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RESEARCH ARTICLE

The Effectiveness of Kahoot! Game in Teaching Accounting Principles Course on Students' Quantitative and Qualitative Academic Performance

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Abstract

This study investigates the use of the educational technology tool Kahoot! in Accounting Principles II within a quasi-experimental design, addressing limited empirical evidence regarding students' perceptual and performance-related responses to such tools in accounting education. Although various digital platforms have been explored in higher education, the documented effects of these platforms on students' perceptions and performance in accounting courses remain relatively limited. Here, we extended this evidence by dissociating perceptual and performance-related measures. This study involves 63 undergraduate accounting and financial management students from Yazd University, who were divided into two groups: an experimental group that used Kahoot! for in-class exercises and assessments, and a control group that completed similar activities on paper. Data were analyzed using Excel and SPSS 27, with ANCOVA, MANCOVA, and a one-sample t-test used. Students in the experimental groups shared positive beliefs about motivation, enjoyment, collaboration, and classroom engagement. Yet when academic performance between the two waves was statistically controlled for baseline achievement, no statistically significant differences were found; initial within-group nominal differences in some classroom tests failed to survive Bonferroni adjustments. Because of the quasi-experimental design with nonequivalent groups, modest sample size, and low statistical power, these findings reflect observed associations rather than causal relationships and must be interpreted with caution. Overall, while Kahoot! While practicing at home may allow for a much more dynamic classroom experience, we cannot be certain whether it impacted their test performance. This study offers a timeline-based framework to inform future research on the pedagogical use of digital instructional tools in accounting education.

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1. Introduction

As the demands of the modern academic environment shift, students want more engaging group interactions than one-way lecturing. For instance, in fields like accounting, which are often taught from a very rigorous, theoretical standpoint, this change is particularly noticeable, as many students do not benefit from static learning when confronting the abstract nature of foundational content. With the digital generation occupying most university classroom seats, higher education is grappling with how to reconfigure pedagogies, as students today have different learning styles.

Previous research has highlighted that the use of technology in higher-education accounting teaching contexts is associated with greater student engagement and motivation (Go et al., 2024) and that the use of game elements in teaching may be related to a better understanding of accounting concepts (Ramesh et al., 2025). Recently, game-based learning (GBL) and gamification have emerged as promising approaches for the modern instructional experience, combining interactive elements with enjoyable activities that mirror students' digital habits and are readily available for educational purposes (Neerupa et al., 2024). Theoretically, gamification in the educational context is usually justified by Goal-Setting Theory and Expectancy Theory, which emphasize that clearly defined goals are more effective when accompanied by prompt feedback and when students perceive a strong association between effort, performance, and valued outcomes. Gamification in accounting education features student motivation and engagement, autonomy, competence, and relatedness needs. Metricated positive impacts on exam scores and problem-solving abilities. Mechanisms for accessing these effects. Resource limitations & gap inclination behavioral Gap issues of student diversity Nubial Outcome Anwar and Mulyadi (2025) Platforms such as Kahoot! are known to increase student participation within the classroom by allowing immediate feedback in a low-pressure, game-like environment. However, despite some positive impact of gamification on student performance, the relationship between gamification and academic performance is so complex that findings from previous studies are highly mixed (Bhavani et al., 2020), and more research in these areas, especially in unexplored educational contexts such as Iran, is necessary.

Over the years, several studies have investigated the use of Kahoot! Most of the research has centered on student perceptions, engagement, and motivation rather than on externally validated learning outcomes (e.g., in accounting-specific courses) and on measured competencies appropriate to disciplines (which warrant further statistical analysis). Nevertheless, we have identified only a handful of studies that directly measure the association of Kahoot! They are founded on formative assessment and key quantitative performance indicators in accounting lessons. The current study seeks to contribute to this burgeoning body of literature by investigating this relationship in the context of Principles of Accounting II (a second-level required accounting course) at a single Iranian university. Furthermore, the study contributes to the understanding of real academic performance rather than self-reported perceptions by using a quasi-experimental design with a nonequivalent control group. In addition, based on Goal-Setting Theory Kahoot!, implements structured quizzes and challenges by points With respect to the first, Clear Goals performance feedback can clarify learning goals and enhance students' engagement with these goals (Durso et al., 2020) while Expectancy Theory implies that transparent scoring and leaderboards may bolster students' motivation by reinforcing beliefs that increased effort leads to improved performance, leading to desirable academic outcomes (Chan et al., 2021). However, the cultural perception of using smartphones in class and in educational games is new to students, so their academic behavior may not be well understood. To fill these gaps, this study analyzed the correlation between integrating Kahoot! into Accounting Principles II and students' academic performance, in terms of quantitative outcomes (grades) as well as qualitative ones (perceptions and motivation). This study uses a quasi-experimental method. The research population consists of 63 undergraduate students who have studied accounting and are

studying financial management at Yazd University. In the Kahoot! condition, please note that the experimental group completed all in-class exercises and quizzes, while the control group continued with traditional paper-based assessments.

2. Literature review

Even if there are studies (Pitic and Irimiaș, 2023) that show the positive impact of educational games on learning in higher education, these studies mainly focus on pre-university students. Undergraduate studies have identified them as elements that encourage active and self-regulated learning, as well as collaboration (Ayllón et al., 2019; Wanner and Palmer, 2018; Bovill, 2020). The interactivity of these online educational games can help improve knowledge retention and conceptual understanding compared with more traditional paper-based activities. Furthermore, learning from mistakes in gamified contexts fosters deeper cognitive reinforcement and continuous development (Jääskä and Aaltonen, 2022). Given the typically low participation rates in accounting classes (Nkhoma et al., 2018), the use of such interactive technologies may enhance both engagement and academic performance. These outcomes operate across two levels: individual-level cognitive motivational processes (e.g., effort, perceived value) and classroom-level environmental factors (e.g., feedback immediacy, competitive climate), which collectively shape performance.

2.1. Gamification

Gamification, defined as the use of game elements in non-game contexts (Basten, 2017), provides a novel way to increase intrinsic motivation, satisfaction, and learning performance (Montola et al., 2009; Mekler et al., 2013). It generates motivation through competition, accomplishment, and feedback. On the other hand, competition can and does lead to positive outcomes; however, excessive emphasis on competition can lead to negative outcomes, such as learner frustration (Zhang, 2008). Gamification has been shown to support theoretical retention and long-term engagement among technology-driven learning strategies (Aguiar-Castillo et al., 2021). To date, gamification is theoretically grounded in Goal-Setting Theory (Locke and Latham, 2002), which argues that specific, achievable goals increase motivation and task performance. In classroom contexts, points and badges and even leaderboards are incorporated into games as part of gamified tools like Kahoot! behaving as proximal goals that can motivate persistent effort and engagement. Goal-related feedback is linked to self-evaluation and achievement striving, thereby reinforcing learners' commitment to academic achievement. The detailed mechanisms described are most relevant to Generation Z students who habitually use mobile devices due to their digital fluency and their preference for mobile-supplemented or blended learning formats (Vizcaya-Moreno and Pérez-Cañaveras, 2020), thus organizing positively within a critical structure with goal-oriented outputs.

In addition, Expectancy Theory (Vroom, 1964) provides a complementary psychological explanation for gamification effects. According to this model, motivation is driven by three perceptions: expectancy (the belief that effort improves performance), instrumentality (the belief that performance leads to rewards), and valence (the value attached to those rewards). Gamified quizzes provide instant feedback, thereby generating a sense of expectancy; visible scoreboards promote instrumentality and a fun interface elevates the perception of valence. In summary, the mechanisms help explain how gamification can increase or clarify goals, sustain engagement, and ultimately improve the academic performance of digitally born cohorts, such as Generation Z accounting students.

2.2. Gamification and psychological levels in accounting education

The variables in this study can be understood through three distinct psychological levels, which help bridge the gap between gamified interventions and academic success in accounting:

1. *Cognitive Level:* Technology-enhanced learning tools, such as real-time online assessments, offer the instant feedback needed to improve knowledge retention and metacognitive awareness (Chappuis et al., 2020; Attali and Van Der Kleij, 2017). Such tools are associated with deeper processing and conceptual understanding in the domain of accounting, a complex field (Krasodomska and Godawska, 2021).
2. *Motivational Level:* Competitive architecture of gamification, specifically point systems and leaderboards, is utilized to invoke goal commitment and perceived competence (Göksün and Gürsoy, 2019; Sailer and Homner, 2020). Recent empirical research in accounting education also finds that these motivational triggers are strongly related to students' academic performance (López-Hernández et al., 2023).
3. *Behavioral Level:* Interactive participation during Kahoot! Sessions increase student attention and classroom interaction, effectively addressing the historically low participation levels observed in traditional accounting instruction (Nkhoma et al., 2018). As highlighted by Lew and Saville (2021), such game-based learning experiences are essential for transforming passive listeners into active participants, thereby fostering a more robust behavioral engagement with technical accounting content.

The theoretical integration elucidates how gamified assessments affect learning across multiple psychological levels by mapping these variables to the cognitive, motivational, and behavioral domains. This multifaceted view provides an important response to a previous criticism of the psychology literature, as many works often ignore how the interplay of psychological domains among students affects objective academic performance.

Use of Kahoot! as a Gamified Learning Tool: Kahoot! is a popular web-based platform used for formative assessments through interactive quizzes (Wang and Tahir, 2020). As of 2024, Kahoot! had hosted more than 10 billion participants, offered over 50 million publicly available games, and attracted over 1 billion unique players annually (Retrieved from Kahoot! website, https://kahoot.com, July 1, 2025). These figures indicate not only widespread adoption but also the platform's perceived usefulness across diverse educational levels and disciplines. In higher education, Kahoot! is frequently used to review course content, check conceptual understanding, and promote participation during lectures. It practically operationalizes the principles of both Goal-Setting and Expectancy Theories by providing structured challenges, transparent scoring, and immediate performance feedback. The tool's engaging and competitive format has been associated with enhanced motivation and performance across diverse disciplines, although mixed findings exist regarding learning outcomes (Lee et al., 2019; Wang et al., 2016; Ranieri et al., 2021). In accounting education, Kahoot! Has been linked with measurable increases in learning activity and post-test scores (Wardana and Sagoro, 2019). Similarly, international studies have emphasized its motivational and formative benefits (Gómez and Menroy, 2018; Ortiz-Martínez et al., 2022). These findings are particularly relevant to accounting, given students' greater need for feedback-driven practice to master abstract numerical concepts.

Synthesis of Kahoot! Impacts: Learning, Dynamics, and Affective Responses: he impact of Kahoot! well-being, and academic achievement is associated with substantial motivational benefits, but its impact on objective school performance depends on the quality of implementation. While broad consensus links Kahoot! to increased concentration and engagement (Lee et al., 2019; Ortiz-Martínez

et al., 2022), findings regarding final achievement are mixed, with some evidence suggesting that effectiveness may be limited in complex or hands-on subjects (Wang et al., 2016; Ranieri et al., 2021). In the context of accounting education—which demands a blend of conceptual and procedural rigor—studies such as Wardana and Sagoro (2019) have demonstrated substantial gains in both learning activity and test scores, reinforcing that when Kahoot! is strategically aligned with curriculum objectives, it functions as a powerful tool for formative assessment and knowledge retention (Bakar, 2024; Omar et al., 2024).

Beyond performance outcomes, the effectiveness of Kahoot! lies in its ability to reshape classroom dynamics and manage affective learner responses. By transitioning instruction toward a student-centered model, the platform enhances interaction and reduces classroom-related stress, particularly for reserved learners who may otherwise be reluctant to participate (Bawa, 2019; Senali et al., 2022). Although the competitive nature of Kahoot! has raised concerns regarding performance anxiety and rushed responses (Wang and Tahir, 2020; Göksün and Gürsoy, 2019), recent literature highlights that this competition, when well-managed, fosters sustained involvement and positive attitudes (Turan and Meral, 2018; Almuntsr et al., 2024; Fortuna et al., 2023). Importantly, both students and teachers agree that the platform is useful because it reduces boredom and workload, but recent calls for research emphasize that more work is needed to understand how gamified interventions can address the multitude of diverse needs (Elkhamisy and Wassef, 2021; Ionescu-Feleagă et al., 2025).

Use of Educational Games in Accounting Education in Iran: Despite this global contribution to the review of gamification, a new review of gamification in accounting education has shown how game-based approaches can enhance student motivation, engagement, and learning across different accounting courses (Queiro Ameijeiras et al., 2025). Evidence, however, is scarce and descriptive in the Iranian higher-education context, but Haji Moradkhani et al. (2017) found in the first study, conducted at the University of Tehran, it was found that teaching with board games such as Monopoly significantly improved student engagement and learning outcomes compared with traditional didactic methods (2018). Alternatively, Khatibi and Badeleh (2021) found that in other Iranian educational contexts, Kahoot! Drawing from a computational perspective, research found that game-based activities increased learner engagement, language skills, and overall satisfaction with the learning process; this work typically describes motivational and perceptual outcomes without concern for the magnitude of the impact on course grades. The most relevant information was found in Devanipour (2022), which studied Kahoot! Formative assessment in a Cost Accounting course Improvements in questionnaire data, such as enjoyment and perception of engagement compared to the traditional paper-based assessments were observed; however no differences in mean final examination scores between Kahoot! was not significant between the gamified instruction and control groups, indicating that the relationship of gamified instruction with academic performance seems to be context-, and more importantly perhaps, learning experience-specific (regarding course design, content, and technological conditions). Overall, these results suggest that classroom-based educational games may facilitate more dynamic and participatory lessons in accounting classrooms; however, there is a lack of empirical studies on digital platforms such as Kahoot! in Iranian university settings.

Summary and Critical Reflections: About Kahoot! In summary, the literature indicates that Kahoot! is commonly associated with improved student motivation, engagement, and classroom dynamics at the college level. Though the platform has proven particularly effective at reinforcing theory and review-based knowledge, its impact on complex, applied, or skills-based learning is still hotly debated. Moreover, the competitive framework innate to Kahoot! This does function as a double-edged sword: the mechanism it uses to encourage participation works, whilst also rearing

hyper-competitive performance anxiety in some learners, meaning the pedagogical promise is highly dependent on the implementation strategies chosen.

However, many findings are hindered by limited longitudinal and cross-cultural research, which limits their generalizability across diverse educational contexts. On a methodological level, there is a lack of studies that account for differences in learner characteristics, such as prior academic performance and learning styles. These gaps require enhanced empirical examination, particularly quasi-experimental and mixed-methods designs to move beyond descriptions and better evaluate the educational potential of game-based platforms in teaching and learning. This study overcomes some of these limitations by moving the focus to a more objective analysis of gamified formative assessment. Kahoot! This study provides important, context-dependent empirical evidence on how accounting knowledge affects both objective academic performance and subjective student perceptions in the undergraduate accounting context in Iran. This paper contributes to the wider gamification literature by linking Goal-Setting and Expectancy theories to explain how digital interventions might be aligned with learning outcomes for accounting students.

3. Methodology

3.1. Population, sample, and sampling method

This study employed a quasi-experimental design with a nonequivalent control group. The statistical population comprised undergraduate students enrolled in the Principles of Accounting II course at Yazd University during the 2022–2023 academic year. The sample consisted of two intact classes: 36 Accounting students in the experimental group and 30 Financial Management students in the control group. Although these groups belonged to different majors and therefore may have differed in prior academic background, both programs shared a common foundational curriculum in Principles of Accounting. This shared prerequisite provided a meaningful basis for comparison in the present study. To account for possible baseline differences in prior knowledge, the students' scores in Principles of Accounting I were entered as a covariate in the statistical analysis (ANCOVA). This approach allowed the post-intervention outcomes to be adjusted for initial differences, thereby strengthening the internal validity of the comparison. Nevertheless, the distinct nature of the two majors should still be considered as a contextual limitation in interpreting the findings.

The same researcher-instructor taught both groups to ensure consistency in instructional delivery. The experimental group was taught via Kahoot! The experimental group used the interactive learning method, while the control group used the paper-based assessment method. Protocols were standardized with the following procedures to minimize expectancy effects and differential treatment:

1. *Strict Protocol Adherence:* Both groups used the same textbook, followed the same instructional schedule, and attended the same number of sessions.
2. *Identical Assessment Content:* The study employed Functional Phased Tests to monitor progress throughout the semester. In addition, identical Midterm and Final examinations were administered to both groups to ensure content equivalence and comparability.
3. *Anonymized Grading:* Written answer sheets for the Midterm and Final examinations were graded anonymously. Student names were removed before evaluation to minimize any conscious or unconscious bias.
4. *Automated Data Collection:* Kahoot! Scores were automatically recorded and exported directly from the platform, with no manual intervention in data extraction. This procedure enhanced objectivity and transparency in the measurement process.

Measures and Data Collection: The main outcome measurements comprised the Functional Phased Tests score, scores on the Midterm and Final examinations, and performance in the Kahoot!

Quiz scores. The measure of learning was developed to closely align with the course objectives and the content delivered in class over a semester.
To support the validity and reliability of the measurement process, the following steps were taken:

- *Content Validity:* The examinations were prepared by the instructor and reviewed by three faculty experts in accounting education to ensure alignment with the course syllabus and learning outcomes.
- *Reliability:* The internal consistency of the summative assessments was examined using Cronbach's alpha. The coefficient indicated acceptable reliability for the instruments used in the study.
- *Baseline Covariate:* The score from Principles of Accounting I was used as a baseline covariate rather than a conventional pre-test. This decision was made to statistically adjust for prior knowledge without introducing testing effects that may arise from administering an identical pre-test.

Limitations: This study has several limitations that should be acknowledged. First, the use of nonequivalent groups means that random assignment was not possible, which may introduce selection bias. Although ANCOVA was employed to statistically control for baseline differences, this limitation cannot be eliminated. Second, the participants were students in this case, from different majors, but, arguably, their common introductory accounting course and a covariate made this less worrisome. Finally, the researcher served as the instructor, but procedural safeguards such as standardizing instruction, anonymizing grading, and automating data collection were implemented to mitigate bias. Finally, the sample size was constrained by the availability of intact classes, which is a common limitation in educational quasi-experiments.

3.2. Research hypotheses

H1: Students hold a positive perception regarding their experience with the Kahoot! Platform for teaching Principles of Accounting II.

Rationale: This hypothesis stems from the Expectancy Theory, where the gamified features of Kahoot! (e.g., immediate performance feedback and competitive leaderboards) act as positive valence that elevates students' expectations of success and engagement, directly influencing their overall perception of learning.

H2: There is a statistically significant difference in academic performance in Principles of Accounting II between students who used Kahoot! And those who received traditional instruction.

Rationale: Grounded in Goal-Setting Theory, this hypothesis posits that Kahoot! Provides a structured environment that facilitates clear, proximal learning goals. We define "academic performance" as the mastery of accounting principles; we hypothesize that the continuous, goal-oriented reinforcement provided by Kahoot! Leads to higher achievement compared to traditional, less interactive instruction.

H3: There is a statistically significant difference in classroom test performance between students who received Kahoot!-based formative assessment and those who received traditional paper-based formative assessment.

Rationale: This is linked to the cognitive mechanisms of Goal-Setting Theory. Kahoot! replaces traditional paper-based formative assessments. The intervention creates a closed-loop system. We conjecture that this immediate cognitive feedback loop allows students to target their studies more effectively, thereby producing greater academic gains on classroom examinations than students who use distant, paper-and-pencil evaluations.

3.3. Data collection tools

3.3.1. Researcher-Made Questionnaire

A questionnaire was developed to gather student perspectives on learning effectiveness. It was based on validated instruments from Lin et al. (2018), Silva et al. (2019, 2021), Marsa et al. (2021), and Haji Moradkhani et al. (2018). Content validity was established through expert review by educational researchers. Reliability was assessed using Cronbach's alpha and McDonald's omega. For the two-item subscale, *Value of using Kahoot in the classroom*, Cronbach's alpha was $\alpha = 0.65$, and McDonald's omega was $\omega = 0.65$. Although slightly below the conventional threshold of 0.70, these values are acceptable for very short scales, as reliability coefficients are highly sensitive to item count and tend to underestimate internal consistency in two-item measures. More importantly, both items loaded highly on a single factor (0.861), indicating considerable shared variance and unidimensionality of the construct. To provide additional evidence regarding construct validity, an Exploratory Factor Analysis (EFA) was carried out on the entire 25-item questionnaire. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.78 (>0.60), indicating that the factor analysis results are reliable [21]. Bartlett's test of sphericity was statistically significant $\chi^2(300) = 742.36$, p 1 or examination of scree plots, leading to a structure theoretically consistent with proposed dimensions. Given the relatively small sample size, the EFA findings were interpreted with caution and used only for preliminary construct verification, not for full structural validation. This approach is supported by methodological literature indicating that when EFA is used for exploratory verification—especially with instruments adapted from previously validated questionnaires—strong factor loadings provide meaningful evidence of construct representation even in smaller samples (Fabrigar et al., 1999). For the entire 25-item instrument, Cronbach's alpha was 0.91, indicating excellent internal consistency (see Table 1 for details on dimensions and item counts).

Table 1. Dimensions of researcher-made questionnaire

Dimensions	Number of items	Item numbers	Cronbach's alpha
The value of using Kahoot in the classroom	2	1-2	0.65*
The effectiveness of Kahoot in understanding the course materials	6	3-4-5-6-7-8	0.83
Benefits of using Kahoot inside the classroom	5	9-10-11-12-13	0.81
Elements of Kahoot! itself	12	14-15-16-17-18-19-20-21-22-23-24-25	0.82

*** Note:** For the two-item subscale, Cronbach's alpha is 0.65. However, this reliability estimate is corroborated by McDonald's omega ($\omega = 0.65$) and by strong construct validity, as confirmed via EFA, with both items loading highly on a single factor (0.861). These converging results support the adequacy of this dimension.

A 5-point Likert scale was used, ranging from Strongly Agree (5) to Strongly Disagree (1). The questionnaire was conducted during the final Kahoot! session with 36 accounting students on an anonymous basis. The session in which they were assured that responses would not affect their course grades.

Design logic and structural alignment with Hypothesis 1: The survey was designed to operationalize Hypothesis 1, which posits student perceptions and involvement during the Kahoot! experience. Compared with traditional instruction. To holistically measure this construct, the instrument was divided into four correlated dimensions representing various phases of the learning experience:

1. *Value of Kahoot (Items 1–2):* Assesses the perceived usefulness and relevance of Kahoot in the classroom, reflecting students' evaluative appraisal of the tool.
2. *Effectiveness in Understanding (Items 3–8):* Measures students' perceptions of how Kahoot

supports understanding of course materials.
3. *Classroom Benefits (Items 9–13):* Evaluates motivational and engagement-related benefits associated with Kahoot use.
4. *Elements of Kahoot (Items 14–25):* Examines specific game mechanics (e.g., points, competition, and feedback) that may contribute to instructional effectiveness.

3.3.2. Functional phased tests

These were formative classroom assessments focused on chapters and short sections, enhancing learning and overcoming hurdles. It should be noted that, in this work, Kahoot was used as a formative assessment tool rather than as direct instruction. The intervention involved using Kahoot! Scheduled competitive review sessions were held at the end of every topic, which gave students a chance to re-evaluate their understanding and gain instant feedback before major tests. This is different from what we would call "game-based learning", where the game itself serves as the primary medium of instruction. Instead, this research assesses the relationship between game-based formative assessment and student performance on classroom tests, compared with traditional paper-based formative assessments. They included stage-by-stage tests throughout the semester to spur participation and discussed regular practice by framing segments.

Control group: Used traditional paper-based evaluations.

Experimental group: Answered similar questions via Kahoot!

Exam topics: Inventory, cash, payroll, partnership I, and stock company.

3.3.3. Midterm and final examinations

The two groups were given the same midterm and final examinations on the same dates under similar conditions. The last test was on partnerships and corporations, with students in both classes answering the same questions at the same time.

3.3.4. Additional research variables

Additional student data were collected, including gender, birthdate, high school major, GPA, entrance exam rank, guest student status, major change, pre-test score for Accounting Principles I, and prior history of failing Accounting Principles I.

3.3.5. Research implementation process

Throughout the semester, accounting students prepared for Kahoot! Quizzes at the end of each topic, using their mobile phones to answer questions on the Kahoot! Online platform. The system reports were useful for obtaining data for analysis. The financial management students also followed the same scheduled reviews and tests as before. Still, instead of computer-based methods, they used paper-based methods to answer all questions, with both groups in each test taking the same content.

1. Intervention program – Lesson Plan of Accounting Principles II

Table 2 presents the lesson plan for Accounting Principles II, highlighting the use of Kahoot! Game. It outlines the required sessions for teaching each topic and the activities for each session.

Table 2. Lesson plan for Accounting Principles II in the experimental and control groups

Session	Activities	Experimental Group	Control Group
1	Inventory Chapter	*	*
2	Fixing the mistakes and Solving Exercise - Cash Chapter	*	*
	The first functional step test – the topic of inventory (15 test questions)	Kahoot	Paper Assessment
3	Cash Accounting (Preparation of Bank Reconciliation Statement)	*	*
4	Solving Cash Accounting Exercise - Payroll Chapter	*	*
	Second Functional Stage Test – Cash Topic (15 Test Questions)	Kahoot	Paper Assessment
5	Solving Exercises for Payroll Accounting: How to Record Payroll Expense	*	*
6	Partnership Chapter: Types of Accounts and How to Register Them, and How to Divide Profits and Losses	*	*
	Third Functional Stage Test – Salary Topic (15 Test Questions)	Kahoot	Paper Assessment
	Mid-Term Exam of Inventory, Cash, and Payroll (Descriptive)	Paper Assessment	Paper Assessment
7	Preparing Financial and Accounting Statements for New Partner Entry	*	*
8	Exit of the Partner in the Partnership	*	*
	Fourth Functional Stage Test: Partnership Topic 1 (Dividend Distribution, Entry of a New Partner - 10 Test Questions)	Kahoot	Paper Assessment
9	Solving Exercise - Partnership Accounting: Liquidation	*	*
10	Stock Company Chapter: Stock Release	*	*
	Fifth Functional Stage Test: Partnership Topic 2 (Partner Exit and Instant Dissolution - 10 Test Questions)	Kahoot	Paper Assessment
11	Stock Company Formation Process	*	*
12	Solving Exercises – Profit distribution, year-end operations, and preparation of financial statements in stock companies	*	*
	Sixth Functional Stage Test – Stock Company Topic (15 Test Questions)	Kahoot	Paper Assessment
	Final exam on the topics of partnership and stock company (descriptive)	Paper Assessment	Paper Assessment

At the end of each topic, accounting students were given one week to study and summarize the material before competing in a live Kahoot! Session in class. Meanwhile, financial management students answered similar paper-based assessments under the same study conditions. Due to holiday breaks and scheduling constraints, the sixth functional stage exam was omitted, though stock company topics were included in the final exam without a separate study week.

3.3.6. Collecting educational questions

Multiple-choice questions and the standard Kahoot! Formats were carefully selected for educational value and alignment with course content. Questions were sourced from the Principles of Accounting II textbook and national exams, avoiding newly designed questions. The instructor reviewed and refined them before entry into Kahoot!.

3.3.7. Implementation of Kahoot!

Each Kahoot! Was custom-built for its topic on Kahoot!'s website. Two usage modes exist: live in class (chosen for this study) or independent practice. To ensure a smooth game session:

- Questions were pre-entered and previewed on the platform.
- Students were informed in advance to review topics and check device battery levels.
- The session required a video projector, a wide screen, and stable internet access for all participants.
- The classic mode was selected for live gameplay and evaluation.

To participate, students accessed Kahoot! Log in to your mobile or computer, enter the game code, and check the real-time leaderboard. No account creation was necessary. The teacher started the live in-class competition, and students answered a question within a limited timeframe. We provided the correct answers after each round, which enabled immediate feedback and discussion.

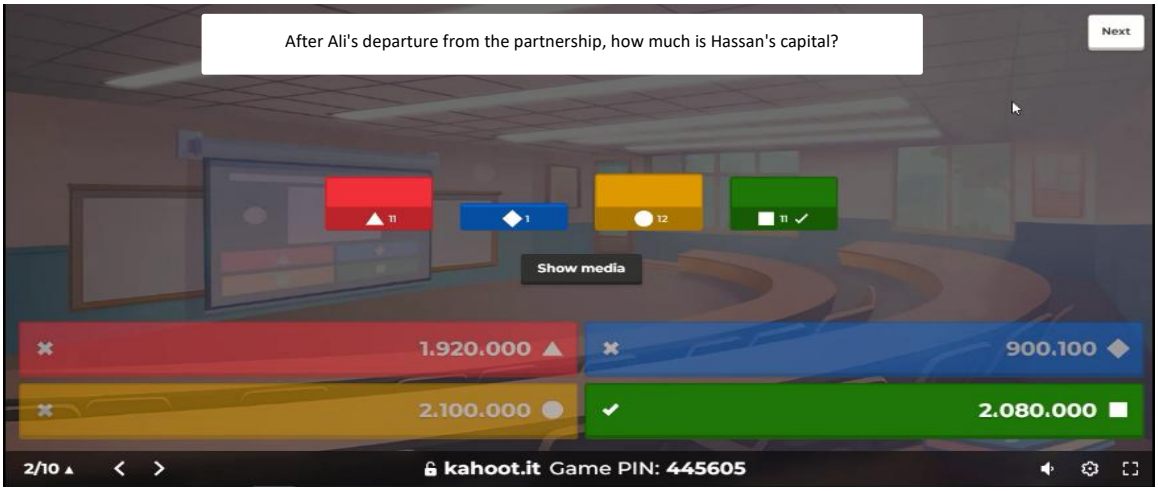

Figure1. The game screen, when displaying the answer to one of the questions

- Scores were ranked based on accuracy and speed, fostering a competitive learning environment.
- The top five players were displayed after the game, with individual results viewable on devices.
- The instructor reviewed a real-time summary, identifying challenging questions for further analysis.
- Players could provide session feedback via Kahoot!'s built-in tool.

3.3.8. Data analysis method

Data were processed using Excel and SPSS 27.

Principles of Accounting I scores were used as a pre-test measure.

Final scores for Principles of Accounting II served as the post-test evaluation.

Statistical methods applied:

- Analysis of covariance (ANCOVA)
- Multivariate analysis of covariance (MANCOVA)
- One-sample t-test

4. Results

The results are presented in relation to the study hypotheses. First, the descriptive findings are summarized, followed by the inferential analyses used to test each hypothesis. As shown in Table 3, the study included 63 undergraduate students: 36 (57.1%) in the experimental group (accounting) and 27 (42.9%) in the control group (financial management). Because intact classes were used, the groups differed in both size and academic major, which may introduce pre-existing differences that statistical controls cannot fully eliminate. The final sample consisted of 63 students, of whom 45 (71.4%) were female, and 18 (28.6%) were male. Initially, the control group comprised 30 financial management students; however, the final count was reduced to 27 after one student withdrew before the midterm exam, another before the final exam, and a third dropped the Principles of Accounting II course after

missing the final exam. Participants ranged in age from 18 to 24 years and, having been born between the late 1990s and mid-2010s, are classified as members of Generation Z.

Table 3. Gender and age range of participants by group

Participant characteristics		Experimental Group (Accounting)	Control Group (Financial Management)
Gender	Female	29	16
	Male	7	11
	total	36	27
The age range	Minimum date of birth	02.10.2001	04.07.1999
	Maximum date of birth	08.09.2004	20.09.2004
	All students	18 to 21 years	18 to 24 years

Among the 63 participating students, 38 (60.3%) held high school diplomas in the humanities, 13 (20.6%) in experimental sciences, 10 (15.2%) in mathematics and physics, and 2 (3.2%) in Islamic studies. The average high school GPA across both groups was 17.45 (SD = 1.49). The sample also included four guest students from other universities and three students who had transferred into the accounting program from other undergraduate majors. A review of academic records from previous semesters indicated that three students had enrolled in the Principles of Accounting I course but failed to pass.

4.1. Survey about the effectiveness of game-based teaching on the Kahoot platform

H1: Students hold a positive perception regarding their experience with the Kahoot! Platform for teaching Principles of Accounting II.

To examine the perceived impact of using Kahoot! In a game-based accounting classroom environment, students in the experimental group completed a researcher-developed questionnaire. The results are presented in Table 4.

The results indicate that over half of the experimental group students agreed with most questionnaire items, except for item 19, which concerned increased confidence at the end versus learning gains throughout the class.

Items 9 and 10 showed a strong positive attitude (more than 90% in agreement) towards Kahoot! Perceived as effectively motivating cooperative learning and involving fun in-class activities. Responses in favor of above 80% are evident for items 8, 12, 15, 22, and 24. This indicated that students were more engaged and excited when using Kahoot!, less aware of time passing, and more likely to enjoy the learning experience. Additionally, the topics you discuss while playing Kahoot! Sessions promoted more content from an educational perspective, and it was felt that the platform contributed to a better understanding of basic concepts. Items 1, 2, 3, 4, 5, and rotas (item pos: 14; agreement >70%; item pos: 20) demonstrated fair levels of >70%. These responses emphasized Kahoot! As an excellent revision tool before exams. Students were eager to engage with the platform more often in class. They, too, recognized it for improving clarity in particular areas such as inventory, cash, and payroll. Most students found the Kahoot! THOUGHTS: Challenges engaged and stated interest in using it again in future sessions.

Table 4. Results of the Researcher- Made Questionnaire

Items	Percentage of agree and strongly agree	Percentage of disagree and strongly disagree	Indifferent Percentage
The value of using Kahoot in the classroom:			
1. Kahoot! was a good way to review the material before the exam.	72.2%	5.6%	22.2%
2. I recommend that this method be used in future classes as well.	75%	16.7%	8.3%
The effectiveness of Kahoot in understanding the course materials:			
3. The game helped me to better understand the contents of the inventory topic.	75%	8.3%	16.7%
4. The game helped me better understand cash accounting.	75%	8.3%	16.7%
5. The game helped me better understand payroll accounting.	75%	2.8%	22.2%
6. The game helped me better understand the chapter's contents on the partnership (profit sharing and the entry of a new partner).	69.4%	11.1%	19.5%
7. The game helped me to better understand the contents of the chapter on the partnership (New partner entry and exit of the partner in the partnership).	69.4%	5.6%	25%
8. Kahoot meetings helped me learn the topics discussed in the class.	83.3%	2.8%	13.9%
Benefits of Using Kahoot Inside the Classroom:			
9. Kahoot! motivates cooperative learning.	94.4%	0	5.6%
10. Using Kahoot! makes the process of class activities more fun.	94.4%	2.8%	2.8%
11. Immediately after answering the questions, I received information about my success/failure.	69.4%	5.6%	25%
12. Using Kahoot! in the classroom environment and reviewing the material in this way helped me to understand the material.	86.1%	2.8%	11.1%
13. Competition in class gave me a good motivation to be accurate and perform better in learning accounting.	66.7%	8.3%	25%
Elements of Kahoot! Itself:			
14. It was challenging for me to use Kahoot!	77.8%	8.3%	13.9%
15. Using Kahoot! was enjoyable and attractive for me.	88.8%	5.6%	5.6%
16. I felt satisfied with the use of Kahoot during the semester.	66.7%	5.6%	27.8%
17. It was uncomfortable for me when I couldn't connect to Kahoot.	52.8%	19.4%	27.8%
18. Kahoot! was well-designed and organized, and I was able to understand its content and educational goals.	69.5%	8.3%	22.2%
19. At the end of the Kahoot! sessions in class, I was more confident about my learning.	41.7%	22.2%	36.1%
20. I would like to use Kahoot! again.	75%	8.3%	16.7%
21. I did not feel tense or anxious while using Kahoot! In class.	61.1%	13.9%	25%
22. While using Kahoot!, I lost track of time. (class engagement)	86.1%	2.8%	11.1%
23. Using Kahoot! helped me to realize my weaknesses in various topics. (Feedback)	55.6%	8.3%	36.1%
24. My enthusiasm and motivation to learn the concepts of the Principles of Accounting Course II while using Kahoot was greater than that of solving the exercises at home in the traditional and usual way.	86.1%	0	13.9%
25. The level of Kahoot's challenge was proportional to my level of ability.	63.9%	8.3%	27.8%

Six of the items (6, 7, 11, 13, 16, and 9) reported over 60% agreement. These included perceptions of the platform's desired level of challenge, its competitive climate, and its ability to increase accuracy and speed. Kahoot! immediately gave students feedback. This not only enriched their understanding

of course content and learning outcomes in a low-anxiety environment but also bolstered the overall student satisfaction with the semester. The platform was viewed as beneficial for promoting understanding of partnership-related topics.

To test the first hypothesis, a one-sample t-test was conducted. The test values were determined at the midpoint of the 5-point Likert scale (score 3) used in the questionnaire. This method is appropriate when evaluating whether the mean response differs meaningfully from a theoretical reference point rather than comparing two groups. Since each dimension consists of a different number of items, the test value for each dimension was calculated by multiplying the number of items in that dimension by 3 (the midpoint of the scale). Specifically: (1) The value of using Kahoot! In the classroom (2 items): Test value = 2 × 3 = 6; (2) the effectiveness of Kahoot! In understanding the course materials (6 items): Test value = 6 × 3 = 18; (3) Benefits of using Kahoot! Inside the classroom (5 items): Test value = 5 × 3 = 15; (4) Elements of Kahoot! Itself (12 items): Test value = 12 × 3 = 36. A mean score significantly higher than the test value indicates a positive perception toward that dimension. As presented in Table 5, all four measured dimensions were statistically significant ($p \leq 0.001$), thus confirming the first research hypothesis. Consequently, it can be concluded that students held a positive perception of their experience with Kahoot! in teaching Principles of Accounting II.

Table 5. One-sample t-test to examine the items

Items	Average	Test Value	t	df	Sig.
The value of using Kahoot! in the classroom	7.800	6	6.120	35	0.001
The effectiveness of Kahoot! in understanding the course materials	22.970	18	8.170	35	0.001
Benefits of using Kahoot! inside the classroom	21.310	15	11.770	35	0.001
Elements of Kahoot! Itself	45.750	36	8.670	35	0.001

Note: Test values represent the midpoint of the 5-point Likert scale (score of 3) multiplied by the number of items in each dimension.

4.2. Investigating the effectiveness of Kahoot! On academic performance

To evaluate the association between Kahoot! Regarding students' academic performance in the Principles of Accounting II course, the Kahoot!-based instructional approach was compared with the traditional teaching method. In this study, students' scores on Principles of Accounting I served as a pre-test (covariate). In contrast, their scores on Principles of Accounting II served as the post-test (dependent variable). To test the second and third hypotheses, both univariate and multivariate analyses of covariance (ANCOVA and MANCOVA) were employed.

Statistical Assumptions and Preliminary Analyses: The underlying statistical assumptions for ANCOVA and MANCOVA were tested before conducting the analyses. Below is the report of the output from these checks against our assumptions. Once these assumptions were confirmed, the principal statistical tests could be performed.

Normality: The Shapiro-Wilk test was used to assess the normality of the dependent variables across groups. The results indicated that the assumption of normality was met for all five classroom tests in both groups ($p > 0.05$ for all variables).

Homogeneity of variance: Levene's test of equality of error variances was conducted for each dependent variable. The results showed that the assumption of equal variances was satisfied for all five tests (Inventory: $F = 1.23$, $p = 0.27$; Cash: $F = 2.01$, $p = 0.16$; Salary: $F = 0.89$, $p = 0.35$; Partnership I: $F = 1.67$, $p = 0.20$; Partnership II: $F = 0.54$, $p = 0.46$).

Homogeneity of regression slopes: The interaction term of each covariate (the pre-test) and independent variable (group) was calculated separately for all dependent variables. The results confirmed that the assumption of homogeneous regression slopes was satisfied for all five tests ($p > 0.05$ for all interactions).

Equality of covariance matrices: Box's test of equality of covariance matrices was conducted to assess the assumption of equal covariance matrices across groups. This yielded a non-significant result (Box's M = 15.34, F = 1.02, p = 0.43), indicating that the covariance matrices were equal between groups and confirming that, despite unequal sample sizes, these are robust to MANCOVA.

MANCOVA was chosen as the main approach to test Hypothesis 3, where all five classroom tests (Inventory, Cash, Salary, Partnership I and II) are conceptually interrelated as measures of formative assessment performance for the same course. MANCOVA enables simultaneous testing of group differences across multiple dependent variables while controlling for the pretest covariate and maintaining the Type I error rate of interest. This method is better than performing several individual ANCOVAs (one for each of the five BTCs), which would increase family-wise error.

H2: There is a statistically significant difference in academic performance in Principles of Accounting II between students who used Kahoot! And those who received traditional instruction.

As shown in Table 6, the experimental group had a higher descriptive mean post-test score (12.31, SD = 3.44) compared to the control group (11.83, SD = 3.20). However, this descriptive difference does not account for pre-existing differences between the groups. The ANCOVA results in Table 7 show no statistically significant difference between the adjusted mean scores of academic performance in the post-test stage for the experimental and control groups after controlling for the pre-test effect ($F = 0.02, p = 0.87, \eta_p^2 = 0.001$,Cohen's $d = 0.04$). A nonsignificant ANCOVA indicates that the difference in post-test means was due mainly to differences in pre-test means (rather than the effect of Group). The low observational statistical power for the group effect (0.05) indicates that this analysis would likely not be able to identify small or moderate group differences. Thus, the lack of statistical significance may partly relate to the reduced sample size, as a second randomization did not reflect the complete absence of impact. Consequently, no statistically significant difference in academic performance was established between the two groups, and Hypothesis 2 is rejected.

Table 6. Mean and standard deviation of variables

Variable		Experimental Group		Control Group	
		Mean	SD	Mean	SD
Classroom Tests	Inventory	6.800	5.720	9.920	3.170
	Cash	11.110	6.320	8.560	3.480
	Salary	11.810	4.280	11.190	2.970
	Partnership 1	6.600	3.060	9.600	3.910
	Partnership 2	9.080	3.950	9.680	3.590
Pre-test	Principles of Accounting I	14.800	2.330	14.380	1.830
Post-test	Principles of Accounting II	12.310	3.440	11.830	3.200

H3: There is a statistically significant difference in classroom test performance between students who received Kahoot!-based formative assessment and those who received traditional paper-based formative assessment.

Table 7. ANCOVA results for academic performance (Post-test)

Source of variation	Sum of squares	Degree of Freedom	Mean of Square	F	Sig.	Partial Eta Squared	Cohen's *d*	Observed Power
Pre-test	218.410	1	218.410	28.240	0.001	0.320	—	0.990
Groups	0.210	1	0.210	0.020	0.870	0.001	0.040	0.050
Error	464.030	60	7.730					
Total	9926.870	63						

The difference between the experimental and control groups lies in how they respond to the functional phase tests. Multivariate analysis of covariance (MANCOVA) was used to investigate this hypothesis. MANCOVA was chosen because the five classroom tests represent related dimensions of student performance, and analyzing them simultaneously controls for intercorrelations among the dependent variables while protecting against inflated Type I error rates that would result from separate univariate tests. The significance values of Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root were examined. The multivariate test results indicated a non-significant overall effect of group across all dependent variables (Pillai's Trace = 0.12, $F = 1.45, p = 0.22, \eta_p^2 = 0.12$), suggesting that when considered jointly, the five classroom tests did not differ significantly between the experimental and control groups after controlling for pre-test scores.

Table 8. MANCOVA and follow-up univariate ANCOVAs for classroom tests

Multivariate Tests								
Effect		**Pillai's Trace**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta Squared**	**Cohen's *d***
Pre-test		0.080	1.02	5	57	0.410	0.080	
Group		0.120	1.45	5	57	0.220	0.120	—
Univariate Tests								
Source		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Cohen's ***d***
Inventory	Pre-test	12.450	1	12.450	1.890	0.170	0.030	
	Group	18.230	1	18.230	2.760	0.100	0.040	-0.670
	Error	396.780	60	6.610				
Cash	Pre-test	8.920	1	8.920	1.340	0.250	0.020	
	Group	15.670	1	15.670	2.350	0.130	0.040	0.490
	Error	399.450	60	6.660				
Salary	Pre-test	3.210	1	3.210	0.480	0.490	0.010	
	Group	1.890	1	1.890	0.280	0.600	0.010	0.160
	Error	401.230	60	6.690				
Partnership I	Pre-test	22.340	1	22.340	3.450	0.070	0.050	
	Group	67.730	1	67.730	5.270	0.020	0.130	-0.870
	Error	464.030	60	7.730				
Partnership II	Pre-test	5.670	1	5.670	0.850	0.360	0.010	
	Group	4.120	1	4.120	0.620	0.430	0.010	-0.160
	Error	398.900	60	6.650				

Note: The multivariate test (omnibus) for the group effect was non-significant ($p = 0.22$). Although the univariate ANCOVA for Partnership I showed a nominal p-value of 0.02, it did not reach the statistical significance threshold after applying the Bonferroni correction ($\alpha = 0.01$). Observed power for the group effect was 0.05.

For a more fine-grained analysis, we performed a one-way ANCOVA for each of the five classroom tests (Inventory, Cash, Salary, Partnership I, and Partnership II), with pre-test scores entered as a covariate. Note that although the overall multivariate test was non-significant, these follow-up univariate tests were thus conducted to further examine this pattern of results across individual tests. This is in line with recommendations on interpreting MANCOVA results, in which univariate analyses can be important for understanding specific variables when the multivariate effect is not significant. Table 8 presents the complete results of these analyses for all five tests.

As shown in the univariate follow-up analyses in Table 8, after controlling for pre-test scores, only the Partnership I test showed a nominally significant univariate difference between the experimental and control groups ($F = 5.27, p = 0.02, \eta_p^2 = 0.13$, Cohen's $d = -0.87$). Given that the overall multivariate test was non-significant, this univariate result should be interpreted with extreme caution. To control for the Type I error rate across the five dependent variables, a Bonferroni correction was applied, resulting in an adjusted significance threshold of 0.01 ($0.05/5$). Using this more stringent alpha level, the p-value for Partnership I (0.02) is not statistically significant.

Results of the pairwise comparison were shown in Table 9, which showed a mean difference of -2.92 for Partnership I, although since the omnibus test was not statistically significant and since statistical power is very low (0.05) for the group effect when N=26, this univariate result could be considered most feasibly as spurious or incidental to a null effect from an intervention. Although students reported enhanced understanding of the material through the use of Kahoot!, their performance on classroom tests did not significantly improve compared with those assessed using traditional paper-based methods. Consequently, the third hypothesis is rejected.

Table 9. Pairwise comparison for Partnership I (Nominal results)

Variable	Group I	Group J	Mean differences (I – J)	Std. Error	Significance level
Partnership I	Experimental	Control	-2.920	1.270	0.020

Note: The reported p-value is nominal. Under the Bonferroni-corrected alpha level ($\alpha = 0.01$ for five comparisons), this difference is not statistically significant.

5. Discussion

This study examined the use of Kahoot!, a mobile-based gamified learning platform, on students enrolled in the Principles of Accounting Course II, focusing on engagement, motivation, and academic performance. Generation Z students, being digital natives, are naturally inclined towards technology-mediated learning environments (Wang and Tahir, 2020). Consistent with previous research in this domain, our analyses show that students who played Kahoot! RESEARCH REPORTS reported increased motivation, engagement, and enjoyment of the classroom (Minton and Bligh, 2021; Marsa et al., 2021). The gamified nature of the platform promotes collaborative learning and instant feedback, creating a feverish educational environment (Neerupa et al., 2024).

Analysis of the First Hypothesis: Our results demonstrate that Kahoot! This is supported by the findings of Lin et al. (2018) and Tóth et al. (2019), who reported that students experienced positive effects on their learning in Principles of Accounting II, primarily as an exam review tool. Students said that interactive formats helped them understand complex topics more clearly, consistent with Khatibi and Badeleh (2021). Kahoot! Studies (Creel et al. 2021). These outcomes align with the engagement-based learning framework and reflect the activating role game-based tools can play in cognitive and affective engagement, as two key mechanisms underpinning this study's theoretical background. Thus, while Minton and Bligh (2021), for instance, found competition to have time-unlimited negative outcomes, most students in this study found it motivating and performance-

enhancing in a context-dependent case. However, the lower level of agreement on the confidence item (Item 19) indicates that positive emotional engagement does not equate to higher levels of perceived learning or confidence, a crucial distinction already reported in previous research, such as Ranieri et al. (2021).

It is important to note that these findings are based on self-reported perceptions, and the test values used in the one-sample t-test were derived by multiplying the midpoint of the 5-point Likert scale (score of 3) by the number of items in each dimension, as detailed in the Results section. This analytical choice is methodologically appropriate for composite Likert constructs; however, such tests rely on the assumption that Likert-type means meaningfully approximate interval-level properties—a limitation that should be considered when interpreting the magnitude of the perceived learning effects. A gamified learning setting motivates students and enhances student enjoyment, as supported by Felszeghy et al. (2019). Technical problems such as unstable internet, as mentioned by Lin et al. (2018), pose challenges. Indeed, in line with Ranieri et al. (2021), theoretical content fared better than practical. In sum, these results add to the existing literature by placing the findings within a theoretical perspective, building on previous empirical research, and demonstrating how Kahoot! Localisation of CS in a university setting. Results demonstrate a localized implementation of CS in an Iranian university context that enhances perceived understanding, student engagement, and enjoyment; however, it also illuminates contextual and infrastructural factors that likely moderate the effectiveness of quality mechanisms.

Second hypothesis discussion: Academic success of the Kahoot! Results suggest that, compared to the control group, the second hypothesis is rejected. Although the descriptive statistics in Table 6 show that the experimental group had a higher mean post-test score (12.31) than the control group (11.83), this apparent difference is not statistically significant after controlling for pre-test scores via ANCOVA ($F = 0.02, p = 0.87$). Crucially, the observed power for this analysis was remarkably low (0.05), and the effect size was negligible (Cohen's$d = 0.06$). These statistical indicators suggest that the study was underpowered to detect effects smaller than extremely large. Thus, the lack of any statistical significance might be due to the final n ( ) being too small rather than in fact a conclusive non-existence of pedagogical effect. Although much of the earlier gamified learning research shows that students are positively inclined toward gamified learning, few studies explicitly examine a quantifiable change in student learning outcomes. The current result reinforces a burgeoning assertion that favorable perceptions do not constitute unequivocal learning benefits, especially when the gamified experience primarily serves as simply a motivational enabler.

Current findings are similar to those of Devanipour (2022), who reported no overall difference in final test scores, despite student enthusiasm in his study. In contrast, studies by Wardana and Sagoro (2019) and Ortiz-Martínez et al. 2022) found improvements in post-test and exam performance, suggesting that context and implementation strategies may be key determinants. These mixed results suggest that Kahoot!'s effectiveness is closely tied to curricular alignment, depth of content engagement, and the degree of integration with broader learning activities. These findings suggest that Kahoot! It is more linked to influencing learner engagement than to a direct impact on academic delivery outcomes, sometimes only within the wider context of an active and digital learning framework (Go et al., 2024). Accordingly, the rejection of the second hypothesis does not undermine the pedagogical value of Kahoot!, but instead underscores the need for intentional design when targeting achievement-related outcomes.

Discussion of the third hypothesis: Despite students' favorable perceptions of Kahoot!, the results from formative assessments showed no significant academic differences at the multivariate level (Pillai's Trace, p =. 22). Although a nominal significance was initially observed in the follow-up univariate analysis for one test (Partnership I; $F = 5.27, p = 0.02$), this finding did not survive the

more conservative Bonferroni correction (adjusted $\alpha = 0.01$). When considering the substantial effect size for this specific module (Cohen's d = 0.87)alongside the extremely low observed power (0.05), this isolated result should be interpreted with caution. It is much more likely to represent either a false positive or a chance anomaly than a solid teaching effect, all the more so from relatively small and unbalanced sample sizes. We cautiously interpret the surprising direction of the nominal difference in Partnership I, in which the experimental group underperformed. The Partnership I test was given towards the end of the semester (see Results section), and procedural observations revealed that many students in the experimental group had postponed their preparation until just before the exam. While military service may better explain distance learning, researchers said this is just speculation, lacking supplementary data on study habits given the small sample size.

Accordingly, the third hypothesis is rejected, in line with Devanipour's (2022) findings in Iran but in contrast to Ortiz-Martínez et al. (2022), who reported performance gains in Spain. While previous studies (such as Wardana and Sagoro, 2019; Ortiz-Martínez et al., 2022) suggest that gamification improves performance, some others (e.g., Scalan and Huff, 2020; Chan et al., 2021; White et al., 2021) show little to no measurable effects. These inconsistencies across studies suggest that Kahoot! The role of formative assessment or testing to help you learn rather than just testing what you know alone is not enough, however, without robust scaffolding and opportunities for deeper cognitive processing. Moreover, as Yao et al. (2024) noted, Formative assessments might work best for lower-performing students, a trend that could have been diluted in this study, as pointed out (2024). Also, non-instructional variables, such as the Hawthorne effect (McCambridge et al., 2014), may have moderated learning outcomes. In sum, these studies suggest that the pedagogical benefits of Kahoot! Likely, the effects of immediacy on engagement, attention, and classroom dynamics are more pronounced in these domains than for performance, which continues to depend upon learner characteristics and specific instructional design choices.

Summary of Findings and Implications for Future Research: Overall, the findings indicate that while Kahoot! Positively influenced students' perceptions and classroom engagement, it did not yield statistically significant improvements in academic performance for Hypotheses 2 and 3. The interpretation of these null results is fundamentally constrained by the study's low statistical power (0.05), which indicates a high risk of Type II error. In other words, the study may have lacked the sensitivity to detect small-to-moderate improvements in performance that might have been present in a larger, more robustly powered sample.

Moreover, the absence of assessments targeting deeper learning outcomes such as conceptual understanding or long-term retention further constrains conclusions about the platform's educational impact. Thus, although the present study does not provide evidence of direct academic gains, its findings are inconclusive rather than dismissive of gamification's potential. Future research employing more rigorous designs, larger and randomized samples, and multidimensional measures of learning is needed to more definitively clarify the relationship between gamified tools and student achievement in accounting education.

5.1. Researcher's observations of the two groups

Bloom (1956) emphasizes that both cognitive entry behaviors and affective entry characteristics influence students' academic performance. Affective entry characteristics refer to students' interest, motivation, and attitudes toward learning new material. At the same time, students' interpretations of their past academic successes or failures may also shape their engagement with new course content. Classroom observations indicated that many students in both groups were primarily focused on achieving higher examination scores. The introduction of a game-based learning environment created a learning experience different from traditional paper-based assessments, which appeared to influence

students' classroom reactions and interaction patterns. However, levels of engagement and participation varied among students in both groups.

Students were expected to use appropriate study strategies, conceptual understanding, and problem-solving skills when answering assessment questions. The results confirmed our expectation that Kahoot! might initially be a bit intimidating for students in the experimental group. On the contrary, the students in the experimental group tended to have less structured preparation patterns at first, but they were already familiar with the Kahoot! -based format increased over time. These observations are offered strictly as qualitative insights rather than as empirical results from statistical analyses to contextualize the instructional setting.

6. Conclusion

The results of this research study suggest that Kahoot! These results were not statistically significant in their impact on students' academic gains, but demonstrated improvements in students' perceptions, engagement, and classroom dynamics in the Accounting Principles II course. As shown in this study, academic performance is a multidimensional construct shaped by motivational and attentional factors, as well as students' interactions with learning tools, not just by evaluation scores. The lack of post-test differences after controlling for pre-test scores reinforces the need to use appropriate controls in quasi-experimental designs. It indicates that improvements in perceptions do not always translate into improvements in performance.

Although Kahoot! Has been effectively implemented in various educational contexts worldwide, its impact in this study appears to be shaped by contextual and infrastructural factors. Furthermore, it is critical to acknowledge that the study's final sample size bounds the statistical conclusions ($N = 63$; 36 experimental and 27 control) and a notably low observed power (0.05). Under these conditions, the study was primarily sensitive to very large effects, potentially overlooking smaller but pedagogically meaningful gains. Barriers to digital engagement were reflected in students' experiences of school: inconsistent internet access and uneven uptake of digital tools in teaching practice across schools. Coupled with this, limited statistical sensitivity in detecting achievement measures may account for the additional engagement benefits experienced by the experimental group compared to gains in achievement. In general, Kahoot! Has the capacity to support engagement but appears to need more robust pedagogical integration and a less volatile infrastructure to make a measurable impact on learning outcomes.

7. Resaerch Implications and limitations

Overall, these findings suggest that policymakers and institutional leaders may want to consider supporting the development of faculty capabilities in implementing game-based learning tools, as well as additional investments in digital infrastructure. For instructors, targeted training, along with blended learning modes that balance gamified assessments with more traditional evaluations in pursuit of collaborative learning, may improve overall learning outcomes for students with diverse needs. For such interventions to be effective, institutional commitment through incentives, technical assistance, and the fostering of digital literacy among faculty and students is needed.

Regarding limitations, this study was constrained by its quasi-experimental design with nonequivalent groups. Although ANCOVA was used to statistically control for initial differences, the final sample size of 63 participants, resulting from the exclusion of three cases in the control group to ensure data integrity, may have limited the study's capacity to detect significant differences. This underpowered design (observed power = 0.05) increases the risk of a Type II error, leaving true effects unobserved. The non-significant MANCOVA results also bolster this. However, a nominal difference was noted on one subtest (Partnership I); this difference lost significance after a conservative

Bonferroni correction, suggesting it may be spurious. The reliance on closed-ended Kahoot! Items were also limited in their evaluation of deeper conceptual understanding. Additionally, fluctuations in internet access inhibited students from engaging. Future studies should utilize a priori power analysis to determine optimal sample sizes, randomization as it relates to treatment-receipt effects, larger (and balanced) participant samples, and better methods of addressing attrition to more definitively elucidate the association between gamified tools and accounting learning (especially outcome-based), ultimately aiding student success. Future research should also adopt a mixed-methods approach to investigate qualitative processes of learning alongside quantitative measures of first-contingent sexual partners, and explicitly opt for a narrower, professionally motivated set of dependent variables to reduce the risk of over-testing. Comparative cross-cultural studies could further illuminate how sociocultural and institutional contexts mediate the effectiveness of gamified learning in accounting education.

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Conflict of Interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication or falsification, double publication or submission, and redundancy, have been fully addressed by the authors.

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