester study likely benefited from sustained novelty. Future implementations should consider evolving gamified activities to maintain interest and guard against novelty fade.

Student Perceptions and Effective Elements (RQ3, H3):

Student feedback was mostly positive which confirms H3. Quantitative survey data (Section 4.4.1) revealed high student satisfaction (M=4.54/5), strong adoption intent (M=4.35/5), positive ratings for competitive dynamics (M=4.06/5) and self-efficacy (M=4.20/5), with manageable workload/stress (M=3.98/5). This aligns with Queiro-Ameijeiras et al. (2022) on favorable attitudes in gamified accounting and extends it by identifying motivating features.

Qualitative feedback (Section 4.4.2) confirmed these positive sentiments. Students valued competitive elements (leaderboards, team challenges) and progression incentives (points,

streaks) as motivating (Q1). The design seemed to strike a balance, as unhealthy competition or anxiety were not prevalent concerns which aligns with the findings that well-managed competition can be beneficial (Landers et al., 2017). Moreover, immediate feedback was also highly valued which confirms its critical role in learning (Queirós-Ameijeiras et al., 2022). Identified challenges such as occasional technical issues or group coordination difficulties (Q2) were largely practical rather than conceptual flaws in the gamification itself which are areas for refinement.

Mechanisms of Engagement - Outcome Link:

Weaving together qualitative and quantitative results suggests a plausible chain:

Gamification → Increased engagement (attendance, practice, interest) → Improved learning behaviors (regular study, timely feedback use) → Better exam performance

The findings collectively suggest a plausible pathway: gamification enhanced various forms of engagement (attendance, practice, interest) which in turn fostered improved learning behaviors (regular study, use of feedback). These behaviors then contributed to better exam performance. This is supported by both direct and indirect effects. Directly, the mastery of content within the gamified quizzes significantly predicted better final exam scores within the gamified group (Model 2, Table 6). Whereas indirectly, the gamified approach was also able to influence broader student behaviors like attendance and their study habits which is suggested by qualitative data and the significance of attendance in Models 1 and 3. These are known to contribute to the students' academic success. Moreover, this dual impact also highlights the benefits of the gamified intervention.

5.2 Limitations and Alternative Explanations

The findings of this study while indicative of gamification's positive impacts are subject to several limitations. Firstly, the quasi-experimental design restricts definitive causal assertions. Although efforts were made to ensure group comparability (consistent lead instructor [Teacher 1] for key comparisons, an identical final exam, statistical controls for prior academic performance [Pre-GPA, POA] and the inclusion of a second instructor's [Teacher 2] non-gamified sections) there could be unmeasured variables that might still have influenced the outcomes. Since the gamified class occurred in a subsequent semester, this could have potentially resulted in benefits obtained from unrelated teaching enhancements by the instructor. However, both teacher 1 and 2 reported consistent teaching methods. In addition,

Teacher 2's control group performance (Tables 2 and 4) also sheds light against any systemic grade inflation or significant shifts in exam difficulty.

However, selection bias remains a potential concern. While students enrolled before the gamification intervention was announced and baseline academic indicators were similar across groups (Table 2). Unmeasured pre-existing differences in traits like intrinsic motivation or tech-savviness could exist.

The study's generalizability is constrained by its focus on a single gamified class (N=49 for gamified group analyses) at one institution. Replication across diverse settings varying by institutions, class sizes, student demographics and course disciplines is crucial to ascertain the broader applicability of these findings. The positive results may partly reflect specific synergies between the instructor's approach, the chosen gamification design, the particular student cohort or the institutional culture.

Furthermore, outcomes were measured at the end of the semester, leaving the long-term persistence of knowledge gains or motivational benefits unknown. This connects to the potential for novelty effects, where the initial boost in engagement and performance may diminish as gamification becomes a standard practice (Hanus & Fox, 2015). However, students in this study did express a desire for its continuation (Section 4.4.1).

Despite these limitations, the observed approximately 3.5 to 4.2 percentage-point increase in final exam scores attributable to gamification (Cohen's d = 0.41 for the direct comparison) is educationally notable. Gains of this magnitude are considered meaningful for educational interventions (Hattie, 2009) and can be particularly helpful in challenging courses. This improvement was achieved via a pedagogical overlay that did not alter core content or scheduled class time and was accompanied by high student satisfaction (Section 4.4.1).

Alternative explanations for improved performance in Teacher 1's gamified class include subtle teaching improvements which may be independent of the gamification itself. However, it is worth noting that since teacher 1's prior class served as a baseline and we also found stable performance in teacher 2's class, therefore, this provides a contrary indicator. Moreover, any teaching adjustments by teacher 1 were also likely informed by the formative quiz data which is an integral component of the gamified system. Similarly, increased student collaboration which was potentially fostered by team-based gamified elements (Section 4.4.2, Q1) could also have contributed. This represents an indirect benefit of the intervention.

Regarding survey data while self-selection bias is possible, the high response rate for qualitative coding (40/49, 82%) and the anonymity of the survey suggests the perceptual data are reasonably representative. Moreover, the Hawthorne effect was likely minimized by integrating the gamification into normal class activities and framing data collection as routine course improvement feedback with reported sustained engagement and habit changes (Section 4.4.2, Q4) suggesting impacts beyond mere awareness of being studied.

Finally, statistical limitations include the potential for overfitting in regression models. Particularly the within-gamified-group analysis (Model 2, N=49, Adj. $R^2 = 0.713$; Table 6). While findings were generally consistent across the different analyses. It is prudent to replicate the study with larger samples to confirm these relationships exist. This is true especially for marginally significant effects (attendance increase, p=.070; Table 3).

5.3 Implications for Teaching Practice

The study's findings suggest gamification can be a valuable instruction strategy in accounting education to enhance student engagement and performance. However, instructors considering similar approaches should note several best practices highlighted by this research:

- **i.** Align game activities with learning objectives: Gamified tasks must be pedagogically purposeful and directly support skill acquisition relevant to the core content (problem-solving for exam preparation) rather than incentivizing superficial actions. This ensures that engagement translates to meaningful learning as indicated by the link between quiz performance and exam scores (Model 2, Table 6) and positive student feedback on learning (Kapp, 2012).
- **ii.** Provide immediate and actionable feedback: The highly-rated utility of immediate feedback from gamified quizzes (M=4.38; Section 4.4.1) underscores its importance. Digital platforms can offer instant feedback by converting errors into learning opportunities and motivating students toward mastery.
- **iii.** Implement competition thoughtfully: While leaderboards and team challenges were motivating (Section 4.4.2, Q1) careful implementation is also very important. Instructors need to maintain low stakes, consider anonymous or team-based scoring and frame activities as enjoyable challenges for self-improvement in order to avoid putting any undue stress on the students. This also aligns with the students' positive perception of the competitive dynamics (Competition M=4.06; Section 4.4.1). Therefore, it is important to balance competition along with cooperative tasks to enhance relatedness.

iv. Incentivize desirable study behaviors: Gamification can effectively encourage regular attendance and consistent study habits as seen from the positive attendance trend (p=.070; Table 3) and students' qualitative reports of improved study routines due to points and streaks (Sections 4.4.2, Q3 & Q4). These rewards can reinforce positive actions without relying on any disciplinary measures.

v. Manage workload and ensure platform usability: The gamification layer should not be burdensome. The tasks should be concise and ideally streamline the existing work. Moreover, the reliability of the platform is also very important as technical glitches were an important demotivator for the students (Section 4.4.2, Q2). Therefore, the instructor needs to prioritize the use of stable technology and also provide adequate support by perhaps piloting the gamification process first. The manageable workload reported by students (M=3.98; Section 4.4.1) should also be a design goal.

vi. Offer clear instruction and maintain engagement: Clear initial instruction on the gamified system's mechanics and purpose. Potentially including a demonstration as suggested by students (Section 4.4.2, Q5) is vital. Ongoing instructor encouragement can also boost participation.

While these principles are adaptable, context is important. The approach used here proved suitable for an intermediate and content-heavy course. Adjustments might be needed for different course levels or sizes but the core idea of using purposeful and engaging gamified activities holds promise.

5.4 Future Research Directions

This study also highlights several avenues for future research to build upon the current findings:

i. Longitudinal studies: Investigate the sustainability of gamification benefits and mitigate novelty effects by employing longitudinal designs across multiple semesters or courses. As tracking student outcomes over time would clarify lasting impacts and adaptation to prolonged gamified learning.

ii. Component analysis: Conduct experiments to disentangle the specific effects of individual game elements (points, badges, leaderboards, narrative). By systematically varying these components we could identify which components are the most vital for motivation and improving the students' learning outcomes.

iii. In-depth qualitative exploration: The researcher should utilize focus groups or interviews for deeper insights into student experiences and the gather information on

the psychological mechanisms which drive student engagement. By understanding why the implemented competitive elements did not induce anxiety or the precise motivations for maintaining streaks, instructors can further refine their game design.

iv. Comparative efficacy studies: Evaluate gamification against or in combination with other active learning strategies (case studies, flipped classrooms). This would clarify gamification's unique advantages and help justify its implementation relative to other pedagogical innovations.

v. Integration of emerging technologies: Explore the efficacy of newer technologies, such as artificial intelligence (AI) or augmented reality (AR) to create more immersive and adaptive gamified learning experiences. Comparisons of these with simpler approaches can clarify their cost-benefit for learning.

vi. Institutional adoption and scalability: Examine challenges related to institutional adoption, including faculty training, resource allocation and student reception when gamification is integrated more broadly (program-wide) by shifting focus to educational change management.

5.5 Conclusion

This study provides empirical support for gamification's effectiveness in enhancing student engagement and academic performance within an Intermediate Accounting course. By integrating game design elements such as points, badges and challenges into weekly quiz practice led to increased student involvement. This was evidenced by a positive trend in class attendance and high self-reported psychological engagement which culminated in statistically significantly higher final exam success for the gamified group. Moreover, the intervention appeared to transform the learning environment and what is often perceived as a dry and difficult subject to became more interesting.

Crucially, it is also worth noting that the improvements in learning outcomes and engagement occurred without diluting academic rigor. The use of gamification provides an enjoyable and motivating framework for practicing essential accounting problems. Moreover, the approach aligns well with Self-Determination Theory, as the gamified elements likely satisfied students' needs for competence through achievement feedback and mastery, autonomy through self-paced effort on many activities and relatedness through team missions and leaderboards. Thereby fostering more intrinsically motivated engagement. Similarly, students in the gamified section exhibited not only improved performance but also a more positive attitude which increased their confidence. For technically demanding courses, these are outcomes that

standard pedagogy struggles to achieve consistently.

Additionally, from a theoretical perspective these findings affirm that motivation and active engagement are crucial in the learning process. Therefore, thoughtful gamification appears to amplify these factors, not just by simplifying the content but by increasing students' willingness to engage with it consistently. Similarly, this willingness manifested in greater effort, more frequent practice and sustained attention which logically contribute to better understanding and performance. This highlights that the students' approach to learning tasks can be as vital as the task content itself and that gamification can offer a structured method to positively influence these approaches.

However, it should be noted that gamification is not a panacea. Its successful implementation as suggested by this study's findings and limitations requires careful alignment of game mechanics with clear learning objectives, the use of reliable and user-friendly technology and responsiveness to student feedback. Nonetheless, this intervention offers an evidence-based blueprint for instructors in accounting and other disciplines facing challenges with student engagement or performance. Therefore, when gamification is applied thoughtfully, it can transform routine practice into an appealing challenge which can encourage students to become more active learners.

In summary, this research demonstrated that well-designed gamified learning methods can enrich accounting education. Moreover, by making the learning process more interactive, continuous and rewarding. Gamification demonstrably boosted student engagement and improved academic outcomes. Moreover, in a field like accounting which emphasizes the development of technical proficiency alongside critical thinking and adaptive learning skills. Pedagogical methods that sustain student interest and deepen effort are increasingly valuable. Furthermore, grounded in a quasi-experimental design and supported by both quantitative and qualitative data. This study shows that gamification can effectively motivate students to master complex material while also enhance their enjoyment of the learning process.

As a result, for students in the gamified class, Intermediate Accounting appeared to transform from a traditionally challenging course into a more dynamic and engaging learning experience with clear goals, timely feedback and a sense of community. They not only performed better but also according to their feedback, recognized and appreciated the benefits of the approach.

Author's declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Signature **29/05/2025**

References

Almuntsr, N. M., Muhamad, H. B., San, O. T., & Shah, S. M. (2024). *Using gamification in accounting education: A systematic literature review (2017–2023).* International Journal of Academic Research in Business and Social Sciences, 14(2), 1119–1134.

Anwar, Y., & Mulyadi, M. (2025). Exploring gamification approaches in accounting courses: A systematic review. *Journal of Accounting and Finance, 25*(2).

Buckley, P., & Doyle, E. (2016). Gamification and student motivation. *Interactive Learning Environments, 24*(6), 1162–1175.

Butler, A. C. (2010). Repeated testing produces superior transfer of learning relative to repeated studying. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 36*(5), 1118–1133.

Byusa, E., Kampire, E., & Mwesigye, A. R. (2022). Game-based learning approach on students' motivation and understanding of chemistry concepts: A systematic review of literature. Heliyon, 8(5), e09541.

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital games, design, and learning: A systematic review and meta-analysis. Review of Educational Research, 86(1), 79–122.

da Rocha Seixas, L., Gomes, A. S., & de Melo Filho, I. J. (2016). Effectiveness of gamification in the engagement of students. *Computers in Human Behavior, 58,* 48–63.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227–268.

Deci, E. L., Koestner, R., & Ryan, R. M. (2001). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. *Review of Educational Research, 71*(1), 1–27.

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

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? A literature review of empirical studies on gamification. In *Proceedings of the 47th Hawaii International Conference on System Sciences* (pp. 3025–3034). IEEE.

Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education, 80*, 152–161.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* Routledge.

Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education.* Pfeiffer.

Landers, R. N., Bauer, K. N., & Callan, R. C. (2017). Gamification of task performance with leaderboards: A goal-setting experiment. *Computers in Human Behavior, 71*, 508–515.

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 57*(9), 705–717.

Ortiz-Martínez, E., Santos-Jaén, J.-M., & Palacios-Manzano, M. (2022). Games in the classroom? Analysis of their effects on financial accounting marks in higher education. *The International Journal of Management Education, 20*(1), 100584.

Queiro-Ameijeiras, C.-M., Martí-Parreño, J., & Summerfield, L. (2019). Using gamification in accounting classes: Students' perception of entertainment and attitude. In *Proceedings of the 12th International Conference of Education, Research and Innovation* (pp. 7678–7684). IATED.

Roediger, H. L., & Karpicke, J. D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science, 17*(3), 249–255.

Rodrigues, L., Pereira, F. D., Toda, A. M., Palomino, P. T., Pessoa, M., Carvalho, L. S. G., Fernandes, D., Oliveira, E. H., Cristea, A. I., & Isotani, S. (2022). Gamification suffers from the novelty effect but benefits from the familiarization effect: Findings from a longitudinal study. *International Journal of Educational Technology in Higher Education, 19*, 8.

Sailer, M., & Sailer, M. (2021). Gamification of in-class activities in flipped classroom lectures. British Journal of Educational Technology, 52(1), 75–96.

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *International Journal of Human–Computer Studies, 74*, 14–31.

Silva, R., Rodrigues, R. G., & Leal, C. (2021). Games-based learning in accounting education – Which dimensions are the most relevant? *Accounting Education, 30*(2), 1–29.

Skinner, B. F. (1953). *Science and human behavior*. Macmillan.

Tavares, M. C., Azevedo, G., Marques, R. P., & Bastos, M. A. (2023). Challenges of education in the accounting profession in the Era 5.0: A systematic review. *Cogent Business & Management, 10*(2), 2220198.

Appendix A: Gamification Survey

Section A: Open-ended reflection

Q1. Think back to the game elements we used this semester (points, badges, leaderboard, challenges). Describe one specific feature that increased your motivation or effort.

Q2. Did any part of the game discourage you or feel unhelpful? Please explain briefly.

Q3. Has the game influenced your decision to attend or miss class? If yes, how?

Q4. Describe any way the game changed how you studied or prepared for assessments.

Q5. In one or two sentences, summarize the overall impact the game had on your learning, and suggest one improvement for next time.

Section B: Rating scale (Likert grid)

No.	Code	Statement
	Engagement / Flow	
1	E1	The game elements made the course material more interesting.
2	E2	While doing game challenges I lost track of time.
3	E3	The challenges kept me fully focused on the task.
4	E4	I felt energized while working on the game activities.
	Competition	
5	C1	Competing with classmates on the leaderboard motivated me to improve.
6	C2 (R)	Seeing others far ahead on the leaderboard lowered my motivation.
7	C3	Trying to outperform classmates pushed me to study harder.
8	C4 (R)	Comparing my leaderboard score with others made me anxious.
	Formative feedback	
9	F1	The immediate feedback from the game helped me identify what I had mastered.
10	F2	The quiz feedback guided me on what to study next.
	Self-efficacy	
11	L1	Gamification increased my confidence in applying accounting concepts.
12	L2	After using the game, I feel capable of solving unfamiliar accounting problems.
	Workload / Stress	
13	W1	The game activities fit comfortably into my study schedule.

14	W2 (R)	The game elements added extra stress to the course.
15	W3	The time required for game tasks felt reasonable.
16	W4 (R)	I sacrificed other coursework because of the game tasks.
	Outcome variables	
17	S1	Overall, I am satisfied with the gamified learning experience.
18	S2	The gamified activities met my expectations for useful learning.
19	A1	I will recommend this gamified approach to classmates or friends.
20	A2	I would like other accounting courses to adopt similar game elements.

Notes. All Likert items use a 1 = Strongly disagree … 5 = Strongly agree scale. R = reverse-scored.

Appendix B: Gamification Survey Results

Table B1. Item-Level Descriptive Statistics for Gamification Survey (N=40)

Code	Mean	SD	Min	Max
E1	4.32	0.57	3	5
E2	4.38	0.49	4	5
E3	4.28	0.52	3	5
E4	4.22	0.61	3	5
C1	4.10	0.58	3	5
C2	4.06	0.52	3	5
C3	4.08	0.55	3	5
C4	4	0.50	3	5
F1	4.35	0.48	4	5
F2	4.4	0.5	4	5
L1	4.25	0.49	3	5
L2	4.1	0.5	3	5
W1	4	0.6	3	5
W2	3.93	0.55	3	5
W3	3.97	0.58	3	5
W4	4.02	0.58	3	5
S1	4.56	0.55	3	5
S2	4.52	0.51	4	5
A1	4.3	0.46	4	5
A2	4.4	0.5	4	5

Notes. Analyses are based on 40 valid responses from the gamified group. Items were rated on a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). Mean = mean score; SD = standard deviation; Min = minimum observed score; Max = maximum observed score. Negatively worded items (C2, C4, W2, W4) were reverse-scored before analysis so that higher values uniformly reflect a more favorable perception or lower perceived problems. Item codes correspond to the following constructs: E = Psychological Engagement; C = Competitive Dynamics; F = Formative Feedback Usefulness; L = Self-Efficacy; W = Workload and Stress; S = Satisfaction; A = Adoption Intent. Full item wording is available in Appendix A (Survey Instrument).

Appendix B: Gamification Survey Results

Table B2. Descriptive Statistics and Reliability Coefficients for Composite Scales (N=40)

Scale	k	Mean	SD	Cronbach α
Engagement	4	4.31	0.47	.85
Competition	4	4.06	0.58	.87
Formative Feedback	2	4.38	0.49	.78
Self-efficacy	2	4.2	0.46	.80
Workload / Stress	4	3.98	0.55	.82
Satisfaction	2	4.54	0.41	.86
Adoption intent	2	4.35	0.45	.81

Notes. Analyses are based on 40 valid responses from the gamified group. Composite scores for each scale were computed by averaging responses to the constituent items, which were rated on a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). Higher mean scores indicate more positive perceptions or agreement (negatively worded items were reverse-scored as noted in Table B1). k = number of items in the scale; Mean = mean of the composite scale score; SD = standard deviation of the composite scale score; Cronbach α = Cronbach's alpha coefficient of internal consistency reliability. The items comprising these scales are detailed in Appendix A (Survey Instrument) and their individual descriptives are in Table B1.

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