

Use of Game-Based Learning Tools in Management Classes: Students' Perception and Effects on Their Academic Performance

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ABSTRACT

The game-based learning tool Kahoot promoted an interactive teaching methodology and was found to work best in enhancing students' motivation and participation. The present study evaluated whether Kahoot improves not only students' motivation, participation, and academic performance. The study participants were two cohorts of accounting students who studied at CamEd Business School in Cambodia in different semesters. Cohort 1 attended fully online classes, and Cohort 2 attended hybrid courses. The perception survey showed that both groups liked Kahoot activities. It increases class attendance and motivates students to engage in class. However, on the perceived advantages of Kahoot, the cohorts' perceptions differ significantly, with Cohort 1 being very satisfied while Cohort 2 was satisfied. The analysis of the student's exam scores showed that their English proficiency contributed 5 percent and 9 percent, respectively, to the variation of the Kahoot scores of the two cohorts. Further, analysis of the correlation results showed that Kahoot scores accounted for 36 percent of the variability in quiz scores, 7 percent in mid-term exam scores, and 1 percent in the final exam scores of Cohort 1. For Cohort 2, Kahoot scores accounted for 52 percent of the variability in quiz scores, 23 percent in mid-term exam scores, and 15 percent in the final exam scores. Considering the timeline when the respondents took the quiz, mid-term and final exams, it is concluded that Kahoot reviews effectively improved exam scores within the short span after the review. The effectiveness, however, wanes after the lapse of time and may not support long-term retention of the lessons.

Keywords: *Gamification; Academic performance; Management class; Online and hybrid classes*

INTRODUCTION

Using a game-based learning tool fosters an interactive teaching methodology suited for Generation Z students, who appear to have a radically different approach to learning compared to the previous generations. The Gen Z-ers (born from 1997 to 2012) are called the "eccentric generation" (Seyi-Ola, 2022) and "digital natives" (Stears, 2019; Cilliers, 2017), born amid technological innovation, embracing the widespread use of smartphones and social media. They spend excessive screen time, which creates feelings of isolation; hence, they are also dubbed the "loneliest generation" (Annie E. Casey Foundation, 2021). They prefer communicating through images, icons, and symbols rather than texts. Gen Z-ers have an average attention span of only 8 seconds (Stears, 2019; Giunta, 2017). They prefer interactive games to lectures. To them, class lectures mean "come

and entertain me, " they dislike long waiting times for a response but prefer highly instant information (Rothman, 2016, cited by Cilliers, 2017).

Many game-based student response systems (SRS) allow educators to test the learning and knowledge of their students interactively. Among these are Kahoot, Quizizz, Socrative, Quizalize, and Peardeck. Kahoot is the most popular SRS application because it has an Android demo application and runs on any device with a web browser (Celik et al., 2016).

Kahoot is commonly used in classrooms today to create a more engaging and joyful environment which most learners prefer. It is a gamification tool that lecturers use more than ever when in-person classes have shifted to online due to the pandemic. Its use continued until classes gradually transitioned to a hybrid mode or a combination of face-to-face and online sessions until classes were back to the traditional face-to-face.

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Kahoot is gaining popularity in many countries as it supports 17 languages (Kahoot, 2022). As Wang (2020) reported, Kahoot is a game-based platform used in more than 200 countries by more than six million teachers and 800 million students. Kahoot is a game-based student response system (GSRS) where a game show is conducted in the classroom, and the teacher is the host while the students are the players. Half of the K-12 students in the US used this platform. Various studies reviewed by Wang and Tahir (2020) showed that Kahoot positively affected learning performance, classroom dynamics, attitudes, and anxiety in higher education and K-12 settings.

However, some studies claim that although Kahoot can attract students' attention faster and motivates students in class, the repeated use of Kahoot may cause students to "focus only on the game features and forget about the learning aspect of the quizzes" (Rajabpour, 2021). Similarly, McNutt (2019) highlighted that "Kahoot is great at measuring breadth, not the depth of knowledge." Saying further, students doing well may enjoy the Kahoot game, but it demotivates those left behind. Those students who struggle with reading are not inspired by Kahoot (McNutt, 2019).

The study by Rajabpour (2021) indicated that Kahoot could boost students' energy levels but shortens their attention spans. It was also stated that some teacher respondents were dissatisfied with the design of Kahoot. They perceived it as immature, using primary colors and shapes, and its settings were the least flexible. Furthermore, Wang and Tahir (2020) cited that some studies showed that Kahoot has little or no effect. Finally, Phelps et al. (2020) evaluated the health sciences and medical students' perceptions of using Kahoot as a teaching tool in face-to-face and online classes. Results revealed that students in both the face-to-face and online learning groups rated their learning experience using Kahoot highly. Still, there were no significant differences between the experiences of both groups.

Another study by Figuccio and Johnston (2021) pointed out that Kahoot, as a review tool, effectively predicts test scores in a social science class. The students prefer reviewing with Kahoot because it helps them learn the course concepts, makes the class more interactive, and give them a higher enjoyment level. However, there was no quantitative difference in students' exam scores using Kahoot review sessions over the traditional review sessions. In contrast, the meta-analysis conducted by Yildirim &

Şen (2021) covering 45 experimental results showed that "gamification has added 7.2 percent positive value to academic achievement" of the students. These differing study outcomes are better scope for further study.

Research Gap and Objectives

The results of 93 studies reviewed by Wang and Tahir (2020) and the studies of Guillo et al. (2019); Pratolo and Lofti (2021); Elkhamisy and Wassef (2021); Wichadee and Pattanapichet (2018); Kalleney (2020); and UP Voice, (2020), support that Kahoot works best in increasing motivation and engagement among K-12 and groups of tertiary learners. However, despite these studies, there still needs to be a gap in whether this game-based learning tool improves accounting students' academic performance. Saxena and Mishra (2021), in their research entitled Gamification and Gen Z in Higher Education: A Systematic Review of Literature, mentioned that the limited studies on gamification in higher education show that games most likely aid the motivation and engagement of the learner. The writers recommended future research assessing that gamification motivates and heads toward academic performance. They also proposed using gamification in various areas like Biology and Management to delve into the possible correlation between gamification and student achievement.

There were also scant studies assessing whether English reading skills relate to the scores in Kahoot using English questions. Since speed in answering the questions is vital in playing Kahoot, a student's ability to read and understand the questions is essential to give correct answers. McNutt (2019) states that Kahoot does not motivate students who struggle with reading. Seccuro (2018) also reported that to win more points in Kahoot games, the player must answer the question faster than other players. Concerning this, the researcher was interested in finding whether the students' English proficiency matters in their Kahoot scores, considering that Cambodia is a non-English speaking country and, based on a global survey, the English proficiency of Cambodians is low (Ngel, 2022). Also, to further evaluate the data whether Kahoot scores correlate with quizzes, midterm, final, and Association of Chartered Certified Accountants (ACCA) Computer Based Exam (CBE) scores. The CBE is an international exam administered online by ACCA in the UK.

The researcher introduced Kahoot quizzes in two cohorts of accounting students to evaluate whether

game-based reviews will enhance the students' motivation, participation, and class performance and whether their Kahoot scores predict of their other examination scores. One cohort attended fully online courses, and the other followed hybrid or a combination of face-to-face and online class sessions. Specifically, this study seeks to evaluate the following:

- The profile of respondents in terms of gender, place of residence, type of internet connection, internet provider, quality of internet connection, and availability of electricity in the area;
- Students' perception of the use of Kahoot in their management class;
- The significant difference between the perception of students attending fully online classes and hybrid courses;
- The relationship between the student's English proficiency (Aptis) and Kahoot scores;
- The relationship between the students' Kahoot scores and their scores in quizzes, mid- term and final exams, ACCA CBE scores;
- Relationship between Aptis and ACCA CBE exam scores.

Null Hypotheses

- Ho1: There is no significant difference between the two cohorts' perceptions of using Kahoot.
- Ho2: No statistical relationship exists between the Aptis and Kahoot scores of the students.
- Ho3: There is no significant relationship between the Kahoot scores and the pop quiz scores of the students.
- Ho4: There is no significant relationship between the Kahoot scores and the mid-term exam scores of the students.
- Ho5: There is no significant relationship between the students' Kahoot scores and final exam scores.
- Ho6: There is no significant relationship between the students' Kahoot and CBE scores.
- Ho7: There is no significant relationship between the students' Aptis and CBE scores.

LITERATURE REVIEW

The following related studies and literature serve as a springboard for this study.

Gamification Tool Kahoot

Many game-based student response systems exist, but Kahoot is a more popular platform (Celik, Akçetin, & Asmalı, 2016). Therefore, this study relates solely to Kahoot, used as an interactive way of testing the learning and knowledge of the student respondents.

Kahoot "is a magical and game-changer tool in the field of education" (Kaur, 2021). Cole (2020) opined that Kahoot is one of the foremost digital tools that allow teachers to introduce interactive learning games for students. Kahoot is an excellent website for educational games. Teachers can select the topic and ask students multiple-choice questions. The students who answer the question correctly and quickly will earn points. At the end of the game, a podium acknowledges the top three students and the fourth and fifth placers. Ares et al. (2018) similarly mentioned that Kahoot is one of the most utilized gamification tools. It is a free tool popular among teachers, simple to use, and promotes interaction within the classroom.

The gamification tool Kahoot is used in class to improve students' class engagement and is a great way to break the monotony of listening to lectures. "It raises the energy level in students" (Rajabpour, 2021). De la Tour (2021) defines engagement as "a measure of a student's participation in the learning process, and the level of student engagement is a good measure of the likelihood that a learning experience will be successful." Kalleney (2020) said Kahoot improves students' engagement and satisfaction in formative assessments. It can be applied live for any face-to-face or virtual learning session. In 2020, the University of Puthisastra in Cambodia introduced Kahoot online quizzes in its English for Dentistry class as a form of assessment that students generally enjoyed, especially during online sessions, and was found effective in motivating students to learn (UP Voice, 2020).

Advantages and disadvantages of Kahoot

Many studies have investigated the impact of Kahoot in the classroom on student learning outcomes. Wang and Tahir (2020) conducted a literature review of 93 studies on the effects of using Kahoot for learning. They concluded that "Kahoot can positively affect learning performance, classroom dynamics,

students' and teachers' attitudes, and students' anxiety." However, they also reported other study results that Kahoot has slight or no effect. Wang and Tahir (2020) also cited the challenges the students and teachers mentioned. They enumerated the problems encountered by the students as follows: unreliable internet connections; hard-to-read questions and answers on a projected screen; not being able to change an answer after submission; stressful time pressure for giving answers; not having enough time to answer; afraid of losing; and hard to catch up if the student had given an incorrect answer. They also identified the challenges mentioned by the teachers, which include: getting the difficulty level of questions and answers right; problems with network connectivity; scoring based on how quickly the students answer, reduced student reflection, and causing some students to guess without thinking; some students can have a problem with failing a quiz; and some teachers find it challenging to use the technology.

The study of Pratolo and Lofti (2021) on using Kahoot for learning English revealed both the benefits and the problems of using Kahoot. They highlighted the following benefits: Kahoot motivates students to learn, builds a good class atmosphere, helps students focus, and provides positive competition. The problems include erratic internet connection and the need for more discussion between the teacher and learners. The results of the study by Elkhamisy and Wassef (2021) revealed the following advantages of Kahoot: 1) it enhances Pathology understanding and retaining knowledge; 2) made learning fun and motivating; 3) simple and easy to use, and 4) self-confidence and imagining skills booster. However, some disadvantages mentioned by the students include no explanation of the answers and the short time limit for the questions. They also found that using Kahoot was significantly associated with better Pathology academic performance but not with the student's general academic performance.

Guillo et al. (2019) showed that using Kahoot in theory classes has positive results. Most students responded that Kahoot "reinforces what they have learned" and "motivates a lot to learn." In addition, most students believe using Kahoot is necessary, and prefer sharing theoretical lessons and practical exercises. Felszeghy et al. (2019) investigated whether medical and dental histology course students would have better grades if they used Kahoot and whether gamification affects learning and enjoyment. The results showed

that Kahoot gives high satisfaction among the participants, with most students saying it "increased their motivation to learn." In addition, Kahoot enables most students "to overcome difficulties and to set up a collaboration." Tan et al. (2018) also studied a group of 51 undergraduate students at a public university in Malaysia were exposed to the Kahoot learning platform during weekly lectures for one semester. They found Kahoot was beneficial in stimulating motivation and engagement and reinforcing learning in theory and practice.

The quasi-experimental study conducted by Wichadee and Pattanapichet (2018) involved an experimental group taught using Kahoot and a control group trained with the conventional method. The results show that the experimental group obtained higher scores and motivation than the control group. Ares et al. (2018) compared the academic outcomes of two groups of third-year students in the Chemistry course. One group used Kahoot, and the other group did not. The result shows a significant improvement in the number of students who passed the exam in the group that used Kahoot in class. Finally, Turan and Meral (2018) studied 46 seventh-grade students (23 control and 23 experimental groups). They pointed out that "the game-based student response systems increase the achievement and engagement and decrease the test anxiety level when compared to non-game-based student response systems."

A study involving 50 Information Technology students in Malaysia shows that classroom (Rahman et al., 2018). The study of Tóth et al. (2019) involved 200 bachelor students who participated in an elective course for 14 weeks and were given Kahoot quizzes and two mandatory exams. Some quiz questions were purposefully merged into the exam's question bank as multiple-choice or true or false questions. The exam results were analyzed based on the number of Kahoot quizzes the students took. They found that students who participated in more Kahoot quiz games did better on the complete exam. However, they added that the result could not be fully credited to Kahoot, as some students were more diligent. The study of Lopez and Cabot (2022) revealed that Kahoot's positive effects on academic performance during lectures were "strongly diluted when high-demanding exams were taken."

Bicen and Kocakoyan (2018) pointed out that using the gamification method in the classroom makes students more ambitious and encourages them to study harder. However, some drawbacks reported by

the participants are an unstable internet connection and freezing of their smartphones, which make them lag and cannot answer some questions even though they know the answer. Plump and LaRosa (2017), as cited in Rajabpour (2021), said that “once students get several wrong answers, it is hard for them to stay motivated and engaged.” Similarly, Kaur (2021) mentioned that Kahoot only works if there is a strong WiFi connection, and sometimes, Kahoot’s background music can be distracting and stressful.

Gamification also encourages students to come to class. Kaur (2021) opined that Kahoot effectively reduces monotony and boredom. In addition, it has increased the students’ performance due to an increase in the student’s attendance. It is also easy for Kahoot teachers to download reports in a spreadsheet. Wang (2020) stated that when used often in class, Kahoot increases attendance, participation, engagement, and motivation. Martinez-Jimenez et al. (2021) also reported that Kahoot is a powerful tool that improves students’ attendance and participation. Additionally, when students see their names on the podium, it boosts their motivation and self-esteem.

The literature suggests that gamification increases student motivation and engagement. That being the case, this paper investigates whether Kahoot would increase the motivation, participation, and academic performance of accounting students studying management courses in fully online or hybrid classes. There are also scarce studies assessing whether the English reading skills of the students relate to their scores in Kahoot using English questions since the speed in reading and understanding the questions are crucial in answering the questions correctly within the time limit.

CONCEPTUAL FRAMEWORK

Figure 1 presents the structure of the study. It intends to assess the students’ perception of the game-based tool Kahoot used to review their management lessons. The perceptions include the advantages and disadvantages of using Kahoot. The scores from 26 Kahoot reviews given during the whole semester to two cohorts of participants were among the primary data collected. In addition, the student’s English proficiency scores from their Aptis exam, one of the school’s entry requirements, were taken from school records. The analysis focused on whether students with high Aptis scores also obtained high Kahoot scores and whether Kahoot scores impact the

learners’ performance in quizzes, mid-term and final exams, and ACCA CBE scores. The Aptis scores were also associated with the ACCA CBE scores.

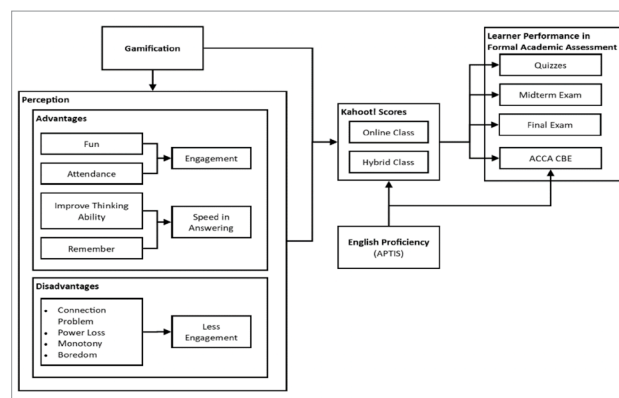


Figure 1: Conceptual framework of the study

METHODOLOGY

Research Design

This descriptive and correlational research has assessed the accounting students’ perception of using Kahoot in management classes and whether Kahoot reviews help to improve their motivation and engagement. In addition, a correlation analysis between Kahoot scores and various exam scores determined the effects of Kahoot on students’ academic performance.

Participants

The participants of this study were a total of 529 second-year students taking up Bachelor of Accounting and Finance at CamEd Business School in Phnom Penh, Cambodia, who enrolled in the Principles of Management (MGMT 201) subject. The participants were two cohorts of students who participated in Kahoot reviews. Cohort 1 comprised 237 students who studied purely online in the second semester (June-December) of the school year 2021 (JD-2021), when classes were still online due to the pandemic and lockdowns. Cohort 2 includes 292 students who attended hybrid courses in the first semester (January-June) of the school year 2022 (JJ-2022), when classes gradually shifted to hybrid mode, and students alternately attended physical courses. From these groups, 343 responded voluntarily to the questionnaire to evaluate students’ perceptions about the game-based activities in class, 151 from Cohort 1, and 192 from Cohort 2.

Data Sources and Collection Methods

This paper utilized primary and secondary data. The

primary data were the responses of 343 students surveyed on their perceptions using a questionnaire in Google Forms and the Kahoot scores of 529 students taken from the 26 Kahoot quizzes.

The secondary data were taken from the school records, which include the students' quizzes, mid-term and final exams, Aptis, ACCA CBE scores, and other relevant information like CBE pass rates.

Instruments

1. A questionnaire in Google form with nine questions about the profile of the respondents, the perceived advantages and problems encountered when playing Kahoot, and the internet connection quality. Questions 4 and 5 relate to the advantages and disadvantages of using Kahoot using a 5-point Likert scale, with 5 indicating strongly agree and 1 indicating strongly disagree.
2. Kahoot quizzes were given during the whole semester for both cohorts. One Kahoot quiz is given immediately at the end of every chapter, but two Kahoot quizzes were given for long chapters. A total of 26 Kahoot reviews were carried out for each semester, and the scores of every participant were recorded.
3. Written quizzes (Pop Quizzes) with 20 questions each, primarily multiple-choice, were given every two completed chapters one to two weeks after the Kahoot review. The ten quizzes were prepared by the lecturer but administered by the school's Learning Support Center (LSC) staff, and LSC collected the scores as part of the school records. The scores were requested from the school as part of the secondary data used in this study.
4. A mid-term exam is a long exam that comprises multiple-choice and multi-task questions more complex than the questions used in Kahoot. It was prepared by the researcher but administered by the LSC in the middle of the semester, approximately two months after classes started. Again, the LSC collected the mid-term scores as part of the school records. These scores were part of the secondary data used in this study.

Data Analysis

The responses to the questionnaire were analyzed using frequency count and mean and weighted mean. On the perceived advantages and disadvantages of

using Kahoot in class, referring to questions 4 (Q4) and 5 (Q5) in the questionnaire, a 5-point Likert scale was used, and the mean ratings were interpreted as follows:

Score range	Mean rating	Interpretation
4.21-5.00	Strongly agree	Very satisfied
3.41-4.20	Agree	Satisfied
2.61-3.40	Neither agree nor disagree	Neutral
1.81-2.60	Disagree	Dissatisfied
1.0-1.80	Strongly disagree	Very dissatisfied

The values for Cronbach's Alpha were calculated to measure the internal consistency in these items. For example, for cohort 1, question 4, on the advantages subscale consisting of 12 items, has a value for Cronbach's Alpha of $\alpha = .955$, and for question 5, the disadvantages subscale, which consisted of 5 items, the value was $\alpha = .673$. For cohort 2 (192 respondents), Cronbach's Alpha values were $\alpha = .971$ for Q4 and $\alpha = .773$ for Q5.

The Cronbach alpha values tell how closely linked a set of test items are as a group. Goforth (2015) stated that many methodologists recommend a minimum α coefficient between 0.65 and 0.8 or higher; coefficients less than 0.5 are usually unacceptable.

Specifically, the higher the α coefficient, the more the test items have shared covariance and probably measure the same underlying concept.

The Mann-Whitney U test was used to compare the differences between the perceptions of the two cohorts. The Pearson-Product Moment Correlation (r) and scatterplots were used to determine any relationship between the Aptis and Kahoot scores. Subsequently, the relationship between Kahoot scores and the different exam scores was analyzed. The correlation values were interpreted using the following classifications in Table 1.

Table 1: Correlation values and interpretation

r value =	Interpretation of r
+ .70 or higher	A very strong positive relationship
+ .40 to +.69	Strong positive relationship
+ .30 to +.39	Moderate positive relationship
+ .20 to +.29	Weak positive relationship
+ .01 to +.19	No or negligible relationship
0	No relationship [zero correlation]

Source: <https://www.statisticshowto.com/probability-and-statistics/correlation-coefficient-formula/#Pearson>

FINDINGS AND DISCUSSION

Profile of Respondents and Quality of Internet Connection

The study collected primary data about the respondents' profiles from the perception survey responded to by 343 students (Appendix A). The data showed that 70 percent were females, and 30 percent were males. The majority (80 percent) came from Phnom Penh City, and 20 percent came from different provinces. In addition, many (48 percent) were using wireless Internet, while 23 percent used mobile data. The commonly used Internet providers were Opennet (29 percent), Metfone (26 percent) and Smart (20 percent). When asked about the quality of their internet connection, 46 percent reported that it is sometimes slow. A majority (69 percent) also said electricity is occasionally unavailable. These unstable internet connections and power supply could affect students' online class sessions and activities.

Students' Perceptions of the Use of Kahoot in their Management Classes

The respondents were asked whether they like to review their lessons with Kahoot.

The result shown in Appendix B indicates that 97 percent of Cohort 1 responded in the affirmative. Those who responded negatively indicated that their Internet could be faster and the electricity in their area is occasionally unavailable. From Cohort 2, about 99 percent like Kahoot, except for one student who said she is using mobile data and her Internet is unstable, and most of the time, electricity is not available in her place.

The overall results show that 98 percent of the respondents like to review their lessons by playing Kahoot. These results conform with the report (UP Voice, 2020) that students generally enjoyed Kahoot, especially during online sessions.

The Perceived Advantages and Disadvantages of Playing Kahoot

The responses to the perception questionnaire, particularly on question 4 on the advantages of playing Kahoot in class, were summarized below:

Table 2: Advantages of playing Kahoot

Advantages of playing Kahoot	Mean (\bar{x}) per item (Online class) n=151	Std. Deviation	Mean (\bar{x}) score per item (Hybrid class) n=192	Std. Deviation
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1. I like the Kahoot game	4.32	.830	4.05	1.056
2. It's fun	4.22	.860	4.02	1.078
3. It will motivate me to engage in class	4.39	.806	4.08	1.065
4. It can increase my class attendance	4.42	.869	4.15	1.073
5. It improves my rapid thinking ability	4.30	.799	4.01	1.036
6. It is good for reviewing difficult topics	4.24	.937	4.02	1.081
7. Lessons can be remembered easily	4.09	.898	3.95	1.098
8. It can reduce monotony and boredom	4.20	.844	3.92	1.078
9. It increases my speed in answering questions	4.20	.853	3.80	1.060
10. If there is a scheduled Kahoot play, I will try my best to attend class so I will not miss it	4.27	.922	4.02	1.109
11. The teacher can control the pace of the game (Can wait if we are disconnected)	4.53	.778	4.20	1.035
12. My Kahoot score can be generated from the system	4.22	.782	3.95	1.128
Composite mean	.28 Very satisfied		4.01 Satisfied	

The data indicate that overall, Cohort 1 was very satisfied (\bar{x} = 4.28) while Cohort 2 was satisfied (\bar{x} = 4.01). Both groups showed higher satisfaction in the three items. One, Kahoot increases class attendance; two, the teacher can control the game's pace (can wait if they are disconnected); and three, it motivates them to engage in class. These results agree with Wang's (2020) findings that when used often in class, Kahoot increases attendance, participation, engagement, and motivation. Also, with the study of Martinez-Jimenez, et al. (2021), Kahoot is proven to be a powerful tool that improves students' attendance and participation and that of Rahman et al. (2018) that Kahoot enhances students' engagement in the classroom.

Table 3 presents the results of the perceived disadvantages of playing Kahoot in class.

The overall result shows that Cohort 1 has a higher composite mean score ($\bar{x} = 3.19$) than Cohort 2 ($\bar{x} = 2.76$). However, both scores indicate a neutral perception. The disadvantages highlighted by both cohorts are problems with internet connection and slow Internet. These relate to the findings of Kaur (2021) that Kahoot only works if there is a strong WiFi connection.

Table 3: Disadvantages of playing Kahoot

Advantages of playing Kahoot	Mean (\bar{x}) per item (Online class) n=151	Std. Deviation	Mean (\bar{x}) score per item (Hybrid class) n=192	Std. Deviation
Problem with internet connection	3.87	.960	3.16	1.135
I often get disconnected when I play Kahoot	3.20	1.031	2.66	1.201
I don't like the background audio of Kahoot	2.60	1.145	2.37	1.266
My Internet is slow	3.31	.964	2.87	1.110
Easy for the student to copy	2.98	1.196	2.73	1.124
Composite mean	3.19		2.76	
	Neutral		Neutral	

The Difference in Perceptions of the Two Cohorts on the Advantages and Disadvantages of Playing Kahoot in Class

A Mann-Whitney U test shows a Z score of -3.992 and a 2-tailed p-value of .000, indicating a significant difference between the perceptions of the two cohorts on the advantages of Kahoot. Hence, null hypothesis 1 (Ho1) was rejected.

However, on the perceived disadvantages of Kahoot, a Mann-Whitney U test shows a Z score of -1.567 and a 2-tailed p-value of .117, indicating no significant difference between the perceived disadvantages of using Kahoot in class. Therefore, null hypothesis 1 (Ho1) was accepted in this aspect.

Relationship Between the Students' Kahoot Scores and Other Exam Scores

Means and correlation scores of test variables

The mean scores of Aptis, Kahoot, Quizzes, Mid-term exam, Final exam and ACCA CBE exam are shown in Table 4. The data show that students in Cohort 1 have a higher mean scores in Aptis ($\bar{x} = 64.05$), Kahoot ($\bar{x} =$

78.40), Quizzes ($\bar{x} = 82.41$) and mid-term exams ($\bar{x} = 76.21$), while those in Cohort 2 have high mean scores in the final exam ($\bar{x} = 91.80$) and CBE ($\bar{x} = 51.19$). The higher CBE mean scores of students in cohort 2 of $\bar{x} = 51.19$ can be associated with their higher pass rate of 58 percent compared to students in Cohort 1 with a lower CBE mean score of $\bar{x} = 50.68$ and with a pass rate of 54 percent based on the school records.

Table 4: Mean scores of test variables

Variables	Online class July-December 2021			Hybrid class January-June 2022		
	n	Mean	Std. Deviation	n	Mean	Std. Deviation
Aptis	237	64.05	14.15	292	54.15	15.92
Kahoot	237	78.40	20.82	292	64.87	25.14
Quiz	237	82.41	13.45	292	78.75	21.49
Mid-term Exam	237	76.21	17.12	292	51.96	16.57
Final Exam	234	61.69	18.48	286	91.80	10.92
ACCA CBE	156	50.68	13.75	118	51.19	13.68

The Pearson-Product Moment Correlation (r) determined whether the Kahoot scores are significantly related to quizzes, mid-term, final, and CBE exam scores. The correlation scores between test variables are shown in Table 5. These results are discussed sequentially in the subsequent sections.

Table 5: Correlation scores

Test Variables	Cohort 1 (Online class)				Cohort 2 (Hybrid class)			
	n	R	R ²	p-value	n	R	R ²	p-value
Aptis vs Kahoot	237	.216	0.05	p=.001	292	.302	0.09	p=.000
Kahoot vs Pop Quiz	237	.598	0.36	p=.000	292	.719	0.52	p=.000
Kahoot vs Mid-term Exam	237	.264	0.07	p=000	292	.480	0.23	p=.000
Kahoot vs Final Exam	234	.101	0.01	p=.124	286	.391	0.15	p=.000
Kahoot vs CBE score	156	.193	0.04	p=.016	118	.440	0.19	p=.000
Aptis vs CBE score	156	.497	0.25	p=.000	118	.472	0.22	p=.000

Relationship Between the Students' English Proficiency (Aptis) and Kahoot Scores

The two cohorts have different Aptis (English proficiency) mean scores. Students in Cohort 1 have a higher Aptis average of 64.05 percent, while those in Cohort 2 have an average of 54.15 percent. A Pearson correlation coefficient was computed to assess the linear relationship between Aptis scores and Kahoot

scores. For Cohort 1, there was a weak positive correlation between the two variables, $r(235) = .22$, $p = .001$ (Figure 2). Since r was only $.22$, the coefficient of determination, r^2 , is only 0.05 or 5 percent which denotes that the linear relationship contributes only about 5% to the variation of the Kahoot scores. For Cohort 2, there was a moderate positive correlation between the two variables, $r(290) = .30$, $p = .000$ (Figure 3). The r^2 of $.09$ or 9 percent shows that the Aptis scores accounted for 9 percent of the variability in Kahoot scores. Therefore, the second null hypothesis (H_02) that no statistical relationship exists between the Aptis and Kahoot scores was rejected.

Figure 2: Aptis vs Kahoot scores of Cohort 1

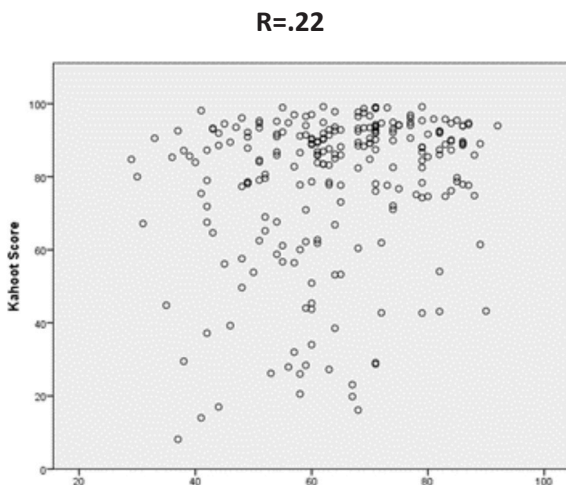
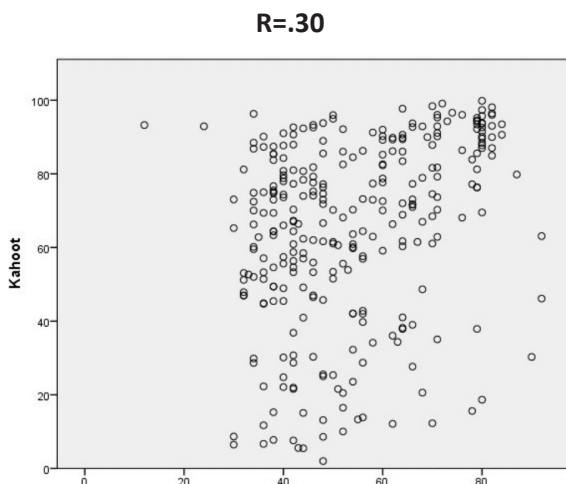


Figure 3: Aptis vs Kahoot scores of Cohort 2



Relationship Between the Kahoot Scores and the Pop Quiz Scores

The computed value $r(235) = .598$ denotes a strong positive correlation with p -value = $.00$ (Figure 4). It means that the Kahoot and quiz scores of Cohort 1 showed a significant linear relationship with a p -value = $.000$. Since r was $.598$, the coefficient of

determination, r^2 , is $.36$ or 36 percent, which shows that the linear relationship contributes about 36 percent to the variation of the quiz scores. For Cohort 2, the computed value $r(290) = .719$ indicates a strong positive correlation between the two variables (Figure 5). The coefficient of determination, r^2 , is $.52$, which shows that the linear relationship contributes about 52 percent to the variation of the quiz scores. Therefore, the third hypothesis (H_03) that there is no significant relationship between the Kahoot scores and the pop quiz scores of the students was rejected.

Figure 4: Kahoot vs Pop Quiz scores of Cohort 1

R=.598

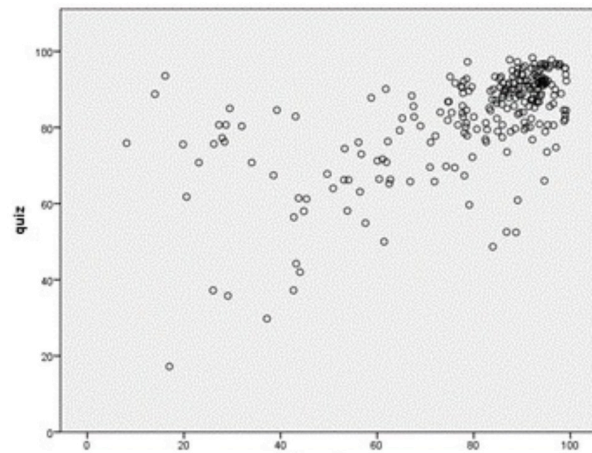
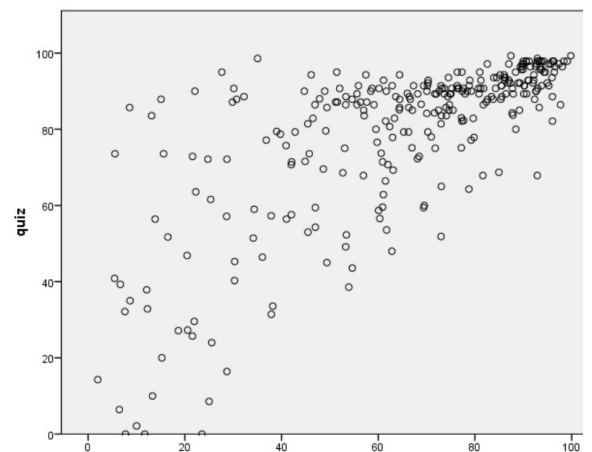


Figure 5: Kahoot vs Pop Quiz scores of Cohort 2

R=.719



Relationship Between the Kahoot Scores and the Mid-term Exam Scores

There was a weak positive relationship between Kahoot and mid-term exam scores. For cohort 1, the computed value $r(235) = .264$, $p = .000$ indicates an r^2 of $.07$, showing that Kahoot contributes only 7 percent to the variation of mid-term scores. For cohort 2,

the computed $r(290) = .480$, $p = .000$, indicating a moderate positive relationship between the two variables. The r^2 of .23 explains that Kahoot scores accounted for 23 percent of the variability of mid-term scores. Hence, the fourth null hypothesis (Ho4) that there is no relationship between Kahoot and mid-term exam scores was also rejected. Figures 6 and 7 show the scatter plots that portray the relationship between Kahoot and mid-term exam scores.

Figure 6: Kahoot vs Mid-term exam scores of Cohort 1

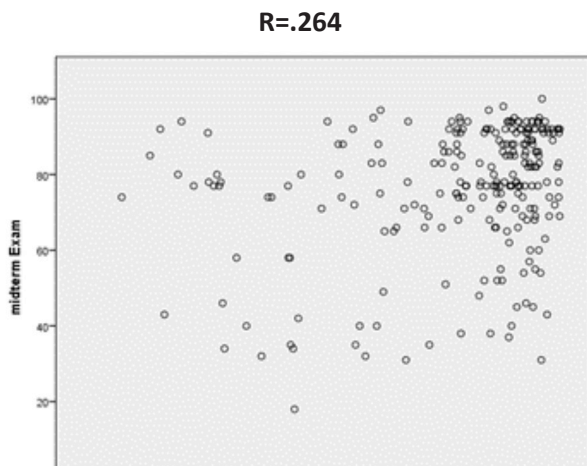
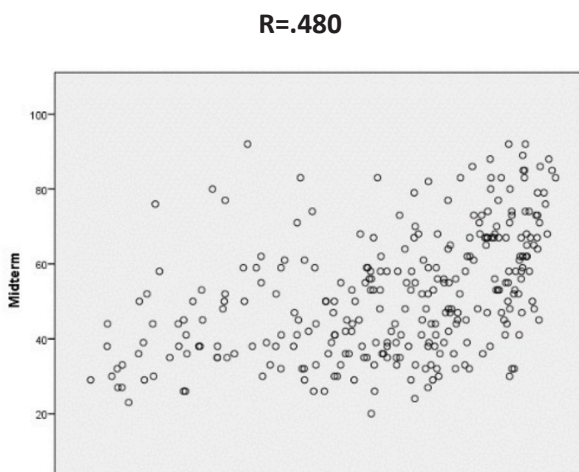


Figure 7: Kahoot vs Mid-term exam scores of Cohort 2



Relationship Between Kahoot Scores and Final Exam Scores

There was no relationship between Kahoot and final exam scores in Cohort 1 with a computed $r(232) = .101$, $p = .124$ (Figure 8), indicating an r^2 of .01. For Cohort 2, the calculated $r(284) = .391$, $p = .000$, suggests a moderate positive relationship between the two variables (Figure 9). The r^2 of .15 implies that Kahoot scores contribute 15 percent to the variation of final

exam scores. Therefore, the null hypothesis 5 (Ho5) that no relationship exists between Kahoot and final exam scores was accepted for cohort 1 but rejected for Cohort 2.

Figure 8: Kahoot vs Final exam scores of Cohort 1

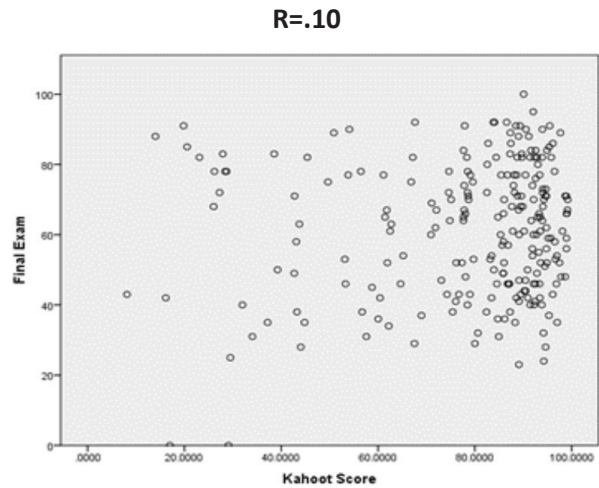
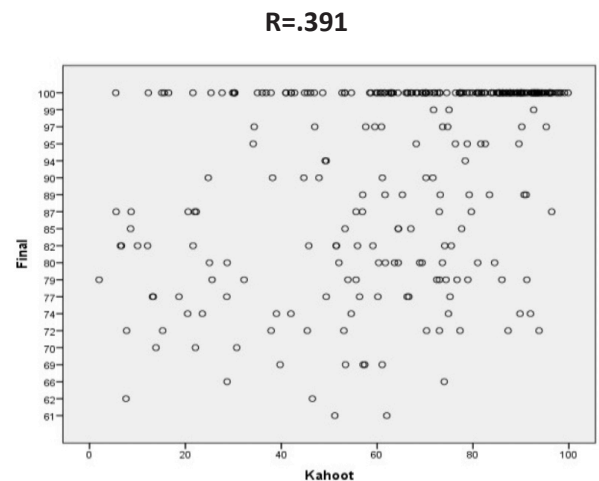


Figure 9: Kahoot vs Final exam scores of Cohort 2



Relationship Between Kahoot Scores and ACCA CBE Scores

The Kahoot scores of students who took the ACCA CBE qualifying exam were separately analyzed. Results show that for Cohort 1, there was a negligible relationship between Kahoot and ACCA CBE scores, as shown in the computed $r(154) = .193$, $p = .016$ (Figure 10). The r^2 of .04 indicates Kahoot contributes only 4 percent in the difference of CBE scores. For Cohort 2, the computed $r(116) = .440$, $p = .000$ (Figure 11) denotes a strong positive relationship between the two scores. The r^2 of .19 hints Kahoot contributes 19 percent to the variation of CBE scores. Therefore, the null hypothesis 6 (Ho6) that there was no relationship between Kahoot and CBE scores was rejected for both groups.

Figure 10: Kahoot vs CBE scores of cohort 1

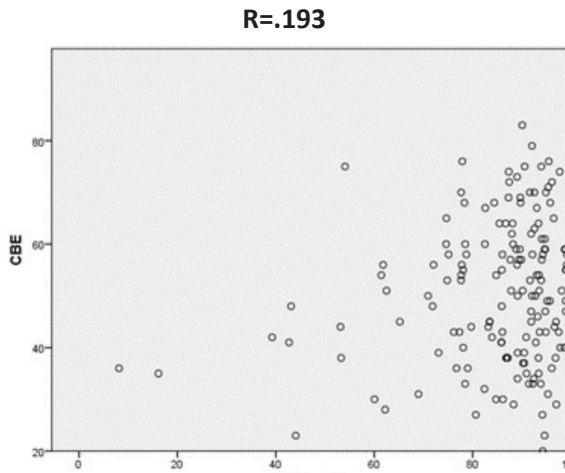


Figure 12: Aptis vs CBE scores of Cohort 1

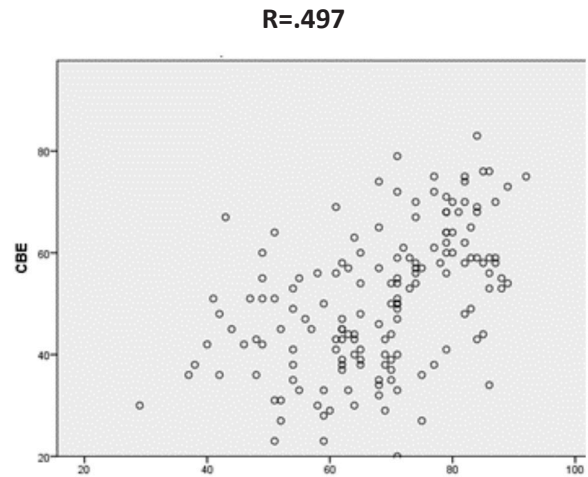


Figure 11: Kahoot vs CBE scores of cohort 2

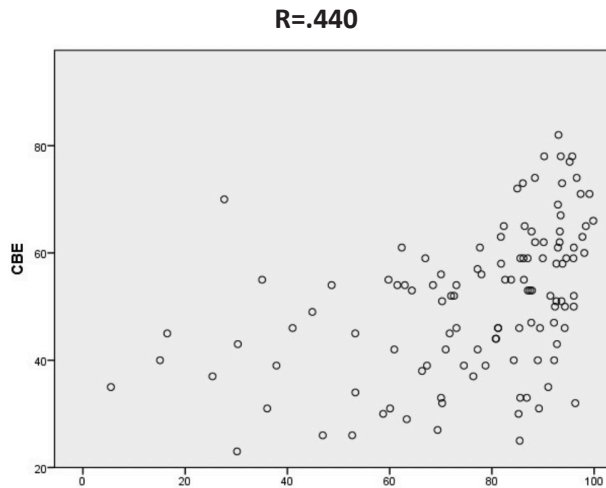
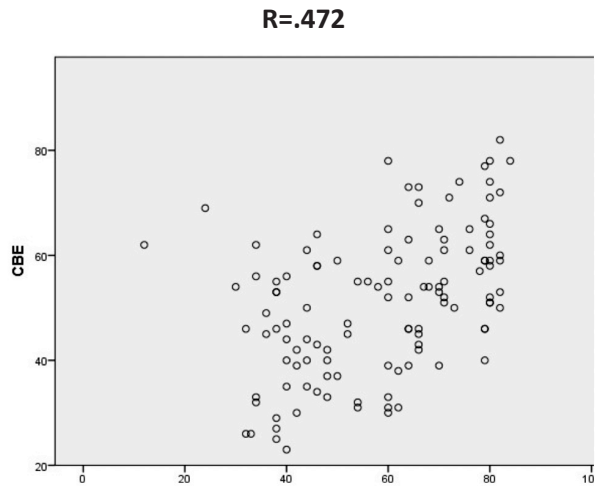


Figure 13: Aptis vs CBE scores of Cohort 2



Relationship between Aptis and ACCA CBE scores

The Aptis or English proficiency scores of those students who took the ACCA qualifying exam were also analyzed. The two cohorts' English proficiency and ACCA computer-based exam scores showed a strong positive relationship as shown by the computed $r(154)=.497, p=.000$ for Cohort 1, and the $r(116)=.472, p=.000$ for Cohort 2 (Figures 12 and 13). The coefficients of determination, r^2 of .25 for cohort 1 and r^2 of .22 for cohort 2, suggest that the linear relationship contributes about 25 percent and 22 percent, respectively, to the variation of CBE scores of both cohorts. The null hypothesis 7 (H_07) that there is no relationship between Aptis and CBE scores was rejected. There was a strong positive relationship between Aptis and CBE scores. The English proficiency of takers matters in passing the CBE. The CBE is an international exam remotely administered by ACCA.

Table 6 summarizes the contribution of Kahoot in the variation of the quiz, mid-term, and final exam scores considering the timeline the respondents took these exams. Figure 14 depicts the trend of the variability of these exam scores.

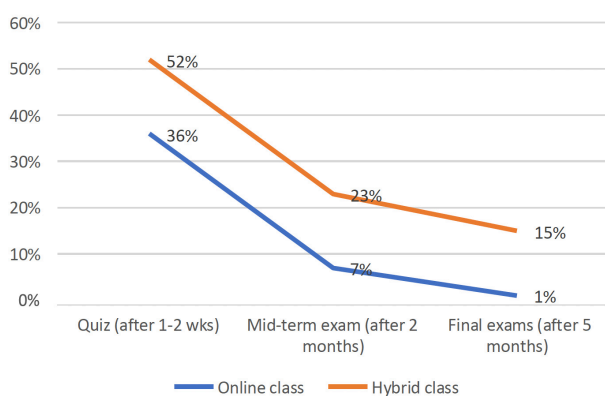
Table 6: Contribution of Kahoot scores in the variation of the quiz, mid-term, and final exam scores based on coefficients of determination (r^2)

Cohort	Contribution of Kahoot scores in the variation of the quiz, mid-term, and final exam scores overtime based on coefficients of determination (r^2)					
	Kahoot vs Quiz (Given within 1-2 weeks)		Kahoot vs Mid-term exam (Given after 2 months)		Kahoot vs Final exam (Given after 5 months)	
1. (Fully online) (JD21 class)	R=.598	R2=.357 (36%)	R=.264	R2=.069 (7%)	R=.101	R2=.010 (1%)
2. (Hybrid) (JJ22 class)	R=.719	R2=.516 (52%)	R=.480	R2=.230 (23%)	R=.391	R2=.152 (15%)

The data in Table 6 and Figure 14 convey that for Cohort 1, Kahoot scores accounted for 36 percent of the variability in quiz scores, 7 percent in mid-term exam scores, and 1 percent in final exam scores. For Cohort 2, Kahoot scores accounted for 52 percent of the variability in quiz scores, 23 percent in mid-term exam scores, and 15 percent in final exam scores.

The data at hand may not explain the consistently lower variation of scores of students in Cohort 1. Nevertheless, it can be assumed that the differences in the performance between the cohorts may be due to differences in the difficulty of the exams they have taken. It is also worth mentioning that the students in Cohort 1 studied entirely online from home due to the pandemic and lockdown, where personal interaction with their lecturer and classmates and group study was not possible, which may have affected their learning and performance.

Figure 14: Kahoot and variability in the quiz, mid-term, and final exam scores



From these results, it can be deduced that Kahoot reviews effectively improved the scores of exams given immediately or within the short span after the review. However, the effectiveness wanes down after the lapse of time. Hence, Kahoot reviews may not support long-term retention of the lessons. However, there are other factors to consider, like the mid-term and final exams are longer and more complex than the written quizzes. These results conform to the Lopez and Cabot study (2022), which revealed that Kahoot's positive effects on academic performance during lectures were "strongly diluted when high-demanding exams were taken." The result, however, contradicts the findings of Elkhamisy and Wassef (2021) that Kahoot enhances Pathology understanding and retaining knowledge.

CONCLUSION AND RECOMMENDATIONS

This section summarizes the findings and directions for future research. The study aimed to evaluate whether game-based reviews will enhance the students' motivation, participation, and class performance and whether students' Kahoot scores are predictive of their other examination scores.

The following conclusions were drawn from the findings of the study. A majority (98 percent) of the students like playing Kahoot in class. It increases class attendance and motivates students to engage in class. However, there was a significant difference between the cohorts' perceptions of the advantages of playing Kahoot, with Cohort 1 being very satisfied while Cohort 2 was satisfied. However, there was no significant difference between the perceived disadvantages of using Kahoot in class.

A *weak positive correlation* was between Aptis and Kahoot scores for Cohort 1 and a *moderate positive correlation* for Cohort 2. Aptis contributes only about 5 percent and 9 percent, respectively, to the variation of the Kahoot scores of the two cohorts. Regarding Kahoot and quiz scores, there was a *strong positive correlation* between these variables for Cohort 1 and a *very strong positive correlation* for Cohort 2. Kahoot contributes 36 percent to the variation of quiz scores for Cohort 1 and 52 percent for Cohort 2.

There was a weak positive relationship between Kahoot and mid-term exam scores for Cohort 1 and a moderate positive relationship for Cohort 2. For Cohort 1, Kahoot contributes only 7 percent to the variability of mid-term scores, and 23 percent for Cohort 2. There was no relationship between Kahoot and students' final exam scores in Cohort 1, but a moderate positive relationship between the two variables for Cohort 2. Kahoot scores accounted for 15 percent of the variability in the student's final exam scores in cohort 2.

Among takers of the ACCA qualifying exam, there was a *negligible relationship* between Kahoot and ACCA CBE scores for Cohort 1 and a *strong positive association* for Cohort 2. For example, Kahoot contributes only 4 percent in the difference of CBE scores of Cohort 1 and 19 percent for Cohort 2. However, the two cohorts' Aptis or English proficiency and CBE scores strongly correlate. For example, Aptis contributes 25 percent and 22 percent to the variation of CBE scores of Cohorts 1 and 2, respectively. This result imparts that students' English proficiency is a factor in passing international qualifying exams.

The overall findings suggest that Kahoot reviews were effective in improving the scores of exams given within the short time after the Kahoot review. However, the effectiveness wanes after the lapse of time, especially when more complex questions are given. Generally, class reviews using Kahoot may not support long-term retention of the lessons.

For future research directions, having multiple cohort studies with control and intervention groups is recommended for better comparison of the effectiveness of Kahoot, as the present study only covers two intervention groups and no control groups. Also, assessing whether comprehensive Kahoot reviews given immediately before the mid-term and final exams will improve the student's scores is suggested. In addition, another scope for further research could be a longitudinal study to assess knowledge retention offered by Kahoot reviews and other contributing factors that will enhance class performance and pass rates in international qualifying exams.

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