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Kahoot: A Promising Tool for Formative Assessment in Medical Education

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ABSTRACT

Introduction: The main purpose of formative assessment is to improve students' learning and it should be seen as a part of the learning process. Game-based learning has become more common in the education and one of the emerging game-based learning platform used in education institutions is Kahoot. This paper investigated the perception of students towards Kahoot as a formative assessment tool in undergraduate medical education and its association with gender. **Methods:** A cross-sectional study was carried out on first year medical students in a Malaysian public medical school. The study employed a survey that consists of 12 items through Kahoot survey platform. **Result:** A total of 113 subjects participated in this study; majority was female (68.1%) and Malay (58.4%). The students highly perceived Kahoot as fun, effective and better than e-learning platform for feedback as its median score was 4. The rest of items were satisfactorily perceived by the students as indicated by the score of 3 except for simplifying complex subjects that obtained unsatisfactory level. There were significant median score differences between male and female students for motivation and perceived knowledge retention, whereby males scored higher than females ($p < 0.05$). **Conclusion:** Kahoot is a promising formative assessment tool that is feasible, practical and makes learning fun and enjoyable. It can be used to motivate students to learn. However, Kahoot was not the best tool to simplify complex subjects as perceived by medical students.

Keywords: *Kahoot, Formative assessment, Assessment, Game-based learning, Medical education*

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INTRODUCTION

Assessment refers to a judgement about performance of learners based on specific weighted set goals (1). There are two types of assessment, i.e., summative and formative assessment. Assessment that takes place after the instruction and requires making a judgement about the learning that has occurred is called summative assessment. Whereas, assessment that provides feedback over the course of instruction is called formative assessment (2). The formative assessment (assessment for learning) is increasingly being emphasised in the academic world (1). In order to improve students' learning on subject matters, the formative assessment should be seen as an important element to facilitate the learning process (3, 4). Therefore, the formative feedback should be properly designed to improve their understanding on the subjects.

Currently, the game-based learning has become more common in education. Most research papers related to this subject show

that the game-based learning has a positive effect compared to traditional learning methods (5, 6). In terms of students' performance, research proved that students who learn using the game-based learning are significantly better than students who learn using traditional methods (6). This is because, by using the game-based learning, it can promote students' learning (7). Studies also found that game-based learning can improve their motivation (6, 8), promotes engagement with learning (9, 10) and provides effective feedback to them (11). One of the emerging game-based learning platform used in education institutions is Kahoot. It is freely available, a real-time, game-based learning platform that has gained wide acceptance globally with more than 30 million users worldwide (12). It allows teachers to create game-based quizzes, surveys and a few more things in which the participants compete against each other. Top responders for each question are revealed and the overall winner(s) will be displayed at the end of the Kahoot session (13). The scoreboard at the end of the game will display the winners. The good thing about Kahoot is, the results including their descriptive analysis data can be exported and saved by the instructors for future reference.

To create Kahoot game, instructors need to login to the Kahoot website (https://getkahoot.com). After choosing a Kahoot option, the instructors can create questions using its available features. Finally they will receive an automatically-generated code. Using laptop or smartphone, their students can access the game by using the Kahoot app or by browsing the website, www.kahoot.it. The students will need to enter the code appeared on the screen and register their name. Once the Kahoot game starts, the students will earn points based on correct answers given and for speedy responses. In Universiti Sains Malaysia (USM) Medical School, the formative assessment is conducted through e-learning portal (www.elearning.usm.my) whereby each student needs to login to the portal on a specific time to answer all the questions set by the faculty members. Recently, Kahoot is used as an additional tool for formative assessment during feedback session. There are specific times for students – usually two times for each course – in which they need to gather in their lecture hall for a Kahoot session. For each session, at least 20 questions are asked. The winners of each Kahoot will be announced at the end of the session and the winners' names are displayed on a dedicated frame – known as "Kahooters of the Month".

The purpose of this study is to investigate the perceived effectiveness of using Kahoot as a formative assessment tool in undergraduate medical education and identifies association between gender and their preference of using Kahoot in teaching and learning activities.

METHODS

Study Setting and Population

A cross-sectional study was carried out on Year 1 medical students in USM Medical School. The school adopts SPICES (14) curriculum that has two phases – Phase I consists of Year 1 and 2 (pre-clinical phase) and Phase II consists of Year 3, 4 and 5 (clinical phase). Pertaining to formative assessment, particularly for Phase I curriculum, the medical school uses e-learning portal (www.elearning.usm.my) as a platform for formative feedback and each course has two formative assessment sessions. To perform the formative assessment, the medical students must login to the portal at a specific time per schedule by using their own username and password.

Study Instrument

This study used Kahoot survey platform. It consists of 12 items as listed in Table 1. The participants rate each item using a 4-point scale, ranging from 1 (strongly disagree) to 4 (strongly agree). Cronbach's alpha of the 12 items was 0.76, indicating a good internal consistency.

Table 1: The items

No	Questions
1	Kahoot helps me to focus on the subjects
2	Kahoot motivates me to learn more
3	Learning with Kahoot is fun
4	I'm more engaged with feedback through Kahoot
5	Kahoot enhances my understanding on the subjects
6	Kahoot helps to retain my knowledge
7	Kahoot simplifies the complex subjects
8	Kahoot facilitates my learning on the subjects
9	Kahoot is an effective method to provide feedback
10	Kahoot is an effective method to correct my misconception on the subjects
11	Kahoot is an effective method for reflective learning
12	Kahoot is a better platform than e-learning for feedback to students

Data Collection

A total of 113 participants were invited to take part in this study. Data collection was performed through a survey immediately after a formative assessment session which was performed through the Kahoot platform.

Data Analysis

The survey data was exported to Microsoft Excel format and then transferred to SPSS Version 22, in which data analysis was performed. Descriptive statistics was performed on the demographic data. Mann-Whitney test was used to test the association between male and female students on each survey item. *P*-value of less than 0.05 is considered as significant at 95% confident interval.

RESULT

Demographic Data

A total of 113 subjects participated in this study, majority was female (68.1%) and Malays (58.4%).

Table 3 shows that all items obtained at least median score of 3 except for Item 3, 9 and 12, in which these three items received median score of 4 and one item obtained median score of 2 (Item 7). This result indicated that Kahoot was a fun and effective method to give feedback thus better than the existing e-learning portal to provide feedback to students. However, they perceived that Kahoot was unable to simplify complex subject matters.

Table 2: Demographic data for gender and race

Variable	Number of participant, n (%)	Total, n (%)	
Gender	Male	36 (31.9)	113 (100)
	Female	77 (68.1)	
Ethnic group	Malay	66 (58.4)	113 (100)
	Chinese	22 (19.5)	
	Indian	18 (15.9)	
	Others	7 (6.2)	

Table 3: Median score for each item

No.	Items	Median (IQR)
1	Kahoot helps me to focus on the subjects	3 (1)
2	Kahoot motivates me to learn more	3 (1)
3	Learning with Kahoot is fun	4 (1)
4	I'm more engaged with feedback through Kahoot	3 (2)
5	Kahoot enhances my understanding on the subjects	3 (1)
6	Kahoot helps to retain my knowledge	3 (0)
7	Kahoot simplifies the complex subjects	2 (1)
8	Kahoot facilitates my learning on the subjects	3 (0)
9	Kahoot is an effective method to provide feedback	4 (2)
10	Kahoot is an effective method to correct my misconception on the subjects	3 (1)
11	Kahoot is an effective method for reflective learning	3 (0)
12	Kahoot is a better platform than e-learning for feedback to students	4 (2)

IQR: Interquartile range

Table 4 shows that there were significant median score difference between male and female students for Item 2 and Item 6. This result indicated that male students were more motivated than female students to use Kahoot as a formative assessment. Likewise, male students perceived Kahoot having a better approach than female students for helping with their knowledge retention.

Table 4: The comparison of median scores of each item between male and female groups

Items	Median (IQR)		*z*-Statistic	*P* value
	Male	Female		
1. Kahoot helps me to focus on the subjects	3.00 (1)	3.00 (1)	–0.113	0.910
2. Kahoot motivates me to learn more	3.50 (1)	3.00 (1)	–2.419	0.016
3. Learning with Kahoot is fun	4.00 (1)	4.00 (1)	–1.143	0.786
4. I'm more engaged with feedback through Kahoot	3.00 (1)	3.00 (2)	–0.271	0.253
5. Kahoot enhances my understanding on the subjects	3.00 (1)	3.00 (1)	–0.703	0.482
6. Kahoot helps to retain my knowledge	3.00 (1)	3.00 (1)	–2.210	0.027
7. Kahoot simplifies the complex subjects	2.00 (1)	2.00 (1)	–0.607	0.544
8. Kahoot facilitates my learning on the subjects	3.00 (1)	3.00 (1)	–1.109	0.267
9. Kahoot is an effective method to provide feedback	3.00 (1)	3.00 (2)	–0.937	0.349
10. Kahoot is an effective method to correct my misconception on the subjects	3.00 (1)	3.00 (1)	–1.228	0.219
11. Kahoot is an effective method for reflective learning	3.00 (1)	3.00 (0)	–0.150	0.881
12. Kahoot is a better platform than e-learning for feedback to students	3.00 (2)	3.00 (2)	–0.256	0.798

*Mann-Whitney test, IQR: Interquartile range

DISCUSSION

Interestingly, most of the items were rated positively by students except for Item 7 (i.e., inability of Kahoot to simply complex subject). They strongly agree that learning through Kahoot is fun, an effective platform for formative feedback and it is better than the existing e-learning portal. The male and female students perceived differently on Kahoot as a factor to motivate them to learn more and to help them retain knowledge. Based on these results, advantages and disadvantages of Kahoot as a formative assessment tool were discussed.

Advantages of Using Kahoot in Formative Assessment

Promotes engagement and motivation

Kahoot is one of the popular online learning platform that was developed to promote students' engagement in learning (15). In line with the majority of studies, the game-based learning provides positive impact on motivation and engagement of student for learning (16). It significantly promotes better students' engagement to learning than those who learn using traditional method (9, 10). A possible explanation is the game-based learning flips the classroom, thus engage and motivate students to learn through empowerment of learners (17). Correspondingly, this study found that medical students perceived formative assessment through Kahoot as an engaging and motivating activity for their learning, thus supporting the findings of previous studies. In addition, Plump and LaRosa (12) also found that most of their students were engaged with Kahoot. They perceived Kahoot has made their learning enjoyable, easy to use, interactive and helping them to understand their subjects better. Probably all five factors that determine learning engagement as described by Whitton (18) exist in Kahoot that lead to student's engagement. In other words, Kahoot motivates them to take up challenges, able to control it, absorb the activity, stimulating their intrinsic interest and they value the session as a useful activity for learning (Table 5).

Pertaining to motivation, it is a sine qua non of successful learning (19, 20). Students learn better when they are motivated (8). A 40-year meta-analysis proved that motivations – both intrinsic and extrinsic – can predict performance of students (21). Compared to traditional approach, the game-based learning is more effective and able to create motivational learning environments (7, 22). This study also supports this fact, in which students perceived formative assessment through Kahoot as a fun learning activity. Students are likely to spend more time on the course if it is enjoyable, engaging, and fun (23). It is worth noting that students respond positively to learning activities that allow them to interact with their teacher and others, and receive immediate feedback (13). This can be incorporated in Kahoot during a teaching session in classroom.

Table 5: Learning engagement factors, with description and origin

Factor	Description
Challenge	The motivation to undertake the activity, clarity as to what it involves, and a perception that the task is achievable
Control	The fairness of the activity, the level of choice over types of action available in the environment, and the speed and transparency of feedback
Immersion	The extent to which the individual is absorbed in the activity
Interest	The intrinsic interest of the individual in the activity or its subject matter
Purpose	The perceived value of the activity for learning, whether it is seen as being worthwhile in the context of study

Previous study showed that the game-based learning was effective and able to create motivational learning environments regardless of sex (7). However, in this study, the male students were significantly more motivated by Kahoot than the female students. This is logical because games have been traditionally considered as a male-dominated domain (22, 24).

Focus

Another important finding was that Kahoot is able to make students more focus in learning, and that could be due to the fact that it caters to various learning styles. There is element of visual stimulus where the students are looking to the questions – including images – projected to the main screen and images in the questions. In terms of auditory, Kahoot entertain the auditory learners by incorporating music in the games (5). Kahoot also tackles kinaesthetic learners by having physical activity at least while choosing their answers. Addressing various learning styles during teaching is important since student achievements will significantly increase if they are taught using approaches and resources that are aligned with their learning styles (23).

Facilitate learning

With respect to perceived learning retention, Kahoot as a formative assessment facilitates learning process to retain knowledge and to correct misunderstanding on the subject matters. However, very little was found in the literature about this aspect, thus need to be further explored to understand reasons to explain this current finding.

Effective feedback and reflective

Feedback is a single powerful tool to promote learning (25), and if learners are given regular feedback about their performance that will close the gap between what is known and what is expected to be known (25–27) – this will promote deep learning among students (7). The real-time feedback provides opportunities for teachers in various disciplines to tailor their instructional strategies based on students' understanding on quizzes while Kahoot allow anonymous classroom participation, which will further engage all students (12). This current study demonstrated that students perceived Kahoot as a potential formative assessment tool to provide feedback for learning.

Kahoot vs e-learning portal

Comparing between two different formative assessment platforms, Kahoot was perceived as a better alternative to e-learning. Therefore, it is recommended for the medical school to start using Kahoot as a formative assessment tool to promote learning among the medical students. There are several advantages of using Kahoot for formative assessment which include:

1. Freely available for anyone to use;
2. Multiple types of Kahoot, i.e. Quizzes, discussion questions, or surveys;
3. Kahoot is easy to use and user-friendly;
4. A simple tool as account registration is not needed for students to use it;
5. Students can simply join Kahoot sessions by entering the code given by instructors;
6. Compatible with smartphones, tablets, or ordinary computers;
7. Music and colours add to students' excitement and energy; and
8. The response time for each question is flexible and adjustable according to students' needs.

In addition to that, instructors can download, review, and save the students' results for analysis of student performance (12). Conversely, there are several disadvantages of using Kahoot as compared to e-learning portal that include:

1. Limited choices of question types;
2. Only allows for certain type of question, i.e. single best answer (SBA) and multiple true false (MTF) format; and

3. Limited to maximum of four answer options. Because of that, Kahoot should be incorporated into teaching session according to its purposes.

Inability to simplify complex subjects

The major concern perceived by students about using Kahoot as formative assessment tool was that it could not simplify complex subjects. This is most likely due to two factors; the nature of subjects and the instructional strategies used by teachers. Difficult subjects will impose high intrinsic load to the students and inappropriate instructional strategies will impose high level of extraneous load, thus both will lead to increased cognitive load. Increased cognitive load will result in inability of Kahoot to simplify complex subjects.

CONCLUSION

Kahoot is a novel formative assessment tool that is feasible and practical to make learning fun and enjoyable, thus motivate students to learn. Medical schools are recommended to start using Kahoot as an alternative tool of formative assessment to nurture students' learning.

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