The Effects of Review Games Using Kahoot!

on Students' Quiz Scores

by

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Abstract

This action research study examined the effects of review games using Kahoot! on students' quiz scores as well as student engagement. The study was conducted in a high school geometry classroom at Tiyan High School (THS) in Barrigada, Guam. This study consisted of a sample size of 42 students in the 10th through the 12th grade. The data collected during the six-week period of the study included students' quiz scores and number of off-task students for both the experimental group and the control group. Overall averages of the quiz scores and number of off-task students from the class that participated in review games using Kahoot! were compared to the class that received a teacher-led review. Results show that the use of Kahoot! during review games produced higher overall quiz averages and more observable student engagement when compared to the outcomes of a traditional teacher-led review. With these results and some limitations, recommendations for future similar studies were made.

Keywords: review, games, review games, Kahoot!, competition, game-based learning

Introduction

A teacher is likely to see the positive effects of student engagement reflected in their academic performance. This action research study was designed to increase student engagement in a high school geometry class by playing review games using Kahoot! before taking a quiz. The experimental group was a geometry class participating in review games using Kahoot! and the control group was a class with similar student diversity and learning ability that receives a traditional teacher-led review. The effects of increasing student engagement through the use of Kahoot! on students' quiz scores were calculated by comparing the assessment results of the experimental group with those of the control group.

Background

This study took place in a geometry classroom at Tiyan High School on Guam. The research involved a total of 42 students from two morning classes with 21 students in each class. There was a total of 20 girls and 22 boys. The experimental group was made up of 12 girls and 9 boys, while the control group was made up of 8 girls and 13 boys. All students were between 15-18 years old and 10th, 11th, and 12th graders.

Problem

It is very crucial for the educator to know strategies that would help students recall previously learned concepts to prepare them to demonstrate knowledge through given assessments. These strategies, however, should ensure that there is sufficient student engagement in the process of reviewing to achieve expected quiz scores. Since the presence of low student engagement often contributed to students' inability to achieve a grade of B or better on their quiz scores, the teacher needs to implement highly engaging activities such as review games. With this, they become a part of the learning experience. This study would determine

whether playing review games using Kahoot! is more effective than a traditional teacher-led review in helping students achieve desirable quiz scores.

While disruptive behaviors in the classroom were not a significant problem in either of the geometry classes, it was also evident that, at times, student interest began to wane, and attention became difficult to maintain. The instruction was designed in incremental steps, gradually increasing in difficulty to give students time and practice in order to succeed in understanding course content. However, once student engagement diminishes, it becomes difficult for them to get the full benefits of instruction and score well on quizzes and tests. Therefore, Kahoot! will be used for the review games to keep the students engaged throughout the activity.

Purpose

Since student outcomes on assessments in a high school geometry class were not as high as they should be, this study was designed to look at possible improvement by infusing technology into the classroom activities to increase student engagement. More specifically, technology was used when the students participated in review sessions for their quizzes. The purpose of this study was to determine whether or not the use of Kahoot! for review games before administering quizzes would result in higher scores when compared to the outcomes of students who received a teacher-led review. This study was guided by the following research questions:

1. Will the use of Kahoot! as a tool for review games in a high school geometry class improve students' quiz scores more than the usual teacher-led review?

2. Does the use of Kahoot! as a tool for review games result in more observable student engagement when compared to student engagement from a teacher-led review?

Review of Literature

This study was conducted to see how playing review games using Kahoot! affects the students' quiz scores in a high school geometry class. The benefits of practice and review before quizzes and tests have been extensively studied over the years. However, with this age of technology, it is important to know whether technological applications can benefit student learning in a normal classroom setting. Although some research has studied the potential benefits of integrating Kahoot! in the classroom, researchers do not always agree on their conclusions.

Student Engagement

Desirable academic performance is usually tied to students who are highly engaged in their classroom lessons. Student engagement in the classroom is seen as one of the best predictors of one's learning and personal development. Students are evidently engaged when they are captivated in the lessons and participating in the designed classroom exercises (A. Abubakar, Y. Abubakar, & Itse, 2017). A study by Corso, Bundick, Quaglia, and Haywood supports this by stating that there is a great amount of research that links student engagement to desirable academic and life outcomes. Students who are likely to excel academically and score higher on standardized examinations are those who are highly engaged in their schoolwork (2013).

Abubakar A. et al. describe three dimensions of student engagement: behavioral, cognitive, and emotional engagement. Behavioral engagement relates to the students' attitude towards attending class, attentiveness during class activities, and effort exerted in class. Cognitive engagement involves indicators that are more internal such as self-regulation and self-sufficiency. This relates to the students seeking to learn and achieve academic goals. Emotional

engagement includes the students' emotions and degree of interest or boredom in the classroom activities (2017).

Promoting Student Engagement

Corso et al. state that recognizing both the students' internal and external views on student engagement is the best way to define and understand it. They explain that engagement is comprised of three modes. These three modes include being engaged in action, thought, and feeling. All of these three modes are consistent with behavioral, cognitive, and emotional engagement as defined by other researchers (2013).

Lekwa, Reddy, and Shernoff add that student engagement occurs when students can focus on the lessons and actively participate in the classroom. The authors suggest that student learning and achievement substantially depend on how the teacher delivers instruction, as well as the level of student involvement and attention during the activities. However, it is important to note that academic achievement is still dependent on the critical content covered by the teacher (2019). To promote and ensure student engagement, the teacher should focus on how the students interact with their environment (Corso et. al, 2013). Also, teachers should incorporate effective instructional strategies that guarantee active participation and undivided attention from students to promote academic achievement (Lenny, Reddy, & Shernoff, 2019). Gebbels (2018) mentions that existing research found that the use of digital technologies, which support student engagement and promote active participation enriches student learning experience in the classroom. She also suggests that having students participate in a student response system (SRS) online supports the productive use of technology. Gebbels states that the three aspects of learning include listening, seeing, and experiencing. All of these aspects are met through the use of digital

technologies for instruction in the classroom (2018). These researchers suggest that promoting student engagement has numerous benefits.

Positive Effects of Student Engagement

Engagement in the classroom lessons contributes to students' demonstration of desirable behaviors. Corso et al. explain that student engagement helps in increasing student participation, which often leads to obtaining higher grades. They highlight that students who are engaged generally perform well in their academics (2013). Students taking interest in the learning task and academic accomplishment habitually yield personal satisfaction. It is also with these conditions in the classroom that ideal and effective instruction occurs (Abubakar A. et al., 2017). Corso et al. agree by stating that students who are engaged are more likely to experience individual well-being by feeling satisfied with their lives and having more self-esteem. Additionally, these students are less likely to get involved in risky sexual behaviors and crime (2013).

Lekwa et. al add that desirable behaviors that result from student engagement include responding to the teacher's cues and questions, as well as assisting their peers. The presence of these behaviors in the classroom produces meaningful student learning (2019). Moreover, the students who are likely to attend and graduate from post-secondary institutions are those who are more engaged in school. Some researchers propose that student engagement has contributed to decreasing achievement gaps (Corso et. al, 2013).

Game-based Learning

Game-based learning, which is also known as educational gamification is the use of games in the classroom to promote student-driven exploration. This refers to the type of instruction that deals with realistic game experiences (White & McCoy, 2019). McColgan,

Colesante, and Andrade (2018) mention that game-based learning is used interchangeably with the term "serious games". The authors propose that game-based learning or serious games should include both pedagogical and entertainment value. Games that have been developed to be educational instruments are considered serious games. Other games that were initially created for entertainment but were later remodeled for educational purposes are also considered serious games. Ahmad, Malik, Siddiqui, and Khan add that one specific type of game-based learning that continues to advance in the field of education is digital game-based learning (DGBL). The authors suggest that digital game-based learning is generally defined as the use of technological devices such as cellphones, tablets, and computers in a learning activity to promote experiential engagement (2018).

Using technological gamification in the classroom to deliver academic content is a promising avenue. This is very crucial as there are newer educational standards that emphasize the need for teachers to support student learning with technologies. Thus, many teacher preparation programs across the nation are preparing new educator candidates to create student-centered strategies with technology (McColgan et al., 2018). Ahmad et al. continue their recommendation that digital-game based learning provides means for students to act as players, fully engage with the course material, and learn through meaningful interaction as opposed to traditional schooling, textbooks, and other written assignments (2018).

Benefits of Game-based Learning

There are existing studies that have proven and explained the benefits of digital game-based learning including increased motivation, involvement, and enhanced student academic performance (Gebbels, 2018). A study by White and McCoy (2019) agrees and states that game-based learning or serious games are persistently used in the classrooms as they have helped

encourage student participation and motivation. McColgan et al. (2018) say that students have

expressed the positive effects of participating in a game-based learning activity with the use of

technology. According to the authors, digital game-based learning helped their students acquire

content knowledge and skills with ease. Additionally, students mention that they view

themselves more immersed in the content and interactive after participating in such games.

These findings are supported by the research that White and McCoy (2019) conducted.

They report that the principle of social interaction is what guides serious games. Using the

method of competitive exploration, digital game-based learning offers students many

opportunities to discover concepts. Ahmad et al. explain that play is a crucial element in the

development of children and digital technology has played a key part in exploring this element.

The authors also highlight digital game-based learning's potential to impart deeper learning

(2019). Gebbels adds that her students exhibited a growth mindset after teaching math in the

form of a game. This growth mindset from the students is supported by their improved academic

performance (2018).

Although studies from these researchers explain the different benefits of integrating

digital game-based learning in the classroom and mention no negative effects, Gebbels warns

that technology alone, will not make activities better as it is still crucial for the teacher to know

the students' profiles and understand the learning objectives (2018).

Competition environment in the classroom

A competition involves two or more people in an activity such as a game, wherein there

would be a winning individual or group in the end. Students have been exposed to competition

since they were at a young age. In a study by Mazza (2018), he incorporates competition in a

review activity for two of his classes to determine the effects of competitive environment on

student success in the classroom. Competition could serve as a motivation for students to succeed or a hindrance to students exerting insufficient effort. In conclusion, he says that competition as an intervention for a review resulted in higher quiz averages (2018).

Aside from integrating competition in a review activity, it could also be adapted when conducting actual assessments. Cutri, Marim, Cordeiro, Gil, and Guerald suggest that using a digital game-based learning tool such as Kahoot! brings natural competition in the classroom, which creates a fun and friendly environment for the students (2016).

Kahoot! in the Classroom

One of the latest and most popular digital game-based learning tools that educators and students enjoy using is Kahoot! (Sabandar, Supit, & Suryana, 2018). Kahoot! is a game-based student-response system that focuses on engaging the students in the classroom. It is an educational software that offers teachers the ability to create questionnaires, quizzes, discussions, and exams (Tóth, Lógó P., & Lógó E., 2019). Prieto, Palma, Tobías, and León state that the use of digital game-based learning tools such as Kahoot! improves participation, because it keeps students involved by using technologies that they are already familiar with. They add that when something relevant to young students is integrated into their activities, meaningful learning happens (2019). Cutri et al. claim that students are more engaged and motivated when using Kahoot! since it can be accessed through new technological resources such as their cellphones (2016).

Tóth et al. explain that students enjoy and find activities that use digital game-based student-response systems more engaging than the traditional pen-and-paper forms. They also mention that they used Kahoot! to create and administer quizzes in their classes (2019). Cutri et al. (2016) state that they used Kahoot! to give a quiz at the beginning of class to reinforce

concepts and skills that they have already gone over during their previous class meetings. Prieto et al. add that Kahoot! has templates that allow teachers to add images and videos to enhance their presentations. The authors stress that the use of Kahoot! as a formative assessment allows the teacher to identify specific concepts that students may have difficulties with. Therefore, teachers are able to take appropriate actions in addressing the problems in the learning process (2019). The fact that there are only a limited number of studies that examined the effects of using Kahoot! as a review tool makes this study especially significant. Rather than conducting actual assessments with Kahoot!, this research will explore the possible benefits of using Kahoot! as a review tool to help students achieve higher grades on their assessments, particularly on quizzes.

Methodology

This study aims to increase student engagement by having students participate in a review game using Kahoot! before taking their quizzes. The research was designed to explain the effects of playing review games using Kahoot! on students' quiz scores in a high school geometry class at Tiyan High School.

Participants

The participants in this study were from two geometry classes (Class A and Class B) with a total of 42 students. The students were made up of 10th, 11th, and 12th graders and from ages 15-18 years old. There was a total of 20 girls and 22 boys. Class A had 12 girls and 9 boys, while Class B had 8 girls and 13 boys. Both classes had approximately the same distribution of difficult learners, advanced learners, and English as a Second Language (ESL) students. None of the classes had any student receiving special education services. Therefore, both classes were generally very similar in terms of academic achievement and quiz outcomes.

All of the students had Kahoot! experiences from their previous classes. Therefore, all participants were familiar with using interactive technology as an educational tool.

Materials

To reduce the variability in the outcomes, the same set of review questions were provided to both the experimental and control groups. The teacher used the iPad and projector to deliver the same lecture notes to both classes. In addition, the same set of checkpoint and textbook problems were assigned to the students during the pre-intervention period. At the start of the review sessions, students were provided scientific calculators, white/filler papers, and pencils that they used to work out the solutions to each problem. Students from the experimental group used their cellphones for the review game. The students either connected to the internet via school Wi-Fi or their data from their cellphone carrier. The game PIN that allowed the students to join the review game on Kahoot.it was projected on the board.

At the end of the review sessions, the teacher administered the quizzes with the same set of questions to both classes. All the participants were allowed to use scientific calculators.

Procedure

The teacher ensured that the lesson plan used for both classes had the same content. The only variation was the delivery of the review. The control group was made up of students from Class A, while the experimental group was comprised of the students from Class B. Students from both Class A and Class B participated in a review and took their quizzes every fifth class meeting. Class A received copies of the review problems, as well as scientific calculators and white paper. The review for this group was teacher-led. Therefore, the students were instructed to pay close attention and take notes. The teacher went over each of the problems and their solutions with the class. The students were given the chance to ask questions after each problem

was discussed and solved. The quizzes were given to the students after each teacher-led review was finished.

Class B was given scientific calculators and white paper, wherein they were able to write their own work and solution during the game. To start the review game, students were instructed to log into kahoot.it to enter the game pin. The game pin to join the review game online was announced aloud, as well as projected for the students to see. Then, the teacher started to project the problems from the review game. When the time was up to answer each question, the distribution of students' responses was displayed with the correct answer being highlighted with a checkmark. The teacher then presented and explained the complete solution to the class. Moreover, the students had the chance to ask for further clarification on the questions before moving on to the next. The quizzes were administered after each review game using Kahoot! was played.

Data Collection and Analysis

The classes chosen for this study were similar in composition and achievement. That is, the distribution of difficult learners, advanced learners, and English as Second Language (ESL) students was about the same for both classes. Consequently, the quiz outcomes of both groups were generally very similar. The data obtained were the participants' scores from the three quizzes given. The scores will be in percentages. They were used to analyze the effects of playing a review game using Kahoot! on students' quiz scores.

The mean quiz scores from both the control and experimental groups were compared to determine the percentage point differences in the mean scores of each quiz, as well as which group obtained the higher overall average. The scores used for the data analysis were only from the participants who participated in all three review sessions and took all three quizzes.

Limitations

This research presents several limitations that could be possibly addressed by extending the study. The limitations of this research study include the small sample size of 42 students in a high school geometry class on Guam and the short amount of time that was possible for the implementation of the intervention. While there were occasional student absences from both the experimental and control groups during the intervention days for quiz preparation, overall, these absences were few enough that they did not significantly affect the class averages. However, the findings of this study may not apply to other populations.

Research Questions and Hypotheses

Research Question 1: Will the use of Kahoot! as a tool for review games in a high school geometry class improve students' quiz scores more than the usual teacher-led review?

Hypothesis 1: The use of Kahoot! as a tool for review games in a high school geometry class will improve students' quiz scores more than the usual teacher-led review.

Research Question 2: Does the use of Kahoot! as a tool for review games result in more observable student engagement when compared to student engagement from a teacher-led review?

Hypothesis 2: The use of Kahoot! as a tool for review games will result in more observable student engagement when compared to student engagement from a teacher-led review.

Results

Data obtained from the participants include all students' scores on the three quizzes given during the implementation phase of the study. The same quiz was always administered to both

the experimental group and the control group, and the mean scores in percentages were calculated for each. In addition, the differences in mean scores between the two groups (higher mean minus lower mean) were calculated for all quizzes.

Research Question 1 asks whether the use of Kahoot! as a tool for review before quizzes in a high school geometry class will improve students' quiz scores more than the usual teacher-led review. Table 1 summarizes the mean scores for all three quizzes that the participants from both the experimental and control groups achieved. Since the mean scores from the experimental group were higher, the percentage point differences for each of the quizzes shown in the table were obtained by subtracting the mean scores of the control group from those of the experimental group.

Table 1. *Summary of the Differences in Students' Quiz Averages (higher mean minus lower mean) in Percentage Points*

	Quiz 1 (Mean)	Quiz 2 (Mean)	Quiz 3 (Mean)
Experimental Group (*N=18*)	83.3%	81.1%	82.2%
Control Group (*N=16*)	78.8%	71.3%	70.0%
Percentage Point Difference (Exp - Con)	+4.5	+9.8	+12.2

Although the general ability of the students and typical quiz outcomes for the experimental and control groups were very similar before the intervention, when looking at Table 1, it is clear that the students from the experimental group who participated in the review game using Kahoot! prior to taking the quiz achieved higher overall average scores than those in the control group on every quiz administered.

The experimental group had a mean score of 83.3% for Quiz 1, while Quiz 2, and Quiz 3 produced mean scores of 81.1% and 82.2%, respectively. The control group averages for the three quizzes covering the same content were 78.8%, 71.3%, and 70.0%, respectively. This

shows that, on average, the experimental group achieved quiz results that were a full letter grade (B versus C) higher than the control group.

Quiz 1 yielded the highest mean score in both experimental and control groups, which indicates that the subject content covered by the last two quizzes was becoming increasingly difficult, as would be expected in a high school geometry class. It is important to note that, although the participants' mean quiz scores decreased as the content material became more challenging, the differences in the quiz outcomes between the experimental and control groups actually increased.

For Quiz 1, the percentage point difference between the mean scores of the experimental group and the control group was 4.3. The percentage point differences between the mean scores of Quiz 2 and Quiz 3 were 9.8 and 12.2, respectively. Quiz 3, which had a 12.2 percentage point difference between the experimental and control groups showed the greatest difference. The progressive differences between the experimental and control groups' averages have continued to increase over time.

With all other elements of instruction and assessment remaining the same for both groups, the most likely explanation for the increase in mean quiz scores and the continuous increase in the differences among these averages can be attributed to the use of Kahoot! with the experimental group. This gives a strong indication that the use of Kahoot! as a review tool can be very effective for improving quiz scores in high school geometry classes.

A part of the results worth noting is the mean scores of the ESL students from both groups. Table 2 summarizes the mean scores for Quiz 1, Quiz 2, and Quiz 3 for the ESL students.

Table 2. *Summary of the Differences in ESL Students' Quiz Averages (higher mean minus lower mean) in Percentage Points*

	Quiz 1 (Mean)	Quiz 2 (Mean)	Quiz 3 (Mean)
Experimental Group (*N=4*)	85.0%	75.0%	80.0%
Control Group (*N=3*)	80.0%	66.7%	66.7%
Percentage Point Difference (Exp - Con)	**+5.0**	**+8.3**	**+13.3**

The ESL students from the experimental group had a mean score of 85.0% for Quiz 1, while Quiz 2 and Quiz 3 produced mean scores of 75.0% and 80.0%. The control group averages for the three quizzes covering the same content were 80.0%, 66.7%, and 66.7%, respectively. Similar to their whole class averages, Quiz 1 yielded the highest average for the ESL students in both the experimental and control groups.

For Quiz 1, the percentage point difference between the mean scores of the experimental group and the control group was 5.0. The percentage point differences between the mean scores of Quiz 2 and Quiz 3 were 8.3 and 13.3, respectively. Quiz 3, which had a 13.3 percentage point difference between the experimental and control groups showed the greatest difference. Furthermore, the progressive differences between the experimental and control groups' averages for the ESL students also continued to increase over time.

Since the results of the ESL students resemble their respective group's results, the most likely explanation for the increase in the differences in averages over time can be linked to the participation of the ESL students from the experimental group in review games using Kahoot! before taking their quizzes.

The hypothesis for Research Question 1 stated that the use of Kahoot! as a tool for review games in a high school geometry class would help improve student scores on content quizzes. Overall, this study shows that the use of Kahoot! had a positive impact on the performance of

geometry students on their quizzes. Outcomes indicate that not only did the students' scores improve, but over time, they were increasingly better than the control group's mean scores. Therefore, the hypothesis for the first research question is shown to be correct.

Research question 2 asks whether the use of Kahoot! as a tool for review games before quizzes will result in more observable student engagement when compared to student engagement from a teacher-led review. Figure 1 shows the number of students who were off-task and needed to be redirected during the review sessions for both groups. The review sessions with the experimental group used Kahoot! while the sessions with the control group were teacher-led.
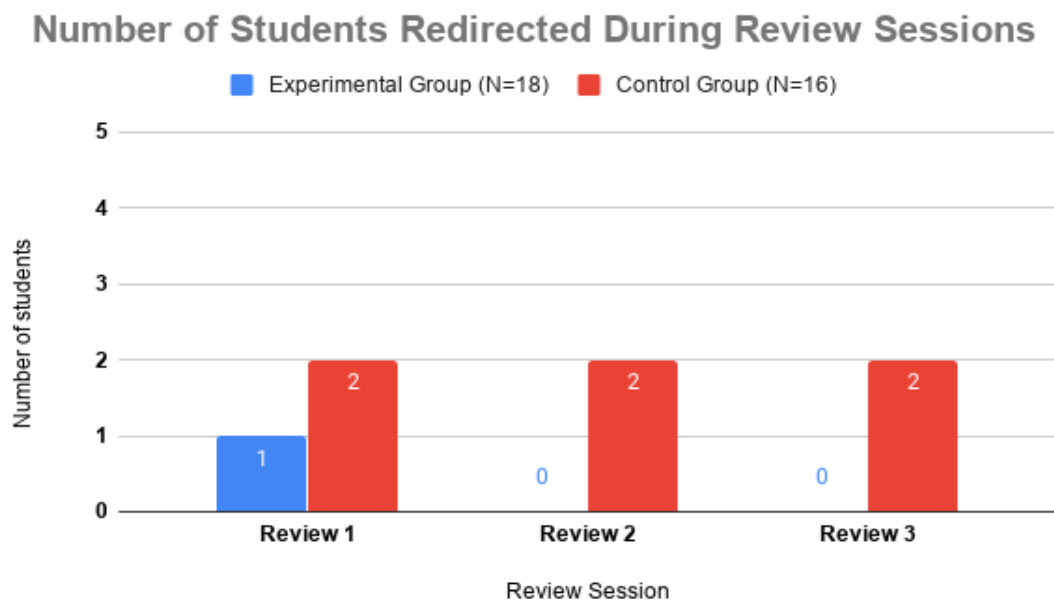

Figure 1. Number of Students Who Needed Redirection During the Review Sessions

During the first review session, there was one student from the experimental group and two students from the control group who needed to be redirected. No student was off-task from the experimental group during the second and third review sessions, while there were two students from the control group who were off-task for those sessions. The students who needed redirection received both verbal and non-verbal directives from the teacher. The verbal directives

used by the teacher involved asking the students what they think about the review problem at hand. This type of directive prompted the students to look at the problem and attempt to formulate the solution. The non-verbal directives included hand signals and gestures and standing next to the off-task student's desk. These instructions shifted the students' attention back to the current problem being worked on during the review session. Furthermore, the teacher only had to give these directives to the students once. That is, the student remained focused for the remainder of each review session.

It is important to highlight that the off-task behaviors that the students displayed were non-disruptive. All off-task students from the control group appeared to be daydreaming during the session and therefore requiring redirection. The off-task student from the experimental group during the first review session was working on a different task. More specifically, the student was troubleshooting the device's setting as the student deemed the internet connectivity was not ideal.

As illustrated in Figure 1, the number of students in the experimental group who were off-task and needed to be redirected diminished, whereas the number of off-task students in the control group remained the same for all three review sessions. In addition, the eagerness of students to participate in the review activity was notably greater when using Kahoot!. Encountering greater student enthusiasm and fewer off-task behaviors suggest that the students who participated in the review games using Kahoot! appeared more motivated and engaged, as they maintained the focus on the task at hand more than those who did not. The level of motivation and engagement demonstrated by participants in the experimental group can be attributed to the fact that the review session was gamified. The hypothesis for Research Question 2 stated that the use of Kahoot! in a review game will result in more observable student

engagement when compared to student engagement from a teacher-led review. Since the results showed that there were more engaged and on-task students in the experimental group when compared to the number of students in the control group, the hypothesis for Research Question 2 is supported.

Conclusion

This research study was conducted to examine the effects of using Kahoot! as a review game in a high school geometry classroom on students' quiz scores and student engagement. More specifically, the purpose of this study was to determine whether or not the use of Kahoot! for review games before administering quizzes would result in higher scores when compared to the outcomes of students who received a teacher-led review. Furthermore, this study was done to see if the same intervention would yield more observable student engagement when compared to student engagement from a teacher-led review. The findings presented in this research study suggest that using Kahoot! for review games in a high school geometry classroom resulted in overall higher quiz average and more observable student engagement when compared to the quiz average and engagement of students who were presented with a traditional teacher-led review.

The improvement of students' attitude towards learning and the boost in their motivation as a result of the gamification of the review session were consistent with existing research by White and McCoy (2019), which proved and explained the various benefits of game-based learning. The higher overall quiz averages of the class that participated in review sessions using Kahoot! proved that promoting individual active participation results in desirable academic performance (Corso et al., 2013). Additionally, the results of having more observable student engagement in a classroom that use Kahoot! as a tool for review sessions reflected the findings of a previous research study that highlighted a greater involvement of students in technological

activities than the traditional pen-and-paper forms (Tóth et al., 2019). The integration of Kahoot! in review activities has shown positive effects on the students' academic performance through increased motivation and engagement. Overall, the results of this research study agree with the current literature.

The use of Kahoot! during review games in a high school math classroom will be continuously applied as it proved to be helpful for many students in recalling the concepts learned from the previous classes. In addition, the students from the experimental group also showed enthusiasm towards the review game using Kahoot!. This was evident with the students' frequent inquiry on when the next Kahoot! review game will be played in class.

To improve this study, a few things would be done differently such as using similar devices and having a stable internet connection. The effects of using Kahoot! in review games in a classroom setting, where similar technological devices are used, and reliable internet is present could produce more reliable results. Further studies with the aforementioned conditions should be considered to examine the effects of Kahoot! review games on students' quiz scores. Lastly, this study could be implemented to determine the possible magnitude of the effects of the intervention on the results of summative assessments such as tests and exams.

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Teacher Research*, *21*(1), 1-17. https://doi.org/10.4148/2470-6353.1259

Appendix A
IRB Approval

UNIVERSITY OF GUAM
UNIBETSEDÅT GUAHAN

Committee on Human Subjects Research (CHRS)
Institutional Review Board

Peter R. Barcinas
IRB Chairperson
University of Guam
College of Natural and Applied
Sciences, Cooperative Extension
Email: pbarcina@triton.uog.edu

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Guam Department of Education
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Dr. Samir Ambrale Md., MPH.
Member
Medical Oncologist &
Hematologist
Samir.Ambrale@FHPHealth.com

MEMORANDUM

Date: October 7, 2019

TO: Ihmar l. Aldana, Principal Investigator

FROM: Peter R. Barcinas

          CHRS Committee Chair

          UOG CHRS Chair Signature

Title:	**Review Games Using Kahoot! And Students' Quiz Scores**
CHRS#:	19-118
IRB Review Date:	9/25/2019
Effective Date:	October 7, 2019
IRB Review Type:	**Exempt Review**
IRB Review Action:	**Approval**

Dear: Ihmar l. Aldana:

Your 09/25/2019, after a review of your application, the Institutional Review Board (IRB) of the University of Guam has approved the above study involving humans as research subjects. Your study: **CHRS#19-118– Review Games Using Kahoot! And Students' Quiz Scores** was given an **Exempt review** under federal guidelines CFR 45, Part 46.101(b) requirements and poses no more than minimal risks to participants.

All participants will have their rights explained in the **Cover Letter**. Consent to take part in the research will be obtained by the completion of an **Informed Consent Form and Assent Form** and this is appropriate for the study. Participants may withdraw at any time without penalty and no physical or emotional harm is expected to accrue to the research participants. Sufficient precautions have been taken to protect the participants' anonymity and the confidentiality of their responses. Data collected from all participants will be adequately protected.

As a result, approval for this project has been granted as of October 7, 2019. Therefore, you may begin your research. Should the project extend beyond a 1-year period (12 months from approval) please submit an extension request. Should any changes in procedures be made, UOG's CHRS must be informed and a review of the procedures and changes must be completed before they are implemented.

Please refer to the assigned CHRS number denoted above in all communications related to your application and this approval.

Appendix B
GDOE Research, Planning, and Evaluation Division Approval

Department of Education
Research, Planning, and
Evaluation (RP&E) Division
www.gdoe.net
501 Mariner Avenue
Barrigada, Guam 96913
Telephone: (671) 300-1241
email: znnatividad@gdoe.net

JON J.P. FERNANDEZ
Superintendent of Education

ZENAIDA N. NATIVIDAD, Ph.D.
RPE Administrator

October 22, 2019

Ihmar L. Aldana
Graduate Student
University of Guam

Re: "Review Games Using Kahoot! and Students' Quiz Scores"

Dear Ihmar Aldana:

Thank you for submitting the request for approval to conduct the study *"Review Games Using Kahoot! and Students' Quiz Scores"*.   Based on the proposal summary that you provided and the IRB approval from the University of Guam CHRS, you are hereby granted approval to conduct your study within the Guam public school system.

Please be advised that the Department empowers schools and employees to make decisions that affect teaching and school operations. Therefore, participation in research studies must be voluntary for each potential participant, even though you have this initial approval.

The Department requires that the completed report contain the following or equivalent statements:
"The activity, which is the subject of this report, has been authorized by the Guam Department of Education. However, the opinions expressed herein as well as the methods utilized do not necessarily reflect the position of the Department. No official endorsement by the Department or the Government of Guam should be inferred. The author accepts full responsibility for the methodology and for the contents of this document."

Please also note that **nowhere** in the final document should reference be made to a specific teacher(s), administrator(s), or student(s) that participated in the study. The Department requests that a digital copy (hardbound copies are no longer required) of the completed study be submitted to the Research, Planning, and Evaluation Division no later than three months after completion. Finally, kindly sign below to indicate that you agree with the terms of this approval and please send me the signed copy.

Sincerely yours,

ZENAIDA NAPA NATIVIDAD, Ph.D.
Chairperson, GDOE Research Review Panel

Concurred: Ihmar Aldana
Date signed:_____

Appendix C
Parent Consent Form

Parental or Guardian Consent Form for Children Participation in Research

Topic: The effects of review games using Kahoot! on students' quiz scores in a high school Geometry class
Student Researcher: Mr. Ihmar Aldana (University of Guam – School of Education)

Purpose: The purpose of this study is to explain the effects of playing review games using Kahoot!, an online game-based platform, in a high school Geometry class on students' quiz scores. The relationship between the review games using Kahoot! and the quiz scores will help inform the teacher of the effectiveness of strategies used in the classroom.

Procedure: In this study, your child may be asked to participate in a review game using Kahoot! prior to taking a quiz in class. Your child's quiz scores will then be collected for data analysis.

Duration: The study is intended to last for six weeks. However, the reviews and quizzes will be administered every other week - more specifically, every 5th class meeting from the start of the study.

Risks: This study will not cause any harm to your child.

Benefits: There are no direct benefits to your child. However, your child's participation in this study will help in determining the effectiveness of activities in class and improving teaching strategies in the classroom.

Statement of Confidentiality: All records will be kept confidential and will only be available to the researcher. Your child's data will be kept secured in a locked file while it is in my possession. Once the study is completed and data have been analyzed, all records will be destroyed.

Voluntary Participation: Your child's participation is voluntary. If your child does not want to participate in the study, their data will not be collected. However, your child would still be required to work on the review and take their quiz. There will be no penalty for not participating and choosing to withdraw from the study at any time.

Questions/Concerns: Any questions or concerns about this research and your child's participation should be directed to Dr. Mary Jane Miller (Faculty Advisor - UOG) at 671-735-2426 or Ihmar Aldana (Student Researcher – UOG) at 671-685-4221.

Rights to see results: Any significant findings will be provided to you and your child during the course of this study. Further information can be obtained from the Office of Research and Sponsored Programs at the University of Guam concerning pertinent questions about the research and an explanation of your child's rights as a research

subject. The Research and Sponsored Programs serves as the official contact office in the event of research related injury to your child. You may contact them at 671-735-2672.

For questions about your child's rights in the study, contact:
Troy McVey, Ed.D.,
Director, Graduate Studies Program
University of Guam – Mangilao, GU
671-735-2912
tmcvey@triton.uog.edu

Signature:
Signing the form below indicates that you have read the pertinent information mentioned and will allow your child to participate in the study during school hours without your presence. If you later decide to withdraw your permission for your child to participate, he or she may discontinue participation at any time.

_____
Printed Name of Child

_____   _____
Signature of Parent(s) or Legal Guardian   Date

_____   10/07/2019
Signature of Investigator   Date

Appendix D
Student Assent Form

Student Assent Form for Participation in Research

Topic: The effects of review games using Kahoot! on students' quiz scores in a high
school Geometry class
Student Researcher: Mr. Ihmar Aldana (University of Guam – School of Education)

Purpose: The purpose of this study is to explain the effects of playing review games
using Kahoot!, an online game-based platform, in a high school Geometry class on
students' quiz scores. The relationship between the review games using Kahoot! and
the quiz scores will help inform the teacher of the effectiveness of strategies used in the
classroom.

Procedure: In this study, you will be asked to participate in a review game using
Kahoot! prior to taking a quiz in class. Your quiz scores will then be collected for data
analysis.

Duration: The study is intended to last for six weeks. However, the reviews and quizzes
will be administered every other week - more specifically, every 5th class meeting from
the start of the study.

Risks: This study will not cause you any harm.

Benefits: There are no direct benefits to you. However, your participation in this study
will help in determining the effectiveness of activities and improving teaching strategies
in the classroom.

Statement of Confidentiality: All records will be kept confidential and will only be
available to the researcher. Your data will be kept in a secured locked file while it is in
my possession. Once the study is completed and data have been analyzed, all records
will be destroyed.

Voluntary Participation: Your participation is voluntary. If you do not want to
participate in the study, your data will not be collected. However, you would still be
required to work on the review and take your quiz. You will not be penalized for not
participating and choosing to withdraw from the study at any time.

Questions/Concerns: Any questions or concerns about this research and your
participation should be directed to Dr. Mary Jane Miller (Faculty Advisor - UOG) at 671-
735-2426 or Ihmar Aldana (Student Researcher – UOG) at 671-685-4221.

Rights to see results: Any significant findings will be provided to you during the
course of this study. Further information can be obtained from the Office of Research
and Sponsored Programs at the University of Guam concerning pertinent questions
about the research and an explanation of your rights as a research subject. The

Research and Sponsored Programs serves as the official contact office in the event of research related injury to you. You may contact them at 671-735-2672.

For questions about your rights in the study, contact:
Troy McVey, Ed.D.,
Director, Graduate Studies Program
University of Guam – Mangilao, GU
671-735-2912
tmcvey@triton.uog.edu

Signature:
Signing the form below indicates that you have read the pertinent information mentioned and will participate in the study during school hours. If you later decide to withdraw your permission to participate, you may discontinue participation at any time.

_____
Printed Name of Student

_____   _____
Signature of Student   Date

_____   _____10/07/2019_____
Signature of Investigator   Date

Appendix E
Students' Quiz Scores in Percentages (Experimental Group)

STUDENTS	Quiz 1	Quiz 2	Quiz 3
S1	100	80	100
S2	100	60	80
S3	100	80	80
S4	80	60	80
S5	60	60	60
S6	100	80	100
S7	40	100	80
S8	60	80	80
S9	100	100	100
S10	80	60	80
S11	80	100	100
S12	80	100	100
S13	80	60	60
S14	100	80	80
S15	80	80	60
S16	100	80	60
S17	60	100	80
S18	100	100	100
MEAN	83.3	81.1	82.2

Appendix F
Students' Quiz Scores in Percentages (Control Group)

STUDENTS	Quiz 1	Quiz 2	Quiz 3
S1	60	60	60
S2	80	100	80
S3	100	80	80
S4	80	60	40
S5	60	60	40
S6	80	80	60
S7	80	60	60
S8	60	60	60
S9	100	80	80
S10	80	60	80
S11	60	40	60
S12	80	60	60
S13	100	80	100
S14	60	60	80
S15	100	100	100
S16	80	100	80
MEAN	78.8	71.3	70.0

Appendix G
ESL Students' Quiz Scores in Percentages (Experimental Group)

ESL STUDENTS	Quiz 1	Quiz 2	Quiz 3
S1	100	80	100
S2	100	60	80
S3	80	80	60
S4	60	80	80
MEAN	85.0	75.0	80.0

Appendix H
ESL Students' Quiz Scores in Percentages (Control Group)

ESL STUDENTS	Quiz 1	Quiz 2	Quiz 3
S1	60	60	60
S2	80	60	60
S3	100	80	80
MEAN	80.0	66.7	66.7