Online Game-Based Learning Usıng Kahoot! to Enhance Pre-Universıty Students' Active Learning: A Students' Perception in Biology Classroom

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ABSTRACT

It is the teacher's responsibility in paying serious attention on highlighting the 21st century way of learning in transforming the education system, focusing on equipping students with communication skills, critical thinking, and collaboration skills. This 21st century learning requires suitable teaching aids to achieve the learning objectives. Online game-based learning is considered as one of the new methods, which is capable of raising sudents' engagement and active learning. This study aimed to obtain the pre-university students' perception on the usage of Kahoot! in enhancing their engagement and active learning in the Biology classroom. In addition, this study also aimed to identify the dominant factors that encourage students to engage in learning and facilitating sessions in order to enhance students' active learning. A quantitative research methodology using survey was implemented in this study. A total of 100 students from pre-university colleges at the northern Malaysia were involved as the sample of this study. The data were analyzed using the SPSS 24.0 to obtain descriptive analysis as well as inferential analysis. The findings indicated that the students believed that Kahoot! can attract them to participate in learning sessions and enhance the students' active learning. Students also agreed that the dominant factors that it motivates them to engage in learning and facilitate sessions, as there is a good interaction and communication between partners and teachers. Hence the findings of this study are expected to encourage teachers especially in pre-university level to integrate the usage of online game approaches such as Kahoot! in Biology subjects to enhance the students' engagement and active learning. This is in line with the needs of the current pedagogy that further stimulates the atmosphere of active learning in the classroom leading towards the revolution industry 4.0 and the 21st century learning.

Introduction

Focusing on equipping students with communication skills, critical thinking and collaboration skills or so called the 21st century learning requires suitable teaching aids to achieve the learning objectives particularly in gaining the students engagement and active learning.

Getting students engaged and involved in the active learning in the classroom has become the most challenging role of the teachers. The challenge increases with students having diverse learning styles. Greater engagement has usually been addressed through active learning and the incorporation of activities into the pedagogical toolbox (Wood & Reefke, 2010). As or that, in recent years, instructors have been confronting a technological training revolution driven by the use of digital technology to deliver instruction (Plump & LaRosa, 2017; Clark & Meyer, 2008). An innovative new trend emerged in the media that aimed to improve the participation of students in classroom activities and promote particular behaviors, called gamification (Bicen, 2017). The value of games as a tool for teaching concepts while inspiring students is now well accepted at almost all level of education (Plump & LaRosa, 2017; Becker, 2007). Becker (2007) notes that instructors cannot be expected to embrace games and the confidence in their abilities to employ them.

Kahoot! is an online game that is free and easy for the students to use, and simple for instructors to learn. In the classroom, it is fast-paced and fun, which supports creative energy and student participation. According to Boller (2012), games are one of the effective learning tools to be used by students in enhancing engagement. Students will learn more from a game than form other forms of learning.

Research Question

The overall aim of this study is to obtain the students' perception towards the implementation of online game-based learning using Kahoot! in Biology classroom in enhancing the students' engagement and active learning. Based on the research problem, the following research questions has been identified:

1. What are the students' perceptions of the implementation of Kahoot! in Biology subject in enhancing the students' active learning.

2. What are the dominant factors that encourage students to engage in active learning in Biology subject.

3. Is there any correlation between students' perception of the implementation of Kahoot! in Biology subject in enhancing the students' engagement and students' active learning with the dominant factor that encourage students to engage in active learning.

Research Hypothesis

The research hypothesis tested for answering the research question is:

H_0: There is no significant correlation between students' perceptions of the implementation of Kahoot! in Biology subject in enhancing the students' engagement and students' active learning with the dominant factor that encourage students to engage in active learning.

Research Limitations

Firstly, this study is limited with the pre-university students at the Northern Malaysia and does not involve all zones in Malaysia. Secondly, there are many types of online game-based learning applications that can be implemented in the classroom, however, the researcher chose Kahoot! as it is thought to be one of the most user-friendly online game based learning. Finally, this research only involved the students taking Biology subject and does not involve students learning other subjects or classes.

Literature Review

Game-Based Learning

Learning is a result of exploration and thought. Game-based learning, a best practice using technology, is an old concept of learning with a new digital face. Gamers will agree video games and educational games cause players to discover and use critical thinking skills. As Whitton (2012) describes, game-based learning (GBL) is learning by active play through games. Another definition of GBL is "any digital game that can be used in a learning context" (DeGrove, Bourgonjon & Looy, 2012, p. 2026). GBL (Game-based learning) has become more preferable in motivating students' learning. It is therefore of utmost importance to innovate in the current teaching practices to enhance learner involvement, comprehension, cooperation and motivation. (Domenech & Berbegal-Mirabent, 2019). The growth of mobile, smart devices has resulted in the suggestion that this may provide new opportunity to engage students in active learning (Thomas and Fellowes, 2017) Games should have two enticing qualities; competition and engagement. Digital games create active engagement. The game-based learning theory is grounded on the idea that engagement is in performing tasks while playing conditions stimulate the brain for active learning. Digital games are designed to integrate content material with game play; this allows the brain to process information from short to long-term memory (Banikowski, 1999). Understanding how children process and store information is particularly important for educators. Game-based learning has paved the way for a new digital form of learning. Whitton (2012) states that game-based learning can be seen in both primary, and secondary schools, universities, adult education, military training, and medical practice. Digital games create active engagement which supports problem-solving skills in learning environments. Digital games provide a safe environment of play which allows students to learn from their failures, scaffolding through life simulations which helps students learn how to deal with possible real-life failures. Games are great educational tools used across content areas for review.

Game-based learning is often associated with implementing educational games, understanding the impacts of GBL, and the planning of game-based educational approaches (Sadler et al 2015). Brown et al. (2018) indicated that digital game-based learning (DGBL) is increasingly being used as an alternative learning tool for teaching science in higher education. To support this, Behnamnia et al. (2020) have stated that digital game-based learning (DGBL) is increasing; therefore, the application of DGBL technology (tablets and smartphones) has the potential to influence biology students' ability to develop creative and critical thinking skills. This is further supported through the process of digital game development for teachers to teach science in the school environment and the use of mobile smartphones as a tool that adds value to the world of education (Eichler et al., 2018); biology teachers included. Mobile game based learning (mGBL) has shown great potential for increasing engagement, creativity and authentic. To name a few, mGBL could produce positive feedback from students, as it increased the interest level to learn biology through game, which 2Dgraphics can be further enhanced into 3D Modelling tools (Rozaidi & Ismail, 2018). However, mGBL's great potential on biology education for teachers remains very limited.

A new game on the web being used in online and traditional learning environments is Kahoot!. Kahoot! allows teachers to create questions with answers and students can compete for points. The game can be activated on the web and several classes can play against each other. The game requires a code and students can contribute to the game anytime during an assigned game time period making it useable for distance students.

Kahoot!

According to Plump & LaRosa (2017), Kahoot! (https://getkahoot.com/) is an online global educational brand that offers a free student response platform resembling the popular trivia game Quizzo. Kahoot! Is reminiscent of previous clicker technology with the exception that it is free and

easy to learn and use. Educators use Kahoot! to create game-based quizzes, discussions, and surveys. To start, instructors register for a free account by going to https://create.kahoot.it. Once registered, educators can select from millions of free public games and adapt them as necessary or create their own. The process is easy and straightforward. Educators launch games for classroom use by going to https://create.kahoot.it, signing in, selecting a particular game, and then clicking "play" to open the game. The game's home page displays a game pin at the top of the screen. Students sign in using the web address https://kahoot.it to access the platform. Kahoot! can be used with smartphones, tablets, or laptop computers. Students can choose one device per person or select team mode to use one device per team. All they must do once they access the web address is enter the game pin displayed on the instructor's screen. Students do not need to register for an account or download an application, which can waste time and further complicate the use of technology. All of this makes the se up time and process easy and efficient, both important considerations for classroom instructional use.

Generally, Kahoot! is used as a supplemental teaching tool in classes no larger than a group of 30 students, approximately once a week, and for about 15 minutes. Kahoot! can be played by over 4,000 players at a time; however, the company recommends instructors to contact its support team for advice if they plan to use it with more than 1,000 participants. Once everyone has answered the question, or the time the instructor set for answering the question expires, the correct answer is displayed on the instructor's screen and the aggregate results shown in bar graph form. The game keeps track of each student's or team's answers, awards points, and ranks players based on speed and accuracy. The top five leaders are displayed after each question.

Table 1 shows the advantages and the disadvantages of that the user can get when using Kahoot in the classroom. In relation with attracting students' engagement, it is clearly seen in the table that one of the advantages of using Kahoot is helping to accelerate the students' engagement in the classroom. Therefore, this application is suitable to be introduced to the Biology students.

Table 1

Advantages and Disadvantages of Using Kahoot! in the Classroom

Advantages	Disadvantages
• Free	• Hard to track students' progress. In order to track student progress the teacher would have to breakdown usernames and attach them to student names and then record the number of answers each student got right in every Kahoot that was played. This would be tedious at best.
• Easy for instructors to learn simple process for students (no account registration or downloading of application) • Compatible with smartphones, tablets, or computers • Real-time results help instructors provide clarification when needed • Music and colors add to student excitement and energy • Increases student engagement	• Need a strong WIFI connection

- Instructors can download, review, and save student results
- Students can take quizzes multiple times
- Instructors can create quizzes, discussion questions, or surveys
- Instructors can adjust the response time

Active Learning

Meanwhile, active learning is a student-centered learning process using active strategies. It has many advantages over conventional learning which is more examined and less interaction between students (Hafiza, 2012). Among the advantages are improving students' ability to communicate, critical thinking skills, and exposing students to the problem (Noor Indon, Intan Shafinaz & Azniza, 2011). According to Wilson and Peterson (2006), emphasis on teaching and learning should change from conventional teaching to active learning through three aspects as summarized in Table 2.

Table 2

Teaching and Learning Benchmarking Involving an Active Learning Classroom

Changed	Benchmark from ...	Changed into ...
Learn	Passing information Passively	Active involvement with information
	Individual activity	Both individual activities and group work
	Individual differences between students are seen as a problem	Individual differences between students are seen as sources
Knowledge	What: Facts and procedures of subject materials	What, how and why: Concentration ideas, concepts, facts, investigative processes, and arguments of subject matter
Teaching	Moderate, simple work	complex and intellectual work
	Teachers as information conveyer	Role of teachers is diverse, from conveying information to planning educational experiences
	Teacher performs a great deal of job	building a class for individual and team learning
	Lessons have low level content, concepts are mentioned; unorganized lessons in a coherent	Lessons focus on high-minded levels and basic content, concepts developed and described; lessons are structured coherently
	Teachers as knowledge-seeking	teachers are highly educated, tend to improve their teaching continuously

Meanwhile, active learning can be done in groups or individually and lecturers act as facilitators to control the classroom. This collaborative learning creates interaction between students and teaching aids, students with students, and teachers with students (Rafiza, 2013). Teachers need to design various effective teaching styles such as the use of graphic tools and group learning to maximize students' ability to think creatively and critically (Hafiza, 2012). According to Ibrahim (2007) active learning is suitable for use in Science subjects as it involves students' understanding of relevant processes and concepts. Kahoot application can be one of the strategies in active learning in the classroom. The results of the study by Asmara and Herliani (2014) prove that students using active

learning with game-based learning are easier to understand and remember the information presented by the teacher. This is also support by Plump and LaRosa (2017) as well as Wang and Tahir (2020) stating that, Kahoot! is a eLearning platform which provide an engaging environment that supports learning and adds active participation in the classroom.

In order to enhance the students' engagement and active learning, an online game-based learning using Kahoot! application can be the one of the suitable methods to achieve these objectives. Teachers should utilize it in the classroom as it will make the students be more active by communicating, collaborating and think critically among themselves.

Methods

Research Design

This study employed a quantitative research design using one-group pretest-posttest experimental research design. According to Gay et al., (2009) and Noraini Idris (2013), an experimental design is so unique as it can create a cause and effect relationship. According to Cresswell (2014), this design includes a pre-test measure followed by a treatment and a post-test for a single group. Figure 1 shows an illustration of the specific research design used.

Figure 1

One group pretest-posttest design

Group A   01 ---------X---------02
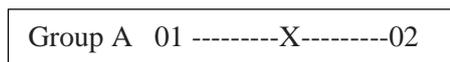
In this design, an intact group was chosen among the pre-university students which a pretest was given, followed by intervention and posttest at the end. A total of 14 weeks (one semester) of teaching and learning using Kahoot! was implemented to the students in the tutorial class. Sample of this study consisted of pre-university students in one of the pre-university colleges in the Northern Malaysia. A total of 100 students taking Biology class was selected for this study. In the Biology classroom, the teachers used graded and ungraded quizzes to assess knowledge, comprehension, and retention (1) after completion of reading assignments, (2) following lectures, and (3) to review material from several units. Having a competition-based learning among the students will increase their motivation to elevate their performance. Students can also create their own Kahoot! quizzes as an assignment or to study for a test. Baszuk and Heath (2020) as well as Plump and LeRosa (2017) reinforces that computer games as educational tools have an intrinsic motivation factor that encourages curiosity and creates the impression that students are in control of their own learning. Indeed, students remarked that they enjoyed this assignment because they were creatively using technology within a learning environment.

As for the research instrument, this study used a Students' Perception of Kahoot! In Increasing Active Learning questionnaire which adapted from Zaid and Ariff (2012). This questionnaire consist of 3 sections, namely: (i) Section A: Demographic Information; (ii) Section B: Students' Perception; and (iii) Section C: Dominant Factor. Section B and Section C contains items to meet the research questions that are students' perceptions of active learning approach and the dominant factors that enhance students to engage in an active learning. In both of these sections, questionnaire responses will use the five point Likert Rating Scale which are, i) strongly disagree; ii) disagree; iii) moderately agree; iv) agree and' v) strongly disagree. A pilot test in order to ensure the reliability of the items in the instrument was carried out among 50 pre-university students which the samples does not involved in the real study. Result of the pilot study shows that Cronbach's Alpha for Students' Perception was found to be 0.783 and Cronbach Alpha for Dominant Factor was

0.723. This result shows that the items for each of the construct has a medium internal consistency and therefore can be carried out for the actual sample.

In this study, the teacher used Kahoot! for assessment purposes, using a quiz after completing a specific topic. Students were asked to discuss in their respective group before the game starts. The students were required to respond individually first and after that there would be discussions in the groups. The group of students who answered more quickly and correctly were asked to explain to other groups of students. The role of teacher was as a facilitator where the teacher would correct any misconception that arises in case the students answer incorrectly. Students who gained the highest score would be rewarded by the teacher for motivational purposes. The implementation of Kahoot! were done throughout the semester and at the end of the semester, students were required to answer a relevant questionnaire. Table 3 shows one example of lesson plan using Kahoot! and Figure 3 shows an example of the quizzes using Kahoot! in Biology class implemented to the pre-university students. Data for this study were analyzed using SPSS 24.0.
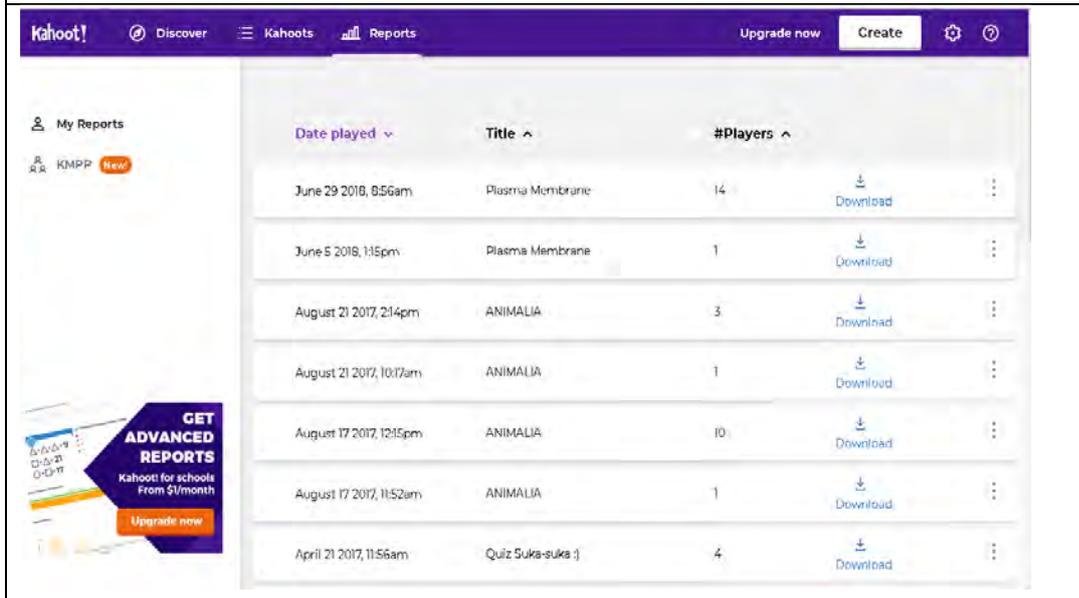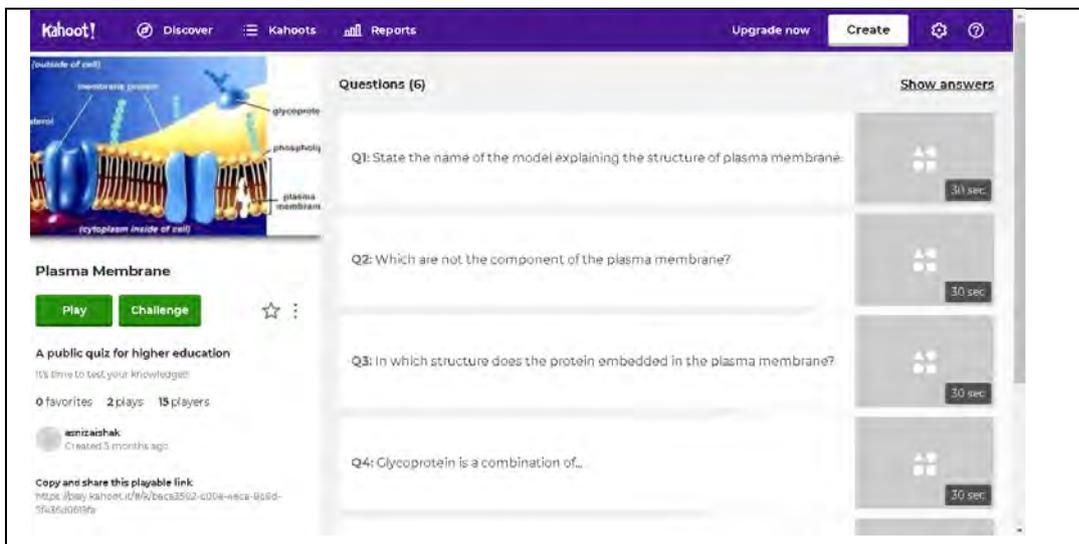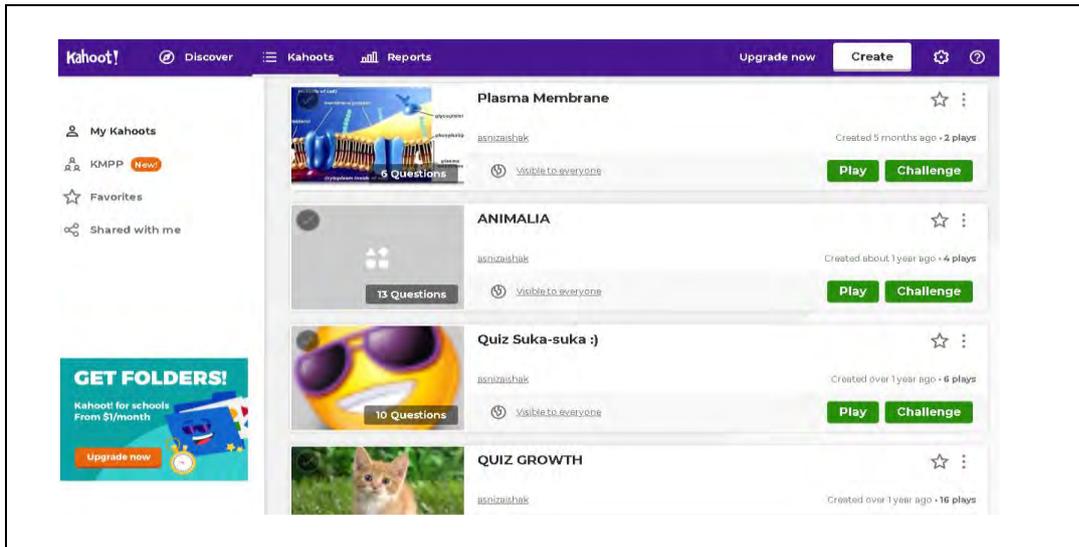
Table 3

Sample of Lesson Plan Using Kahoot! in Biology Classroom

Step	Teacher's Activity	Students' Activity
Engagement (10 mins)	The teacher will ask students to answer the pretest using Kahoot! individually regarding the topic of Animalia.	The students need to answer the pretest using Kahoot! individually
Exploration (20 mins)	The teacher will ask students to form themselves in a group of four and discuss the phyla of Animalia.	The students will form a group and discuss the phyla of Animalia
Explanation (10 mins)	The teacher will ask the group leader to create their own Kahoot! to assess their understanding on the phyla of Animalia. Students will play among themselves.	Students will play Kahoot! among themselves in assessing their understanding of phyla in Animalia.
Extension (10 mins)	The teacher will ask students to answer the posttest using Kahoot! regarding the topic of Animalia. This time the students will answer the questions in their respective group.	Students will answer the questions from Kahoot! in their respective group. The group of students who answered more quickly and correctly were asked to explain to other groups of students.
Evaluation (10 mins)	Teacher will ask students to give feedback on the usage of Kahoot! in the teaching and learning process.	Students will give feedback on the usage of Kahoot! in the teaching and learning process.

Figure 2

An example of the quizzes in Biology class using Kahoot!

Findings

Demographic Findings

Table 4 shows the demographic information of the respondents involved. Out of 100 respondents, 22 respondents (22%) were male students and 78 respondents (78%) were female students. Also, 98% were Malay students and Chinese and Indian students were 1% each. Finally, out of 100 students, 51 of them were among Module 1 students, who takes Biology, Chemistry, Physics and Mathematics subjects and the rest 49 students were among Module III students wo takes Biology, Chemistry, Computer Science and Mathematics subjects.

Table 4

Demographic Findings of Research Respondent

Demographic Findings		Frequencies	Percentage (%)
Gender	Male	22	22
	Female	78	78
	Total	100	100
Ethnic	Malay	98	98
	Chinese	1	1
	Indian	1	1
	Others	-	-
	Total	100	100
Module	I	51	51
	III	49	49
	Total	100	100

Descriptive Statistics

This part will explain the descriptive statistics for each of the construct in the instrument.

Students' Perception of 'Kahoot!' In Enhancing Their Active Learning

The purpose of this construct was to answer research questions number 1 which sought "what are the students' perception of the implementation of Kahoot! in Biology subject in enhancing the students' active learning". For this construct, the item that show the highest mean was item 2 (*In my opinion, the active learning approach through Kahoot!, can attract/engage many students to participate in teaching and learning sessions),* (M= 4.63; SD= .485). Meanwhile, the item showing the lowest mean score was item 7 (*In my opinion, the active learning approach through Kahoot! only suitable for certain topics*)**,** (M=3.53, SD= .958). Table 5 and Figure 3 show the detail findings for this construct.

Table 5

Students' Perception of 'Kahoot!' In Enhancing Their Engagement and Active Learning

Item No.	Definition of the Items	Mean	Standard Deviation
1	In my opinion, the active learning approach through Kahoot! build students social interaction.	4.44	.50
2	In my opinion, the active learning approach through Kahoot !, can attract/engage many	4.63	.49

	students to engage in teaching and learning sessions.		
3	By using an active learning approach through Kahoot !, students 'existing opinions and knowledge are further valued.	4.20	.43
4	In my opinion, students love attending classes that use a combination of active learning approaches through Kahoot! and lectures.	4.37	.63
5	In my opinion, in an active learning approach, students are responsible for their own learning.	4.21	.54
6	In my opinion, the active learning approach through Kahoot! able to provide adequate lesson content.	3.73	.62
7	In my opinion, the active learning approach through Kahoot! only suitable for certain learning topics.	3.53	.96
8	In my opinion, the active learning approach through Kahoot! suitable for all students regardless of age limit.	4.32	.53
9	In my opinion, the active learning approach through Kahoot! suitable for all students regardless of the type of learning style of their choice.	4.03	.67
10	In my opinion, the students prefer to attend lectures/tutorials that use an active learning approach using Kahoot!.	4.09	.73

Figure 3

A histogram on students' perception of "Kahoot!" in enhancing their engagement and active learning

Dominant Factor That Influenced Students to Get Involved in Teaching and Learning of Active Learning Using 'Kahoot!'

The second construct of this instrument consisted of 10 items measuring the dominant factor that influenced students to get involves in teaching and learning of an active learning using

'Kahoot!'. The purpose of this construct was to answer research question number 2. For this construct, the item that shows the highest mean was item 1 (*Good interactions and communication between friends encourage my involvement in active learning*) (M= 4.38; SD= .51) and item 10 (*The appropriate classroom/layout affects my involvement in active learning*), (M= 4.38; SD= .51). However, the item showing the lowest mean score was item 6 (*I think an active learning approach through Kahoot! only suitable for certain topics*), (M=3.53, SD= .96). Table 6 and Figure 4 show the detail findings for this construct.

Table 6

Dominant Factor That Influenced Students to Get Involves in Teaching and Learning of Active Learning

Using 'Kahoot!'

Item No.	Definition of the Items	Mean	Standard Deviation
1	Good interaction and communication between peers encouraged my involvement in active learning.	4.44	.50
2	Effective classroom control by the lecturer influenced my involvement in active learning.	4.63	.49
3	Adequate time allocation while conducting activities influenced my involvement in active learning.	4.20	.43
4	Too many students in a class affects my involvement in active learning.	4.37	.63
5	The appropriateness of the size of the lecture/ tutoring room influenced my involvement in active learning.	4.21	.54
6	Discussion of issues based on existing knowledge influences student engagement in active learning.	3.73	.62
7	Easily accessible resources and reference materials can encourage my involvement in active learning.	3.53	.96
8	The complete infrastructure facilities influenced my involvement in active learning.	4.32	.53
9	A sense of responsibility for learning influenced my involvement in active learning.	4.03	.67
10	Appropriate lecture/ tutoring room layout influenced my involvement in active learning methods.	4.09	.73

Figure 4

A histogram showing the dominant factor that influenced students to get involves in teaching and learning of active learning using 'Kahoot!'

Inferential Statistics

This study was also intended to seek correlation between students' perception of "Kahoot!" in enhancing their engagement and active learning with the dominant factor that influenced students to get involves in an active learning using 'Kahoot!' as stated in research question four. To answer this question, an inferential analysis using the Pearson correlation via SPSS version 26 was carried out. Table 7 show the data analysis of the SPSS output on correlation analysis.

Table 7

SPSS Output for Pearson Correlations

		Students' Perception	Dominant Factors
Students' Perception	Pearson Correlation	1	.531**
	Sig. (2-tailed)		.000
	N	100	100
Dominant Factors	Pearson Correlation	.531**	1
	Sig. (2-tailed)	.000	
	N	100	100
**. Correlation is significant at the 0.05 level (2-tailed).			

The null hypothesis constructed to answer this research question was there is no significant correlation between students' perceptions of the implementation of Kahoot! in Biology subject in enhancing the students' engagement and students' active learning with the dominant factor that encourage students to engage in active learning. From Table 7, it can be seen that the p value is less than .05 ($p < .05$), hence the null hypothesis is rejected (r= .531; p= .000) which is there is a significant correlation between students' perception of "Kahoot!" in enhancing their engagement and active learning with the dominant factor that influenced students to get involves an active learning using 'Kahoot!'. Besides the magnitude of the correlation shows that, there is a medium correlation

between students' perception of "Kahoot!" in enhancing their engagement and active learning with the dominant factor that influenced students to get involves in teaching and learning of active learning using "Kahoot!". Therefore, in order for the students to get involved actively in the learning process using Kahoot!, factors that related to active learning need to be considered by teachers before executing the lesson plan.

Discussion and Conclusion

The discussion of this study will cover the objectives of the study to answer the research questions that have been submitted. The first research objective was to identify the students' perceptions of the implementation of Kahoot! in Biology subject in enhancing the students' active learning. The second objective of this study was to identify the dominant factors that encourage students to engage in active learning in Biology subject and finally the third research objective was to identify if there was any correlation between students' perception of the implementation of Kahoot! in Biology subject in enhancing the students' active learning with the dominant factor that encourage students to engage in active learning. Conclusions were made based on the findings of the study that were analyzed by using a questionnaire that had been constructed.

Students 'perceptions in this study refer to students' views on several aspects of the active learning approach. The findings of the study found that the highest mean for the items involved in first research question was item 2. Students believed that the active learning approach through Kahoot!, can attract/engage many students to participate in teaching and learning sessions. This high mean value indicates that the level of students' perception of the active learning approach is positive. In other words, the active learning approach has succeeded in attracting many students to be actively involved in teaching and learning sessions. This is in line with the statement from Woodcock, Middleton and Nortcliffe (2012) and Nel (2017) mentioned that students interest can be created and enhanced by using various approaches in teaching. There are various techniques that are part of the techniques in the active learning approach, such as cooperative learning (Cooperative Learning) and also problem-based learning (Problem-Based Learning) (Khairiyah et al., 2005). This is also in line with Rafiza (2013) mentioned that collaborative learning creates interaction between students and teaching aids, students with students, and teachers with students. According to Springer et al. (2000) on graduate education in science, technology engineering and mathematics (STEM) have also shown a more positive attitude of students towards learning that supports the use of learning in small groups.

The second research question was discusses several factors that enhance students to be actively involved in teaching and learning sessions based on an active learning approach. The high mean value of this second research question indicates that there are several dominant factors that have motivated students to engage in active learning. Data analysis showed that student agreed that good interactions and communication between friends encourage them to involved in active learning as well as agreed that appropriate classroom/layout affects their involvement in active learning. According to Abd. Ghafar (2003), communication is a process of conveying information, messages or signals to other parties constructed from experience or understanding between the two parties. He added that the lecture room is a constantly interacting community where lecturers interact with students during lectures, and students interact with each other based on needs during the teaching and learning process. This constant interaction is actually what enlivens the atmosphere of a lecture room.

The third objective shows that there is a significant correlation between students' perception of the implementation of Kahoot! in Biology subject in enhancing the students' active learning with the dominant factor that encourage students to engage in active learning. There are many studies on factors that may influence the active learning process in the classroom. One of it is interaction and communication factors. Study conducted by Siti Norbaizura (2006) and Tseng and Yeh (2013) showed that good interaction and communication factors between group members are the main

factors that can promote student learning in groups. Students prefer to work in a group environment because it can affect their learning. Teaching and learning is a process of dialogue that involves two parties where this two-way interaction and communication will make the atmosphere of the lecture room more lively and cheerful. This in turn will encourage them to participate in learning more actively.

As for the conclusion, it is proven that 'Kahoot!' can attract many students to participate in teaching and learning sessions particularly in Biology classrooms involving pre-university students. It is clearly seen from the findings where the data analysis show that students' engagement and achievement increases when students are treated with this method of teaching and learning through an online game-based learning. This conclusion is in line with the results stated by Bicen and Kocakoyun (2017; 2018); Plump & LaRosa (2017) and Becker (2007). Students seem to communicate, collaborate, using their scientific process skills and think creatively when answering the quizzes either given individually or in group. It means that good interaction and communication between friends is a driving factor for encouraging student engagement in active learning when using 'Kahoot!'. This is in parallel with the results of Kapp (2012), for an educational game to be successful, it needs the right context, the right cognitive activities, meaningful challenges, and feedback. Students also disagreed that teaching and learning in the classroom using online game-based learning is only suitable for certain subjects but it can be applied to other subjects as well. Hence, the findings of this study are expected to encourage teachers to integrate the use of 'Kahoot' in Biology subjects to enhance students' understanding as well as stimulate active learning among students. This is in line with the current pedagogical expectation which further stimulates the atmosphere of active learning in the classroom leading to the education of the Industrial Revolution 4.0 and the 21st century learning in Malaysia as Malaysian Education Blueprint (2013-2025) proposed by Ministry of Education giving serious attention on highlighting the 21st century way of learning in transforming the Malaysian education system

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