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"Go Kahoot!" Enriching Classroom Engagement, Motivation and Learning Experience with Games

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Abstract: Technology is being increasingly integrated as a part of teaching in view of enhancing students' engagement and motivation. Game-based student response systems in particular can motivate engagement, and ultimately, improve students' learning experience. In this paper we report on the outcomes of employing a game-based student response system, Kahoot!, in an Information Systems Strategy and Governance course at a research-intensive teaching university in New Zealand. In order to examine the efficacy of the system in engaging students during lectures, we conducted semi-structured interviews with students to learn about the extent to which Kahoot! contributed to better engagement and enhanced learning experience. We also explored students' views about Kahoot!'s influence on classroom dynamics, motivation and the learning process. Overall findings reveal that the deployment of Kahoot! enriches the quality of student learning in the classroom, with the highest influence reported on classroom dynamics, engagement, motivation and improved learning experience. We also learned that the use of games in the classroom can largely minimise distracting classroom behaviours and activities, and improve the quality of teaching and learning beyond what is provided in conventional classrooms (e.g., normal PowerPoint slides and chalk and talk).

Keywords: Game-based Student Response Systems, Kahoot!, Classroom Dynamics, Engagement, Motivation, Learning

1. Background and Research Questions

With mobile devices being ubiquitous and Bring Your Own Device (BYOD) being almost widespread in contemporary classroom teaching, technology is increasingly being integrated into many aspects of classrooms to facilitate assessments, enhance student engagement, motivation and learning. Technology is also frequently used to render difficult topics more engaging and interesting (Prensky, 2001). In supporting such efforts, there has been a shift from student response systems (SRS) such as "clickers" and "zappers" to more contemporary game-based student response systems (GSRS) such as Kahoot! and Socrative systems (Wang, 2015). GSRS are game-based systems where the teacher designs interactive quizzes projected as regular lecture slides to enable students to respond to questions using a web browser on their digital devices in a game-show like situation. Quizzes may be enhanced with images and videos, and the teacher is able to control the pace of play. Students are awarded points for answering questions correctly, and the timeliness of correct responses also impacts the points awarded. Students' points are displayed on the screen as in game shows, and this drives students to get to the top of the leader board.

The utilisation of games to support engagement in a range of academic settings, including for learning Computer Science, Mathematics and Physics was found to enrich student learning experience (El-Nasr & Smith, 2006). Similar to other mobile device teaching tools, GSRS require participants to activate relevant previous knowledge, and assess their performance as they play and learn content of a subject (Papastergiou, 2009). Further, the multi-sensory, experiential nature of games also enhances students' problem-solving and critical thinking skills (e.g., McFarlane, Sparrowhawk, & Heald,

2002), as they cannot advance to the "next level" without attempting to answer questions.

Early research shows that integrating GSRS (e.g., Kahoot!) into regular classroom lectures contributes to improvements in student engagement (Wang, 2015). In addition, our initial observations during Information Science lecture sessions over the past two years suggest that such tools excite students to actively engage in lectures and contribute to the learning environment. Furthermore, consistent with previous research, GSRS enhance positive classroom dynamics (Rosas et al., 2003) and improve students' interactions with their peers and lecturers. Also, GSRS can motivate those students who may not normally participate in class discussion (Wang, 2015). GSRS were also reported to improve overall class attendance (Cardwell, 2007), and lecturers also found GSRS to be useful teaching tools in supporting personalisation of learning (Wang, 2015).

Despite increasing utilisation of GSRS, it remains unclear *the extent to which* GSRS can improve learning beyond what would be expected from conventional teaching methods. In addition, it is still unknown whether or not GSRS can improve students' academic performance. For instance, a meta-analysis revealed that, in over half of the studies investigated, students' performance did not significantly differ between the use of SRS and traditional learning methods (Randel, Morris, Wetzel, & Whitehill, 1992). Educational games are activity-driven learning tools that often require students to complete special "missions" in order to advance their learning. Until recently, educational games have only supported engagement, with limited understanding of their contribution to improving academic performance. Students can at times learn the correct actions and answers through trial and error rather than by actively reflecting on their learning (Kiili, 2005). There is also a body of research suggesting that high performing students are reluctant to use games as legitimate learning tools (Squire, 2005).

On the contrary, Papastergiou (2009) found that games improved students' knowledge of computer memory systems to a greater extent than other computer-mediated learning tools, namely, educational websites. This may be due to the experiential nature of GSRS, which likely enhances learning for (at least) two main reasons. Firstly, GSRS induce a "flow" experience where the students become completely absorbed in the goal-driven task expected of them (Kiili, 2005). In other words, students' experiences "flow" when the games' interfaces are user-friendly and do not detract attention from the task, and when their abilities match the skill level of the game (Kiili, 2005). Secondly, games encourage the students to collect data, test their own knowledge, seek feedback, draw conclusions and make generalisations so that their knowledge is applied to future learning situations (Kiili, 2005).

In addition to enriching learning, the effectiveness of GSRS depends on whether students perceive the games as appealing, accessible, useful and of high quality. Papastergiou (2009) also found that students rated GSRS as more appealing and more valuable as an educational tool compared to other performance-tracking educational websites that contained the same content. In spite of a small "wear off effect" of long-term GSRS use on student communication and enjoyment (Wang, 2015), students who continued to use GSRS throughout the semester reported positive impacts on learning and engagement similar to the excited new users. Students also commented that, even after a whole semester of using GSRS, they were still motivated to do additional study to prepare for the weekly quizzes.

The simple Likert-scale measures (on their own) that were previously used for GSRS evaluations are not necessarily adequate for understanding the complexities in human behaviour, and particularly those related to students' engagement, motivation and learning (e.g., Ke, 2009). The literature suggests that exploring users' experience with game-based technology may be better suited to qualitative survey-based approaches rather than quantitative measures (Nacke, Drachen, & Göbel, 2010). Although Wang (2015) utilised GSRS Likert-scale evaluations with students' open-ended comments, the data were only analysed quantitatively, and thus, it remains unclear whether semi-structured interviews were conducted to generate answers to specific questions, necessitating further exploration of whether students' perceptions of GSRS remain the same or can change over time. Finally, the Likert scales were also not always consistent with students' open-ended comments (Wang, 2015). For instance, the positive effect of GSRS on communication reduced over time, but students explained this was because of impending assessments, and they wanted to focus more on the quiz content than communicate with other students. There is thus need for exploratory studies to unpack *if* and *when* GSRS tools help, in support of our understanding of classroom dynamics and enhance students' engagement, motivation and learning.

We broadly conceptualised classroom dynamics as the interaction between students and lecturers. Student engagement relates to the level of attention, curiosity, focus and interest that

students show during the course. Motivation is the persuasion to be engaged and interact in the classroom. Learning is defined as the knowledge and skills that students attain that is directly attributed to their involvement and participation in the course.
Overall our research aims to contribute to the better understanding of accrued benefits of using GSRS in learning, and to gauge the extent to which the use of Kahoot! can enhance students' learning experience. More specifically, our objective was to understand how students experienced the use of Kahoot!s and to explore the extent to which this interactive technology influences classroom dynamics, engagement, motivation and learning. In our study we addressed the following four research questions:

RQ1. What effects does Kahoot! have on classroom dynamics?

RQ2. Does the use of Kahoot! influence students' engagement, and how?

RQ3. To what extent does the use of Kahoot! influence students' motivation towards learning?

RQ4. How does the use of Kahoot! enrich learning according to students' experiences?

2. Methods and Procedures

We employ a qualitative approach to address the four stated questions. We believe that a qualitative research approach is relevant to utilise in this study because the phenomenon being studied is not easily distinguished from the context in which it is observed (Yin, 2013). Using an explorative case study, we intend to unravel complex perceptions and issues relating to the use of Kahoot! in the context of students' engagement, motivation and learning.

The game-based student response system (Kahoot!) was used as a part of a third year course on Information Systems Strategy and Governance (INFO322) in the second semester of 2016 (between July and November). This tool was used in four (4) different ways during seven (7) different lectures, with a duration of about 30 minutes on average (students could also play Kahoot! outside of the classroom). These include: to quiz students on various topics to understand their competence before tailoring lesson plans, for exploring students' knowledge of topics after they were delivered in lectures, to help students to validate their comprehension and understanding of topics by having them design their own Kahoot! assessments which were then collectively played, and for fun where the focus was on topics unrelated to the course (e.g., sports). Moreover, the Kahoot! game environment was designed with many interactive features (including suspense music), where students used mobile devices (smartphones, tablets and laptops) to join the games and answer questions, and responses to their choices were visualised (illustrated in Figure 1).

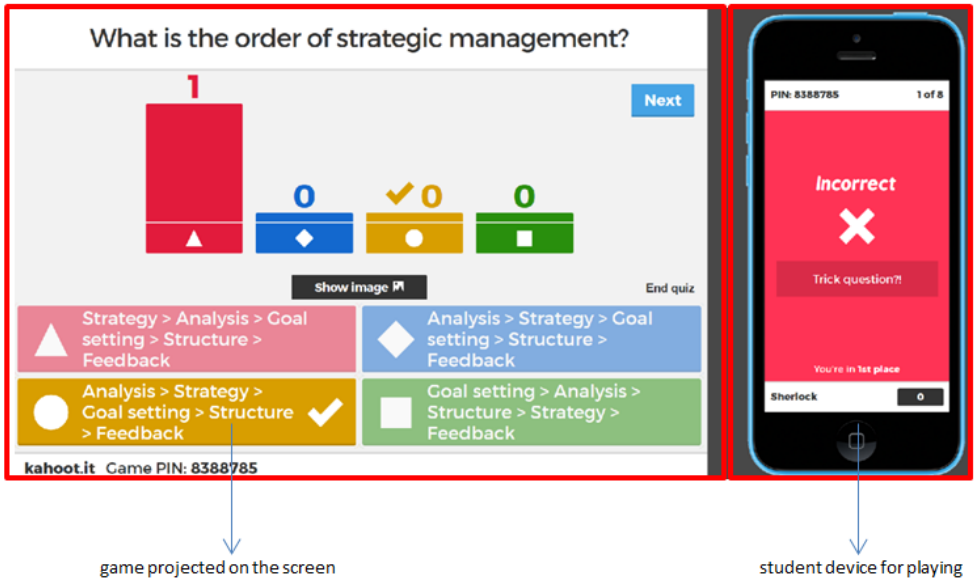

Figure 1. Game show interface projected on screen and on mobile device

2.1. Sampling and Participants

At the end of the course students were interviewed using a semi-structured approach. Purposive non-probability sampling was used to recruit students enrolled in the course. The study was announced and its purpose explained during the final lecture. The study received human and behavioural ethics approval from the university in which the study was conducted.

Fourteen students (10 male, 4 female) agreed to participate in the study. The sample size is deemed adequate for the chosen (purposive) sampling method as the possible pool of participants is already restricted (Marshall, 1996). Students agreeing to participate were asked to spare 20 minutes of their time for the semi-structured interview where they were asked questions relating to the use of "Kahoot!" during the course (interviews took between 15-20 minutes). The questions were focused on understanding students' experiences using Kahoot!, and the tool's influence on classroom dynamics, their engagement, motivation and learning. Students were also asked to give suggestions for alternative uses of "Kahoot!", and describe their general experience with the tool. Sample questions included: "How do you feel about the changes in the INFO322 classroom dynamics brought about by Kahoot!?" and "Do you feel that Kahoot! increase/decrease your engagement during the INFO322 course, and how did it increase/decrease?".

2.2. Data Processing and Analysis

Students' responses to the interviews were transcribed by the second author, i.e., verbatim. The transcripts were identified by author ID, interview time, questions and responses, and students were treated as the units of analysis. Thereafter, our analyses of the content were performed.

We adopted an inductive (bottom-up) approach to content analysis to test whether clear themes relating to classroom dynamics, engagement, motivation and learning appeared in the data (Patton, 1990). The procedure involved open coding where the interviews were read and re-read for familiarisation and initial codes were identified based on explicit, surface-level semantics in the data, rather than implicit responses and preconceptions (see Braun & Clarke, 2006). Through axial coding, codes were recombined and connections were formed between ideas. Then, we used thematic mapping to restructure specific codes into broader themes. Finally, following Braun and Clarke's (2006) selective coding procedure, the resulting themes were refined and organised into a coherent, internally consistent account, and a narrative ("story") was developed to accompany each theme. Themes were extracted from answers provided in response to interview questions, which targeted understandings around *classroom dynamics*, *students' engagement*, *motivation* and *learning.*

Descriptive statistics were used to summarise participants' demographics, including the gender distribution (noted above), ages, years of study, hours spent studying and performance in the course. Performance was measured based on coursework (i.e., case critique, case study and class project) and final exam grades, where students tended to perform better in the former assessment. Our summary statistics show that overall students' average age was 21.4 (median=21.5 and Std. Dev.=1.3), and they had completed close to 4 years of study (mean=3.4, median=4, and Std. Dev.= 0.8).

We observed that students spent around 6 hours a week studying for the course (mean=6.1, median=6.0, and Std. Dev.= 2.7), their performance in coursework averaged 81.7% (median=81.2 and Std. Dev.=8.8) and for exam 73.4% (median=76.1 and Std. Dev.=15.2). On balance, there were no statistically significant differences across gender; however, females tended to be slightly older than males (mean 21.8 versus 21.2), males were studying for slightly longer and spending more hours each week on the course (mean 3.5 versus 3.3, and 6.3 versus 5.8, respectively), and females performed slightly better in coursework but poorer in the final exam (mean 82.1 versus 81.5 and 72.4 versus 73.8 respectively). Of note here, however, is that there is a disparity in the number of observations for males and females, so these statistics are not used to examine statistical significance between these two groups.

3. Findings

Our aim was to examine the extent to which Kahoot! influenced classroom dynamics, students' engagement, motivation and learning. Findings from the analysis revealed four major themes related to students' experience in the use of Kahoot! in the classroom: (1) attention and focus, (2) interaction and engagement, (3) learning and retention of knowledge, and (4) fun and enjoyment. Three themes were prevalent in the responses of the 14 participants. Moreover, the theme of fun and enjoyment was identified in the responses of 12 of the 14 participants. We examine our outcomes for each of the four themes in Sections 3.1 to 3.4, and then consider how the other details collected for respondents' were related to these themes in Section 3.5.

3.1. Attention and Focus

All participants (14) seem to agree that the use of Kahoot! triggered positive attention and focus in the classroom. Some suggested that interacting with Kahoot! captured and sustained their attention, as well as enabled them to take a break in the lecture, and provided a point of difference.

Attention: While the use of Kahoot! itself was an enjoyable activity, students said that Kahoot!s motivated them to pay attention during the lecture. The deployment of Kahoot! also motivated students to closely examine lecture material in order to prepare for the Kahoot! and answer questions correctly.

> *"I guess it keeps you more aware in a way but you've got to listen throughout the lecture to know what the answer is in Kahoot! which is also a good thing. So you're always focused if you want to do well in Kahoot!"*

Having a break: A major barrier to staying focused in class was the length of the lecture as well as the time of day in which the lecture took place. Our analysis revealed that 9/14 participants highlighted the importance of having a break during lectures in order to balance and sustain a desirable level of attention during lectures. They reported that Kahoot! facilitated breaks in positive ways. Ten of the 14 respondents described staying focused in a 2 hour lecture as challenging, with some describing the experience as tedious or boring. Taking a break to engage in a fun activity allowed students to feel refreshed, providing timely relief at the halfway mark of the lecture and re-energizing students for the second hour. In addition to facilitating breaks during lecture, the use of Kahoot! also created richer variation in lecture delivery, enabling a moment of fun while continuing to engage with lecture content, only in a more light hearted way.

A point of difference: Participants referred to Kahoot! as a unique lecture experience that is enjoyable and stimulating to learning. Compared to engagement in other lectures, students mentioned that learning with Kahoot! was a rewarding lecture experience that is captivating and desirable.

> *"What's been good is that it was different… it allowed people to sort of sit back and go well this isn't how lectures usually run. So it did capture everyone's attention straight away."*

3.2. Interaction and Engagement

Our analysis suggest that Kahoot! gave students more opportunities to interact and engage with the lecturer, peers and lecture content by providing a fun platform on which to engage. All 14 participants reported that Kahoot! positively impacted engagement in the class, and 13 of the 14 participants said that Kahoot! increased their interaction and involvement in the lectures. Key points that emerged from the data were the importance of discussions, competition and anonymity.

Interaction and discussion: Participants reported that the use of Kahoot! fostered interactivity and engagement during lectures, through answering questions, participating in quizzes, and discussions triggered by Kahoot!. The use of Kahoot! encouraged wider participation in class as opposed to conventional classrooms where discussions are often dominated by a few extraverted students. The wider student participation in the class also fostered deeper engagement in the learning environment.

> *"Kahoot! gives me a platform that I can express what I think … even though it's silent … I still give ideas"*

Kahoot! fostered wider and active student participation, and yet provided students with the opportunity to retain their most desirable personal choice of participation. Participants reported that when engaging with Kahoot! they interacted more with peers around them and with the lecturer during and after lectures than they normally would in any other lecture. Participants pointed out that with Kahoot! in the classroom, they could decide on the level of interaction that they felt comfortable with, either participating anonymously or overtly with friends, other classmates, the lecturer or with the whole class.

> *"Yes it made it more interactive. I supposed I don't talk in any other class … [I talked] with my classmates more than the teacher. I probably wouldn't have volunteered any information to the teacher. But I definitely did have more discussions in terms of the actual content with people around me than I did in other classes"*

Competition: Nine participants discussed the competitive element of Kahoot! in relation to their interaction and engagement. Many respondents liked the competitive aspect of Kahoot!s, seeing it as a motivating factor to participate, encouraging them to think critically, increasing their participating energy levels and creating a lively classroom dynamic. Competition was viewed as a strong motivator, with one respondent describing how students like to 'perform' and another expressing their motivation to reach the top of the scoreboard and be the best in the class. Having a desire to win encouraged many students to prepare beforehand and engage with the material. It also seems to have been an icebreaker for many students, encouraging them to interact with their peers.

> *"…it was almost a sense of, not just competition, I want to be the best, but also comradery, hey do you think it's also the square, oh I hit the wrong one what did you go for?"*

Despite the positive experience associated with the competitive nature of Kahoot!s' utilisation, two participants felt that the use of Kahoot! had a negative competitive effect on their learning experience. They mentioned that negative aspects of competition came into play when students focused more on the competition and having fun rather than learning. In their desire to compete, some students rushed to answer questions, not taking the time to understand the questions or the answers.

> *"I enjoyed it, I think towards the end we probably all got a bit distracted with names and being competitive, I think sometimes you lose sight of trying to learn new things because you are just trying to win and have fun with friends instead of learning"*

Anonymity: While viewed as a negative aspect of participation in technology mediated learning environments, allowing anonymity can foster deep and enriched participation. Providing anonymous participation in a learning environment can encourage wider participation as it inculcates a sense of safety and privacy (White & Dorman, 2001). The way Kahoot! was used in the course allowed students to enter a name of choice into the system each time they participated. Students could decide if they wished to remain anonymous or identify themselves. Anonymity allowed students' to feel safer when responding to questions. It also allowed students to focus on comparing the content of Kahoot!s and differences of opinion, rather than comparing students' aptitudes. This encouraged participation as students were able to take part without feeling that they were being judged for answering correctly or incorrectly. Several respondents described funny names within the Kahoot! adding positively to the element of fun and social learning in game-based environments (Squire, 2011). However, this also had the potential to shift the focus away from learning as students became distracted and no longer took the Kahoot! seriously.

> *"…so because it's anonymous it never creates conflict … so if the system is anonymous that's good for students."*

3.3. Learning and Knowledge Retention

Nine of the 14 participants stated that Kahoot! was a useful learning tool and all 14 described Kahoot! as having a positive influence on their learning. Throughout the interviews participants made positive references to how Kahoot! supported their learning. Engaging with Kahoot! during lectures helped students not only to remember previously covered material but to understand new perspectives and increase their knowledge. Knowing that there would be a Kahoot! in class also motivated several students to prepare and review material in order to do well in the Kahoot!. In particular, students

enjoyed Kahoot!s that were relevant to the course, explored complex concepts and offered insight into applications of theory. Key benefits that participants discussed were how Kahoot!s aided revision, generated discussion and helped them to retain knowledge.

> *"When you get a question it does help you, you've got to think about the answer, you've got to look at lectures to prepare for it… so that's part of revision as well"*

Revision: Participants felt strongly that Kahoot! could be used for revision, with 12 participants seeing Kahoot! as a useful revision tool. In fact, three participants had used Kahoot! as a revision tool for exam preparation. Participants commonly felt the best use of the tool was to review lecture content and key topics, with Kahoot!-related course content favoured over those unrelated to the course. By repeating the content in a novel way through Kahoot!s, students felt they were more likely to remember the concepts. In particular, participants mentioned Kahoot!s being useful for allowing a deeper understanding of theoretical concepts. Kahoot! also offered a brief and concise understanding of the basic concepts in the course, which was then reinforced and enriched by a class discussion that encouraged more in depth thinking.

> *"It helped with the revising what we'd already been taught more so than actually learning the stuff because you were already asking questions about things you'd already taught us [and] I guess that does help in the long run of actually understanding"*

Discussion: Participants' responses indicated that the discussion generated by Kahoot! was often where the most valuable learning took place. Specific benefits to post-Kahoot! discussions provided perspective, highlighted diverse opinions and allowed students a chance to evaluate their knowledge in comparison to other classmates. Kahoot! and the following discussion also gave students feedback to immediately correct their own mistakes, knowing if they got an answer right or wrong, and more importantly, why. Exploring the answers and understanding why they were right or wrong generated a deeper understanding that strongly aided participants' engagement and retention of knowledge.

> *"The Kahoot! itself almost seems like a fun tool to get people back engaged and then the conversation afterwards is where the learning actually occurs. You're not actually learning from it directly but more indirectly from the discussion afterwards"*

Increasing and retaining knowledge: Six participants mentioned that Kahoot! helped them remember information during and after class. A few students also felt that Kahoot! added to their knowledge, as when new information was introduced they were more likely to remember it through a Kahoot!. In terms of knowledge retention, respondents appreciated that it was a quick and simple way to refresh their memory and continue to engage with the material. Respondents indicated that within the two hour lecture a lot of material was presented to them, making it hard to retain key concepts and facts. Kahoot!s supported students to re-grasp and retain key points from within the lecture, providing a reminder of what was covered. Participants also noted that they were more likely to remember Kahoot!s that they got wrong, as they had to consider why they got the question wrong and seek to understand the correct answer.

> *"It's often good to go back because then ones you got wrong, you remember them because you are like oh I got that one wrong and it's easier to remember them"*

3.4. Fun and Enjoyment

As a game-based student response system, fun and entertainment lie at the core of Kahoot!. The data showed that respondents enjoyed the Kahoot!. Twelve participants specifically pointed out that Kahoot! was fun. The element of enjoyment and fun underlies the positive aspects of all three aforementioned themes. However, fun and enjoyment were also alluded to as being a contributor to several negative impacts of Kahoot!.

> "*It was a positive interest … it wasn't a standard boring lecture where you could sit there and read the notes later on."*

The firm preference to using Kahoot! among participants was attributed to the game features. Participants said they enjoyed the game, they liked the use of it in class, and they enjoyed the course because of the Kahoot!. Further, the aspect of fun and enjoyment seems to have helped a number of students overcome barriers to interaction that they face in a typical lecture environment. Kahoot!s as

an energetic, fun, class-wide activity (that didn't require students to identify themselves or speak in front of the class) served as an ice-breaker for many respondents.

> *"It was just a fun way of interacting and learning the stuff and seeing if you knew your stuff with the quizzes and stuff for me that was useful"*

That said**,** two (2) participants reported a mixed response, and one (1) of the two participants felt the aspect of fun had a negative impact. Throughout the data it is evident that striking a balance between fun and learning is vital to effectively using Kahoot! as a valuable tool in the classroom. It seems as though participants reported negative impacts when the focus shifted too much in either direction. Respondents specifically described whacky or funny names in the Kahoot!s as sometimes distracting. They also felt that Kahoot!s involving guessing were purely for the sake of having fun and did not contribute to their learning. Only one participant specifically mentioned that they enjoyed fun 'off-topic' Kahoot!s, with most participants feeling such Kahoot!s were irrelevant and an inefficient use of class time.

> *"It didn't feel directed enough … I was kind of like why are we doing this, it just seemed like a random fun activity… I mean it's fun but there's not point to it in the grand scheme of things."*

3.5. Correlational Analysis

To supplement our qualitative results trends, we tested whether the associations between participants' demographics, overall performance in the course and perceptions of Kahoot! were statistically significant. Pearson's correlations revealed that participants' gender did not significantly correlate with the other demographics and performance information collected – (e.g., gender, year of study), study habits (lecture and course preparation time), or overall course grade. However, a larger sample size is required to ensure that future quantitative analyses have adequate power to obtain significant effects. Participant age did not correlate with demographic factors or study habits; however, older students were more likely to emphasise the effects of Kahoot!'s influence on their attention and focus during lectures, $r = .60$, $p < .05$. In the absence of an association with study habits, rs = -.53, -.17, ps > .1, year of study positively correlated with perceptions of Kahoot!'s influence on interaction and engagement, $r = .60$, $p < .05$, which further supports the long-term value of Kahoot! and other GSRSs in higher education. That said, this outcome somewhat contradicts Squire's (2005) findings, as more qualified students in this work consider Kahoot! relevant and useful to their learning than their lesser qualified counterparts. Perceptions of Kahoot!'s influence on attention and focus was not significantly related to length of study, weekly lecture preparation and overall course preparation, rs = -.08, -.49, .26 respectively, ps >.05. However, consistent with our findings above, perceptions of elevated attention and focus during Kahoot! use positively correlated with perceptions of increase learning and knowledge retention, $r = .58$, $p < .05$. This finding provides support for Kahoot!'s overall positive effects on learning, notwithstanding our relatively small sample size. Finally, students' perception of Kahoot!'s positive influence on fun and enjoyment correlated with their level of interaction and engagement when using Kahoot! during lectures, $r = .61$, $p < .05$.

4. Summary and Implications

RQ1. What effects does Kahoot! have on classroom dynamics? We observed that Kahoot! gave students more opportunities to engage with the lecturer, peers and lecture content by providing a fun platform on which to engage, in a way shifting the classroom dynamics. This was particularly different to what students experienced prior to these lectures, and in other courses. Our findings substantiate previous research in support of the use of Kahoot! in supporting our understanding of classroom dynamics, enhanced lecturer-student interactions, and more constructive discussions with peers (Rosas et al., 2003; Wang, 2015). Also consistent with Wang (2015), anonymity was mentioned as noteworthy in facilitating the less willing students. However, contrary to findings of previous research, Kahoot! use led to excessive competition which invoked negative feelings at times.

RQ2. Does the use of Kahoot! influence students' engagement, and how? Students felt that Kahoot! captured their focus and interest during the course, but was also timely for allowing breaks.

This was particularly necessary for the longer lecture time that was instituted. In the same vein, the need to be attentive to perform well in Kahoot! helped students to maintain interest in the lessons during lectures. Their willingness to perform was also influenced by the level of anonymity afforded by Kahoot!, which allowed students to remain focussed on comparing the content of Kahoot!s and differences of opinion, rather than comparing other students' aptitudes. This further emphasizes the importance of GSRSs for monitoring one's knowledge through feedback and discussion, encoding and storing this knowledge for future use (e.g., Ke, 2009; Papastergiou, 2009). These findings also somewhat contradict the idea that students only learn through trial and error when using GSRSs (Kiili, 2005).

RQ3. To what extent does the use of Kahoot! influence students' motivation towards learning? Our outcomes show that Kahoot! motivated students to be engaged, and encourage interaction in the classroom. Students were motivated to be attentive on the backdrop that they wanted to perform well in Kahoot!s. This in turn motivated students to engage with the lecturer, peers and lecture content. Kahoot! also motivated competition in the classroom, where students were driven to see their names at the top of the leader board, and thus, were more attentive during lectures and related discussions. These effects of enhanced attention and "healthy" competition are consistent with Wang's (2015) findings.

RQ4. How does the use of Kahoot! enrich learning according to students' experiences? Student conceded that Kahoot!s' use in the course had a positive impact on the knowledge and skills they attained. Students noted that the drive to increase their attention and focus and interaction and engagement strongly supported their learning in the course. This supports previously documented positive effects of GSRS use on learning (Papastergiou, 2009). When students did not perform well in Kahoot!s, those specific Kahoot!s were used to drive revision efforts, in view of overcoming learning deficiencies. In addition, Kahoot! offered students the opportunity to focus on specific relevant content, when a large amount of materials were delivered in lectures, which, again, is consistent with Wang's (2015) findings. However, as student assessment approaches, Kahoot! may play more of a supporting role in the revision process as students may focus more on studying lecture content than interacting with students and the lecturer.

On balance, Kahoot!s with the highest impact on classroom dynamics, student engagement, motivation and learning seems to be those that focussed on relevant course topics, and where there is little use of excessively distracting names and students' behaviours. In fact, consistent with Papastergiou's (2009) findings, students noted that Kahoot! improved classroom dynamics, engagement, motivation and learning beyond what would be expected from traditional teaching methods (e.g., normal PowerPoint slides and chalk and talk). However, we were not able to quantitatively examine such differences with the data collected; we hope to do so in future work. The themes identified support the previous studies that have found a positive effect of GSRS on, for instance, classroom dynamics (Rosas et al., 2003), learning, motivation, social interaction (e.g., Papastergiou, 2009; Wang, 2015), attention (e.g., Kiili, 2005) and willingness to prepare for class (Wang, 2015).

In terms of our contributions in this work, this study shows strong rigour interpreted through the element of credibility because we provided a systematic procedure for data coding and thematic extraction that researchers can follow in the future (Cope, 2014). The findings of this study also reflect high transferability, as our results have implications for how Kahoot! and similar GSRS (e.g., Socrative, Quizlet and Buzz!) can be successfully implemented into university lectures in the future. The results of the present study also provide guidelines as to when and for how long Kahoot! can be a useful learning tool.

Our future research will involve a large scale deployment of Kahoot! to examine the efficacy of this tool in enhancing student learning outcomes, using quasi-experimental design as well as exploring the experiences of teachers in using Kahoot! in enhancing their teaching effectiveness. We also plan to administer a web-based survey to gather quantitative evidence to triangulate our outcomes, and particularly those around the specific aspects of GSRSs that contribute to the enrichment of learning over the use of the 'chalkboard' or 'PowerPoint slides'. Furthermore, there is scope to correlate our outcomes with those provided by learning analytics tools.

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