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EXAMINING THE IMPACT OF GAME-BASED FORMATIVE ASSESSMENT ON STUDENTS' UNDERSTANDING AND PARTICIPATION IN A HUMAN-COMPUTER INTERACTION COURSE

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ABSTRACT

This study discusses an attempt to examine the impact of game-based formative assessment on the students' knowledge in a Human-Computer Interaction (HCI) course, which is a fundamental subject for Multimedia students. This course is important to expose them to the ideas of user interface and interaction design methodologies, skills, and values that are required for them to develop a practical interaction design system. The respondents in this research were 63 undergraduates who enrolled in an HCI course in a public university in Malaysia. An experimental research design was employed whereby the respondents were conveniently assigned to two groups; control (33)

and experimental (30). Eight paper-based formative assessments were given to the control group, while eight online game-based evaluations were given to the experimental group. The students' scores are recorded to assess their understanding of the learning content and their participation in the HCI classroom. A test was also administered at the end of the semester and utilised as a data collection tool to examine the effectiveness of the intervention in terms of student comprehension. The information was then gathered and analysed using descriptive and ANOVA statistical methods. The students' involvement was reflected through an opinion survey that was given to the students at the end of the semester. The findings revealed that students who participated in a game-based formative assessment shown greater understanding and involvement than students who participated in a formative paper-based evaluation, implying that introducing a scope of game-based formative assessments improved the understanding and participation in the HCI course classroom.

Keywords: Formative assessment, game-based, human-computer interaction, involvement, Kahoot!, understanding.

INTRODUCTION

Students perceived the learning process of the HCI course as a challenging undertaking because the content of this course relies upon theories regarding the user interface design of interactive systems. The students are exposed to theories involving interaction styles, psychological basis, principles and patterns for designing interfaces, methods and techniques for user-centred interaction design, interface design in different application areas, and design analysis from a user point of view. For a novice student who has no background in the design and development of interactive systems, this content can be viewed as abstract and has too much information to digest. Although the subject's content can be explained using various strategies by the facilitators, it is still unknown whether they can understand the content (Culen, Mainash & Finken, 2014). Furthermore, the assessment methods such as traditional paper-based quizzes and online quizzes used in this course are thoroughly based on the coursework marks. They do not serve as formative assessments to access the students'

comprehension and understanding of the content for each teaching and learning session. Students tend to address the format assessment method as boring.

Therefore, the objective of this study is to examine the effect of the game-based formative assessment such as Kahoot! on the students' understanding of the human-computer interaction subject and the impact of Kahoot! Formative assessments participation on the students' involvement in the human-computer interaction classroom.

BACKGROUND OF THE STUDY

The field of Human-Computer Interaction (HCI) is expanding in terms of both educational opportunities and professional needs (Mor, Garreta-Domingo, Hettiarachchi & Feraan, 2014). HCI is regarded as a critical field by universities and other educational organisations (Churchill, Bowser & Preece, 2013). As a result, in the last ten years, a growing number of educational institutions have included the HCI curriculum in their offerings (Mor et al., 2014). Ultimately, the HCI teaching and learning process aims to encourage students to pursue a degree in human-computer interaction, be enthusiastic about it, and gain new skills that will enable them to build the next generation that will have a beneficial impact on the world.

Currently, educators have been showing interest in applying different learning approaches and pedagogies in the HCI classroom, such as Studio-based learning (SBL), Problem Based Learning (PBL), Project-Based Learning (PjBL), and inquiry-based learning (Koutsabasis, Vosinakis, Stavrakis, & Kyriakoulakos. 2018). However, these strategies have been only implemented in the teaching and learning process and not been applied in the assessment process. Assessment, which can be defined as a question or exercise on a test, quiz, classroom observation, class discussions, quizzes, homework, test or other evaluation, is a part of the teaching and learning process, aim to bring improvement for the individual assessed (Shaw, 2015). It is argued that the assessment should be done for every teaching and learning session to assess students (Khairil & Mokshein, 2018) as this will provide evidence that may be used to assess the learners' understanding and

participation. Nevertheless, there is a distinction to be made between learning assessment and learning assessment. Assessment of learning is primarily concerned with providing marks as the primary measure of student performance. In contrast, assessment for learning is concerned with enabling students to fully comprehend their understanding and the goals they are pursuing through appropriate feedback (Khairil & Mokshein, 2018). This research will focus on the assessment for learning, particularly in the STIV2013-HCI course in UUM, a core subject for undergraduate students taking BSc. (Multimedia) and BSc. (Information Technology) program.

A preliminary investigation of the students enrolled in the HCI course revealed that they had difficulty visualising the abstract and difficult-to-understand concepts, theories, and content of human-computer interaction. A survey of the students' opinions revealed that due to the lack of formative assessment following the teaching and learning session, the students are confused whether they have grasped the correct content of the topic. They also revealed that they tend to misunderstand topics that appeared to be carried over into the rest of the course without formative assessment for every lecture session. As a result, the students find the course challenging to comprehend and demotivating. Furthermore, the theoretical assessment for the subject is only done twice using a boring method such as paper-based quizzes and online quizzes. These factors eventually exacerbate their lack of engagement, drive, and enthusiasm for learning. As a result, the students struggled with the subject content. In this context, students are only assessed via learning, which is primarily focused on providing marks on overall student performance, rather than assessment for learning, which allows students to fully grasp their understanding and the goals they are aiming for through appropriate feedback. Furthermore, these students report that employing a pleasant technology-based learning aid to understand the content-based subject makes them happy.

Technology has not only aided learning but has also shifted assessment into a new realm. Technology-enabled examinations can assist cut down on the time, resources, and interruption to learning that paper assessment demands (Gohl, Gohl & Wolf, 2009). Technology-based assessments can give a fuller and nuanced picture of a student's needs, interests, and talents than traditional evaluations, allowing instructors to tailor instruction. (West, 2011). Although technology falls into

many methods such as computer-assisted learning (CAL); computer-based learning materials (CBL); works; video; mobile application, simulation; multimedia; scientific visualisation and virtual reality (West, 2011), it is argued that games are one of the most effective methods to assess learning (Boeker, Andel, Vach, & Frankenschmidt, 2013)

Despite their apparent usefulness, teachers are still not widely using educational games to measure student learning results (Levine, 2014). According to research, teachers are more likely to utilise games to teach content than to analyse or grasp what pupils are learning, according to research (West, 2011; Boeker et al., 2013). Teachers are unlikely to use games to assess students, despite their rising use of games in the classroom, for a variety of reasons, including the fact that many games do not target critical learning objectives, are not designed to test students, and do not provide the type of information teachers require in a timely way (Mubaslat, 2012).

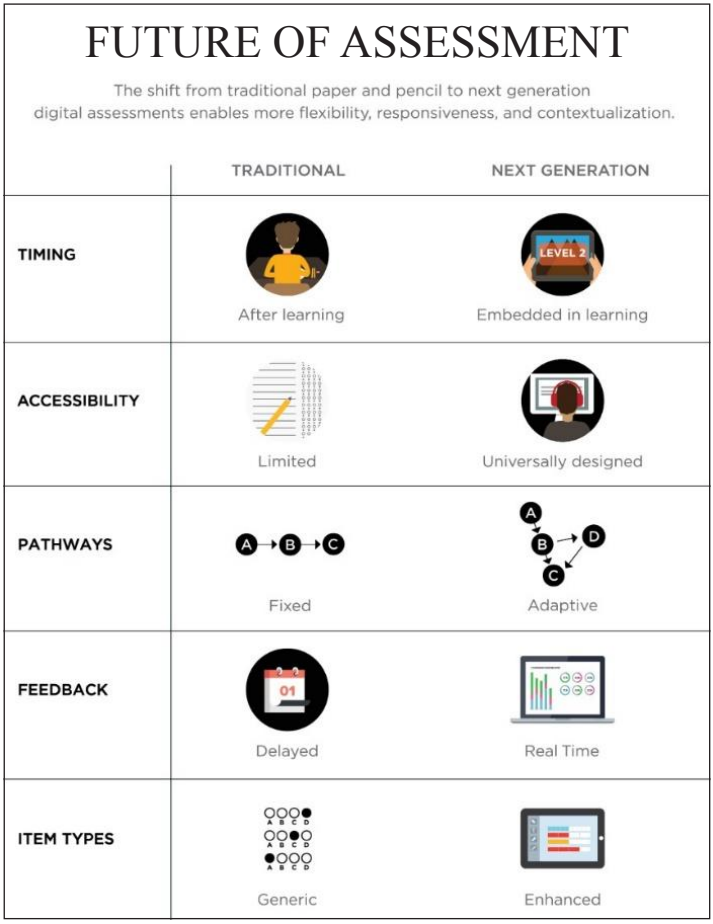
Proposed Intervention

This research proposes a game-based formative assessment approach to measure the students' understanding of each subtopic in the Human-Computer Interaction (HCI) course**.** The motivation of this research originates from a preliminary investigation done by the researcher on the students' understanding of the content after each teaching and learning session and the advantages of game-based assessment reviewed in past works of literature.

The instructor can see proof of students' understanding during the learning process and provide near real-time feedback with game-based assessment, which is impossible with traditional evaluations. Traditional evaluations take place after learning has taken place, with findings coming days or months later. Assessments, it is said, are more instructionally practical when they provide prompt feedback (U.S. Department of Education, 2010). The benefits of game-based assessment ensure that all students have the best chance to exhibit their knowledge and skills and their understanding. Figure 1 illustrates the comparison between traditional assessment and digital assessment, such as game-based.

Figure 1

Comparison Between Traditional Assessment and Digital



(Source: https://tech.ed.gov/netp/assessment/)

Game-based assessment can be a powerful tool for unlocking instructional methodology and fostering a student-centred learning environment (Licorish, Owen, Daniel & George, 2018). Using an existing gaming tool, the instructor can construct game-related performance challenges that are as intriguing and engaging as the game itself. Students' involvement, motivation, and interest in the learning topic would all improve due to this (Mart, 2011). It also

pushes the students to apply what they have learned, allowing them to assess their critical thinking abilities. Not only that, but game-based assessments foster a constructively competitive environment that encourages students to interact in an enjoyable manner (Mubaslat, 2012).

For this research, an online gamifying tool called Kahoot! will be used to create a game-based formative evaluation for every subtopic of the HCI module. It is a free and open-source internet programme that may be used at various levels by academics of all topics. It is not difficult to use, and it does not necessitate any special skills or equipment. The instructor can construct their questions based on the students' knowledge and abilities. It is simple to use and has all of the essential game components, such as points, a leaderboard, real-time feedback, and a reward. It is also enjoyable and competitive, which adds to its value. Research claims that using Kahoot! as both a learning and assessment aid (Cetin, 2018; Prieto, Palma, Tobias & Leons, 2019; Nguyen & Yukawa; 2019) improves students' motivation to learn as well as improves classroom dynamics, students' engagement (Licorish et al., 2018) and perceived learning (Piskorz, 2016; Plump & LaRosa, 2017; Pretorius, 2016; Wang, 2015).

LITERATURE REVIEW

Human-Computer Interaction (HCI) is a multidisciplinary subject that deals with engineering, science and social aspects. A significant part of the HCI courses in the computer and multimedia education curriculum is usability engineering (Moroz-Lapin, 2008). The research claimed that students mostly positively accept the science aspects of the HCI curriculum, such as the HCI principles, models and theories that accumulate the experience of the development of user interfaces but social context of use is often a challenging part of the course for technically-oriented computer-based students (Moroz-Lapin, 2008).

The HCI classroom facilitators are currently using a variety of learning methodologies and pedagogies, including Studio-based learning (SBL), Problem Based Learning (PBL), Project-Based Learning (PjBL), and inquiry-based learning (Koutsabasis & Vosinakis, 2012). Still, these approaches have only been used in the

teaching and learning process and not in the evaluation process. The evaluation approach in the HCI classroom is still the same as it was in the past, with paper-based or online quizzes and assignments (Culen, Mainash & Finken, 2014). Formal higher education does not exist without assessment (Gikandi, Morrow, & Davis, 2011). Classroom observation, class discussions, quizzes, assignments, and tests are examples of assessment activities (Black & Wiliam, 2006). There are two types of assessment; assessment of learning and assessment for learning (Khairil & Mokshein, 2018). Assessment of learning is generally concerned with providing marks as the primary measure of student success, whereas assessment for learning focuses on enabling students to fully comprehend their learning and the goals they are pursuing through appropriate feedback (CERI, 2008). In other words, summative assessment is a type of assessment for learning, while formative assessment is a type of assessment for learning. Overall, assessment can be considered a tool for improving educational quality because it can increase lifelong learning skills and boost performance in various educational settings (Nasri, Roslan, Sekuan, Bakar, & Puteh, 2010). It is incredibly crucial to have the appropriate assessment method for students (Khairil & Mokshein, 2018). Instead of memorising facts, students should understand what they are studying and master the abilities required to be a whole individual. Furthermore, this can be done using formative assessments.

Technology-based formative assessment is considered as having the ability to promote substantial changes in the way that learning occurs in Higher Education, according to the 21st-century education proposal (Pachler, Daly, Mor, & Mellar, 2010). Pachler et al. (2010) stated that to give significant impact on the students; the assessment should be based on critical strategies; (i) Engineering active classroom discussion in questions and learning tasks that elicit evidence of learning, (ii) Providing feedback that motivates learners forward, (iii) Clarifying and sharing learning intentions and standards for success, (iv) Activating students as in control of their learning and (v) Activating students as instructional which not only informative to instruction but also can be very engaging for the learner (Ray, 2016). It has now evolved into a new educational paradigm that is proliferating in Malaysian higher education institutions because of its numerous benefits, including automatic marking, high-quality feedback, and engaging discussions, as well as accurate and valid

assessment, economic and environmental benefits, and practicality and increased motivation (Khairil & Mokshein, 2018).

A variety of digital assessment tools may be used to assess students, including web assessments, e-portfolios, online quizzes, simulations, games, and questionnaires (National Academy of Engineering and National Research Council, 2006). Recently, applications such as Kahoot, PlayPosit, Socrative, The Answer Pad, College Paper, Quizziz and many more have been used as assessment tools. However, gamification is claimed to effectively assess millennial students who are digital natives (Shute & Ke, 2012). It can help motivate students and encourage students' participation (Visch, Vegt, Anderiesen, & Van der Kooij, 2013). Researchers have proved that this encourages critical and strategic thinking (Che Pee, 2011), engages students (Che Pee, 2011; Figueroa-Flores, 2016), and enhance learning retention (Jabbar & Felicia, 2016). One of the game-based applications that have been doing round proving its effectiveness is an online gamification tool called Kahoot!.

'KAHOOT!' is a gamified instructional tool that focuses on student motivation and participation. It is a fast-paced assessment tool that sounds like a "game show" and allows teachers to track their students' progress while they play a "game" (Licorish, Owen, Daniel, & George, 2018). Teachers can use a fun and innovative student response system that is more appealing than traditional student response systems because of its accessibility, cost, and user-friendly characteristics (Licorish et al., 2018). like typical student response systems, 'KAHOOT!' incorporates gamified aspects such as vibrancy, light-hearted music, and competition to keep students engaged throughout the game (Lin, Ganapathy, & Kaur, 2017; Mu & Paparas, 2015).

Gamification in 'KAHOOT!' can increase student participation by using popular video game methods (such as points, leaderboards, and badges), which have been demonstrated to entice and capture millions of video game players (Cameron & Bizo, 2019; Ismail & Mohammad, 2017; Nicholson, 2015). Gamifying pedagogical tools can increase and maintain engagement by using the same elements that game developers incorporate into their games to increase and maintain player engagement, thus increasing students' enthusiasm and allowing them to achieve their academic achievements and

goals (Yapc, & Karakoyun, 2017). Not only that, Kahoot! increases students' understanding of the learning content and helps them score better in their assessments (Law & Mahamod, 2021).

It has been discussed that teaching and learning based research should implement an action research design that involves planning, acting (implementing), observing (evaluating) and reflection (analysis) (Kemmis, McTaggart, & Retallic, 2004). There are three requirements for action research to incorporate the goals of improvement and involvement that characterise any teaching and learning based project: i) The project takes as its subject matter a social practice, regarding it as a strategic action requiring improvement, ii) The project proceeds through a spiral of cycles that include planning, action, observing and reflecting, each being systematically and self-critically implemented and interrelated, and iii) The project involves those responsible for each step of the activity, widening participation in the project gradually to include others affected by the practice but with the researcher maintaining collective control of the process (Kemmis, McTaggart, & Retallic, 2004).

METHODOLOGY

The purpose of this study is to see how effective the implementation of game-based formative assessment is in improving student knowledge in the Human-Computer Interaction classroom. This study employed an action research design that involves planning, acting (implementing), observing (evaluating) and reflection (analysis) (Kemmis, McTaggart, & Retallic, 2004). This study has been carried out for nine weeks to improve students' understanding of HCI content and investigate students' participation in the HCI classroom. This study adapted the methodology from Tripp (2005), which employs four main stages in order to accomplish the goal of the study, (i) Plan, (ii) Act, (iii) Observe, and (iv) Reflection.

The participants in this study were 60 undergraduates enrolled in a Malaysian public university's HCI course. Thirty respondents were randomly assigned to the experimental group, which was formatively assessed using Kahoot!, a game-based online assessment tool and 33 respondents were assigned to the paper-based formative assessment.

The instruments used for this study include eight sets of formative tests to measure students' understanding of the learning content; and an open-ended survey to measure the student's involvement in the classroom. The survey also recorded student's reflections on the use of Kahoot! as a formative assessment tool.

The students answered eight formative tests (one for each chapter - 15 questions each) for both intervention modes during the study. The question in the formative tests is similar between the two treatment modes. The students were also given a test at the end of the semester to demonstrate the intervention's success. All instruments used in this study were tested for reliability. The subject matter experts validated the formative questions and the test questions, while the feedback questionnaires' internal consistency was established by the computing alpha value using the Cronbach procedure.

All of the scores are taken into account to assess the students' comprehension of the learning content. Following that, the data was gathered and analysed using parametric statistical analysis. This study only employed these statistical analyses as this study's research objectives, only require simple parametric analyses such as t-Test and ANOVA.

FINDINGS

This section reports the statistical analysis and the reflection summary.

Statistical analysis

This study's data was analysed using descriptive and ANOVA statistical methods. The students' formative assessment scores and pre-test and post-test scores to determine their understanding of the learning topic were all assessed.

The students experienced the Kahoot! game-based assessment and answered eight formative tests (one for each chapter - 15 questions each) online. The students were given pre-tests before the intervention and post-tests after the intervention. The scores are obtained to measure the students' understanding. The statistical analysis of the formative assessment scores is depicted in Table 1.

Table 1 describes whether the students' formative assessment scores from both treatment modes are significantly different. The magnitude of the differences in the mean scores is in the range of 4.79 -6.79. The significant value for all the pairs is 0.00, which is less than 0.05, indicating a significant difference in formative assessment scores between the two groups. Hence, this means that students prefer to be assessed using Kahoot! as it encourages further involvement, and the student can better understand.

Table 1

Analysis of Formative Assessment Scores

	Mode	N	Mean	Std. Deviation	Mean Difference	Sig. (2-tailed)
FA1	Experimental - Kahoot	30	14.60	1.303	5.509	.000
	Control - Paper	33	9.09	2.898		
FA2	Experimental - Kahoot	30	13.80	2.524	5.467	.000
	Control - Paper	33	8.33	3.332		
FA3	Experimental - Kahoot	30	14.57	1.135	6.597	.000
	Control - Paper	33	7.97	3.015		
FA4	Experimental - Kahoot	30	14.43	1.455	6.373	.000
	Control - Paper	33	8.06	3.579		
FA5	Experimental - Kahoot	30	14.17	1.744	5.955	.000
	Control - Paper	33	8.21	3.286		
FA6	Experimental - Kahoot	30	14.77	.898	5.706	.000
	Control - Paper	33	9.06	3.010		
FA7	Experimental - Kahoot	30	14.10	2.023	4.797	.000
	Control - Paper	33	9.30	2.823		
FA8	Experimental - Kahoot	30	14.57	1.194	5.082	.000
	Control - Paper	33	9.48	3.261		

The ANOVA statistical analysis of the test scores is depicted in Table 2. Table 2 describes whether the students' test scores are significantly different. The magnitude of the differences in the mean scores is 8.176. The significant value of the scores is 0.03, which is less than 0.05, indicating a significant difference in scores between the two groups. Hence, this means that students who experienced the Kahoot! formative assessment obtained a higher understanding as they can comprehend and remember the course content much better from those who were formatively assessed using paper.

Table 2

Analysis of Test Scores

Mode	N	Mean	Std. Deviation	Mean Difference	Sig. (2-tailed)
Experimental - Kahoot	30	73.93	15.182	8.176	.031
Control - Paper	33	65.76	14.175		

Overall, the findings showed that Kahoot! is a motivating formative assessment tool to learn HCI.

REFLECTION: STUDENTS' FEEDBACK

All of the participants who had used Kahoot! for game-based formative assessment believed that it prompted good attention and focused in the classroom. Interacting with Kahoot! according to some, caught and sustained their participation in the HCI classroom and allowed them to take a break from the lecture and provide a point of distinction.

> *"Kahoot boosts up a good understanding of a topic at the end of each lecture and it is motivating for students to focus more in classroom. Kahoot can be an effective and efficient tool for quizzes. It is fun."*

While using Kahoot! was a fun exercise in and of itself, students reported it encouraged them to pay attention throughout the lecture. The usage of Kahoot! also encouraged students to pay careful attention in class to prepare for the Kahoot! and accurately answer questions.

> *"Kahoot is one of the online quiz that we use to play before to end of the class to measure our understanding and focus in that class. it is more fun when our lecture motivates us with some present for the top scorer or sometimes the 3 top student."*

The students also stated that engaging them in a fun activity allowed them to feel refreshed, and the use of Kahoot! also created richer variation in lecture delivery, enabling a moment of fun while engaging with lecture content in a light-hearted way.

"For me Kahoot has always been a fun method to learn. It is a method that makes students learn by having them answer questions to revise back what they have studied."
"I like the ways of teaching method, we can more concentrate in the class. Use of Kahoot in our face-to-face class in the end of the class makes me more interested in this subject."

Kahoot! was also described by the respondents as a one-of-a-kind lecture experience that is both fun and engaging to the learning process. Students said that studying using Kahoot! was a satisfying lecture experience that was fascinating and desirable compared to previous lectures. They also say that Kahoot! allowed students to communicate and engage better with the instructor.

"It was more fun, reliable and we had a better 2-way communication." (Student 1)
"My opinion about kahoot is very interesting. First thing it can make we play like a game with multiple question. Secondly, kahoot can boost our memory on what already we learn in class. Lastly, student can easily win and gain some gift from lecturer as a reward. Kahoot is the best platform for student." (Student 2)
"Using kahoot is more interesting than online class because lecturer still can make interaction with us. And the music of kahoot is funny." (Student 3)

Kahoot! encouraged students to participate more actively, challenging them to think critically, raising their involvement energy levels, and generating a lively classroom environment.

"It is a fun method on studying, while using dun method we won't easily get sleepy. We also can learn thing faster by doing activity by ourselves" (Student 4)
"In my opinion, kahoot gives a motivating factor to us. It also helps us to focus and revise back what have learnt, Kahoot is really enjoyment and fun to use." (Student 5)

Students said that using Kahoot! during lectures helped them recall not just previously presented content but also to grasp new viewpoints. They also stated that Kahoot! helped them learn more. They knew that there will be a Kahoot! assessment in class encouraged many

students to study and review the learning content to perform well in the game.

> *"Kahoot is a fun game in education which help in the understanding of the subject more clearly and help in boost memory of the subject."* (Student 6)
> *"Interesting, class with Kahoot will be fun and not bored. It can let students to absorb and received the important information easily."* (Student 7)
> *"It's a fun and effective way also to measure the understanding of students towards the topic.* Student 8)
> *"I think the use of Kahoot is suitable and easy to learn & at the same time, student can understand more about the topic."* (Student 9)

Participants were unanimous in their belief that Kahoot! could be used for revision, with the optimum use of the tool being to review lecture content and important concepts, with Kahoot! related course content being preferred above non-related course content. Kahoot! also provided a simple and clear comprehension of the course's key topics, which was then reinforced and enhanced by a class discussion.

> *"The use Kahoot is fun in class hour. and it may also help us recap what we have learn in class."* (Student 10)
> *"I love the use of Kahoot. I can do some revision when answer quiz."* (Student 11)
> *"The use Kahoot is more fun and interesting in class lesson, we can also know how much we learn and understand the lesson. It can also help us as a revision from what we learn."* (Student 12)

Kahoot! also provided students with the rapid feedback, allowing them to remedy their errors by knowing if they got an answer right or not and, more importantly, why. Exploring the responses and determining why they were correct or incorrect resulted in a better comprehension that increased participants' engagement and information retention.

> *"I think that, the kahoot using in face to face class is interesting. Because i can more understand the topic. After we playing the kahoot question, we can check which answer that we answered incorrect, so we can take noted or remember it."* (Student 13)

Despite the positive experience associated with the competitive nature of Kahoot's utilisation, two participants felt that the use of Kahoot! did not affect their learning experience.

> *"okay but maybe line not that good for example me, maybe will miss out"* (Student 14)
>
> *"I do not mind whatever ways that better for the learning process I agree."* (Student 15)

DISCUSSION

The findings of this study showed that Kahoot! which is a game-based learning platform, can also be used as a formative assessment tool in the HCI classrooms. It can be accessed via web browser and mobile, and it is uniquely designed to ensure that all students can participate in the classroom in a way that they are comfortable with. In this study, the students agreed that students who experienced the Kahoot! formative assessment obtained a higher understanding as they can comprehend and remember the course content much better from those who were formatively assessed using paper. Students also prefer to be assessed using Kahoot! as it encourages more involvement as the students feel engaged to learn and to win more.

Furthermore, Kahoot! game-based pedagogy caters to a variety of learning styles and modes. Kahoot! is also created for students with various learning needs, whether in a group or one-on-one environment, using images, visual hints (such as diverse colours and forms), and a simple, easy-to-read question and response style. This study agrees with Wang, Meng, and Saetre (2016), who stated that Kahoot! has been a game-assessment tool that aims to attract and motivate students through appealing graphical user interfaces and music and gamifying the whole student response experience.

Based on the analysis of the students' feedback, 'KAHOOT!' can increase participation in the students learning the HCI course. The students stated that they enjoyed the interactive activity more than a traditional lecture class with 'KAHOOT!' making learning more pleasurable (Ismail & Mohammad, 2017), and this also applies for the formative assessment process. Feedbacks from the students support that game-based learning such as Kahoot! can be used in the classroom

as a supplementary method to encourage student-centred learning and inspire students to be motivated. This study agrees with Iwamoto, Hargis, Taitano, & Vuong (2017), who stated that 'KAHOOT!' can enhance and improve high-stakes examination scores at the college and university level the students felt positive about their experience.

The results from this study also support other research (Cameron & Bizo, 2019; Özer et al., 2018) on gamification that incorporating gamified elements into a learning platform makes learning abstract and complex topics in Human-Computer Interaction course more desirable/manageable. Student engagement and enthusiasm with the game support the ideology proposed by other research (Iwamoto, Hargis, Taitano, & Vuong, 2017; Bicen & Kocakoyun, 2018) the best when what they are learning excites them.

CONCLUSION

Higher education institutions use learning technologies to encourage student motivation and engagement, with interventions ranging from lecture content to assessments, including exam revision. Educational games and gamification, in particular, are thought to aid in the cognitive, motivational, emotional, and social development of students. Kahoot! improves the students' understanding of the learning content and fosters engagement through gamification. In addition, it also enhances the students' motivation to learn because the courses that adapted game-based learning as one of its approaches are entertaining and allow active participation and meaningful learning. Students had additional opportunities to interact with the professor, their peers, and the lecture subject via Kahoot!. Students further said their aim to improve their attention and focus, and their involvement and engagement aided their learning in the course. Our findings imply that using educational games in the classroom can reduce distractions, boosting teaching and learning quality beyond what is available in traditional classrooms. However, larger-scale follow-up research is required to confirm these findings.

The outcomes of this study are likely to open up new avenues for lecturers, particularly those who will be teaching the Human-Computer Interaction courses, to use game-based formative evaluation

to increase students' mastery of the topic and to better understand their involvement in the classroom by examining their potential by providing immediate feedback using game-based assessment. This strategy will help students to stay engaged, thereby overcoming the limits of traditional teaching assessments. Instead of responding to standard assessments such as question and answer sessions and online quizzes, the students can participate in a fun classroom situation without feeling restricted or uncomfortable. In a nutshell, the findings of this study might just be successfully applied to a variety of classroom situations or subjects.

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