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Let's Kahoot! Anatomy

Utilicemos Kahoot! Anatomía

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SUMMARY: Anatomy education in medical schools has always been considered demanding, as students need to learn and remember vast amount of information about the human body. Since ongoing technological innovation, is changing how humans interact with information, integrating the web in anatomy education can provide students a way to revise what they have learned in an interactive and competitive means. There has been research on the use of game-based response systems to engage learners during lectures; however, a significant gap exists in demonstrating the value of game-based learning to motivate medical students learning anatomy. This study aims at revealing the effects of using mobile phones and a game-based classroom response system as a closure activity to foster anatomy learning. To that end, 45 medical school students were given a Kahoot! quiz at the end of each anatomy lecture during two semesters. Higher attendance and participation and more focused and engaged students in class have been the observed benefits of the application. The findings suggest that game-based response systems can be used in core subjects like anatomy education as a closure activity.

KEY WORDS: Mobile learning; Anatomy education; Game-based classroom response systems; Closure activities.

INTRODUCTION

It is not difficult today to consider the improving effect of technology use in education when even toddlers are more capable of playing with mobile devices than many aged individuals. There is a new population emerging from young people born after the time when digital technologies began to be embedded in social life and whether we call them the Net generation (Tapscott, 2009), or Digital Natives (Prensky, 2009) or Millenials (Oblinger & Oblinger, 2017), their approach to learning has definitely changed. The new generation requires rapid access and quick rewards, is impatient with linear thinking and displays a novel capacity for multi-tasking (Jones *et al*., 2010).

Technology has also been involved in medicine with an uttermost speed, which brings the need for properly educated and skillful professionals. This inevitable situation necessitates accretion of the changes in the way of teaching in medical education. To that end, some medical schools have included the technology in their educational curriculum to be used by students and professionals. As Briz Ponce *et al*. (2014) mentioned, medical students have to be prepared as the physicians of a digital future beginning from the medical school.

Our aim is not to present the positive effect of mobile technology use but to show its motivational effect in a group of medical students to improve the classroom environment and to assess how mobile technology changes their looking toward anatomy which is one if not the most challenging subjects in basic medical sciences. We suggest here an alternative closure activity to strengthen understanding and enhance learning.

Background of the Study: Research on the use of mobile devices (phones, tablets, etc.) in education has gained currency in recent years; varying from improving foreign language (Kadyte, 2003; Thornton & Houser, 2005; Kam *et al*., 2009; Saran *et al*., 2009) to teaching and learning mathematics (Yerushalmy & Ben-Zaken, 2004; Zhao & Okamoto, 2008; Chinnappan, 2009); from teaching ethnography and design (Rost & Holmquist, 2008) to visual arts education (Brown, 2009). The benefits of mobile devices in education can be listed as fast accessibility, efficient use of time, portability, and increase in learning opportunity (Briz Ponce *et al*.).

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Mobile learning is the intersection of mobile computing and e-learning solution when accessible resources, strong search capabilities, rich interactions, powerful support for effective learning and performance based assessments are considered (Pastore *et al*., 2006). In the circumstances, scholars in medical education have been keen to incorporate the use of such devices in teaching and learning activities. Some medical schools adopted the mobile devices as a new tool in order to allow the students to achieve their maximum potential (Briz Ponce *et al*.). Universities such as Yale, Brown, Georgetown and Stanford School of Medicine in the USA have provided or required the students to purchase an iPad to be used in their education, while University of Leeds in the UK has offered an iPhone 4 to the students of the final year (Lewis, 2011). These medical schools have included the new technologies in their educational curriculum as a new tool to enable their students to become the physicians of the digital era.

Games, on the other hand, have been found to be beneficial for academic achievement, motivation and classroom dynamics in K-12 (Rosas *et al*., 2003; Icard, 2014). Higher education institutions have been much slower to adopt the advent of serious games with a concern of measurement. According to Dyer (2013), measurement of students represents the overarching goal of the institution's curriculum whose aim is to improve the performance of students' post-graduation. But as the utility and effectiveness of games for teaching and learning has expanded in Higher Education, games can be more often used to address some limitations of traditional teaching. Game-based learning can be seen in both primary, and secondary schools, universities, adult education, military training, and medical practice (Whitton, 2012). Games can mainly be integrated in education in different ways, one of which can be to integrate them as part of a traditional classroom lecture to improve learning, motivation and engagement (Wang, 2015), as in our case.

This study tries to provide a method that can be implemented in any basic science courses in a medical school for revision purposes. It conducts a study with medical students at Acıbadem University, Turkey by using a mobile application, game-based learning platform, namely Kahoot!, as a tool to revise anatomy. Researchers focus on the main aspect of the mobile learning, in their case mobile phones and tablets, and learning opportunities mobile technologies provide.

Mobile learning is often defined in terms of the use of technology, as learning that takes place while using mobile devices and services and it is often personal and location-free (Vavoula, 2005; Naismith *et al*., 2006; Walsh, 2015).

Mobile learning has been defined within the context of higher education and has been divided in three components: the mobility of the technology, the mobility of the learner and finally, the mobility of the process of learning itself (El-Hussein & Cronje, 2010). The authors also add that mobile learning values and defends in its own unique way the introduction of what is radically new in the technological, social and cultural spheres of human life and activity.

Digital games create active engagement due to the qualities of competition and engagement. When they are played through mobile devices, students can take learning into their own hands beyond the classroom. According to Naismith *et al*., a blended approach to enabling learning with mobile technologies is necessary as successful and engaging activities draw on a number of different theories and practices.

Educational psychology research suggests that to help learners develop self-efficacy, we must encourage them to trust and believe that they can achieve their goals by immediately providing praise, encouragement, and reinforcement (Dörnyei, 1994). Games have the potential for providing students with immediate feedback by displaying a high score chart and providing "leveling up" opportunities and, as a result, providing easy gaming tasks and immediate reinforcement may help develop confidence to carry out specific tasks (Yang, 2012).

Moreover, the game-based learning theory is grounded on the idea that engagement is in performing tasks while playing conditions stimulate the brain for active learning (Gerace *et al*., 1999). Digital games are designed to integrate content material with game play; this allows the brain to process information from short- to long-term memory (Banikowski & Mehring, 1999). In this respect, games can provide a safe environment of play which allows students to learn from their failures and they can be great educational tools to be used across content areas for review.

Kahoot! was launched in 2013 as a game-based response system (GSRS). The application has been developed by Mobitroll, which is collaboration between Norwegian University of Science and Technology (NTNU) and the British company We Are Human (Mobitroll, "Products by mobitroll." http://www.mobitroll.no/). Kahoot! gives teachers a new and engaging method to test student knowledge and encourage classroom participation because it is easily accessible by any device with a web browser and Internet connection (http://www.emergingedtech.com/2014/07/kahoot-game-based-classroom-response-system/). The application makes use of blended learning, which combines

face-to-face classroom methods with computer-mediated activities, creating an environment where students learn in part through online delivery and self-directed learning (Bonk & Graham, 2004).

Kahoot! creates quizzes made from a series of multiple choice questions and allows adding multimedia instruments (videos, pictures, diagrams, etc.) to the questions to strengthen engagement. Kahoot! also enables users to prepare surveys and offers a platform for discussions. The researchers supported the initial idea for Kahoot!, which was to create media where the teacher and the students in a classroom could interact through a quiz in the form of a game where students compete. The aim of the game was to give the answers of the questions on the board, reflected from the teacher's computer, as fast and correct as possible on their own digital devices. A chart between questions gave all students' performance and the scoreboard showed the nicknames and scores of the top five students.

Detailed information about how Kahoot! works can be obtained from the the following link: https://getkahoot.com/how-it-works.

Closure Activity has been defined as the activity that ends a lesson and creates a last impression that emphasizes key information. It corrects misunderstandings, checks for understanding and informs subsequent instruction. From the students' aspect; they find closure activities helpfulfor summarizing, reviewing, demonstrating their understanding of major points, consolidating and internalizing key information, linking lesson ideas to a conceptual framework and/or previously-learned knowledge and transferring ideas to new situations.

Advantage of summarizing comprises giving detailed information in a short and understandable form, which highlights significant factors of the subject. An effective closure activity creates what psychologists call the Recency Effect, otherwise known as a last impression.

Closure activities create powerful learning effects at the tail-end of the class, something that will reverberate for hours after the lesson is over, something a little sticky (Lucero, 2006). It has been also added that as a deliberate part of teacher planning process, these activities summarize the current lesson, provide it context, and build anticipation for the next. Properly implemented, they will help one establish and maintain course momentum.

Such activities may also help the teacher to enhance the content of the current and further sessions to maintain course momentum as well as serving as an assessment tool.

MATERIAL AND METHOD

This study was carried out in the School of Medicine, Acıbadem University with the contribution of 45, year 2 medical school students. During the two semesters, that comprises 47 h of theoretical sessions, at the end of each anatomy lecture, a Kahoot! quiz, which was previously prepared, was played by students. Preparing Kahoot! quizzes provides an opportunity for the lecturer to revise the content, to emphasize significant points, and it took only about 15-30 min to prepare 5 questions for each topic.

At the end of the year, students were asked to fill a five point Likert Scale questionnaire of 10 questions (survey questions and percentages of responds can be viewed as a supplementary file). Then, a focus-group interview was performed with randomly selected 5 students to evaluate their answers in detail. The personal details of the students who responded the questionnaire and accepted to be interviewed were kept confidential. Twenty-eight of the students were female and 17 were male and their mean age was 19±6.

The aim of the questionnaire and the interviews was to reveal the effects of this game-based activity. Questions of the questionnaire can be grouped under three headings considering whether they are interrogating the learning environment, the positive impacts on learning or the proper guidance for examinations. The final question was polling an overall judgement about Kahoot! the students were also asked to evaluate the implementation considering these headings and reflect on the overall application. The interviews were transcribed and emerging themes were highlighted.

RESULTS

Students think that playing Kahoot! creates positive classroom environment (95 %) and increases positive classroom atmosphere (93 %). Other students (5 % and 7 %, respectively) did not disagree but were indecisive.

Regarding the impacts of playing Kahoot! on learning, students found it motivating (93 %), helpful to strengthen their learning (91 %), helpful for their understanding (82 %), positive for fostering learning (93 %) and appropriate for their way of learning (80 %). Only 2 % of the students were disagreeing for the positive impact of playing Kahoot! on learning and 16-18 % were indecisive.

About providing proper guidance for examinations,

56 % of students thoght that playing Kahoot! was helpful while 29 % was indecisive and 15 % disagreed. The reasons of playing Kahoot! were determined not to give clues about the exam but to motivate the students, to foster the learning environment, to underline the critical points and to detect the lacking parts of the subjects. Thus, the results for this item clearly showed that while preparing the questions within the play, the priority was not the exam but the learning.

The final question was about their overall judgement and 98 % of students found playing Kahoot! amusing that can also be applicable in other courses.

An interview was performed with randomly selected 5 students to evaluate their answers in depth. The interview transcripts were evaluated by discourse analysis and the data helped to elicit participants' impressions of playing Kahoot!. Three themes were highlighted during the analysis: creating positive atmosphere and positive competition among students, motivating and encouraging students to follow the course and retaining knowledge. Below are some selections to illustrate students' positive attitudes and elevated motivation.

Extract 1: Kahoot! helps me to focus on what is important, emphasizes necessary parts, which I may discard. It also has a positive effect on the learning environment because classmates compete with each other at the end of the class (in a positive way).

They also noted that it creates an enjoyful competition among students, which is again considered as a favorable factor for learning.

Extract 2: It has a direct effect on learning because with the atmosphere it creates it turns the competition into a game. This also allows us to concentrate more on the lesson until the end.

Extract 3: Playing Kahoot! at the end of the class whips up my enthusiasm to learn. It adds a fun element to the lesson. Not only in Anatomy but also in other subjects it can be used surely.

As for the support for exams, Kahoot! does not serve as a tool to help achieve better in tests but it nurtures the learning environment, highlights the critical parts of the subject taught and enables students to keep some points in mind longer.

Extract 4: If there are questions that I couldn't answer in Kahoot!, I understand that those are the parts I haven't understood well and I need to study them primarily.

Extract 5: I haven't compared the questions of Kahoot! with the exams' so I cannot comment on that.

Extract 6: I've noticed that Kahoot! makes me remember the subject better by recapping critical parts. It allows the necessary information, the information our professor highlights, to stay in my mind longer and recall in the long term.

DISCUSSION

Promoting game-based learning can support medical student engagement with anatomy and the findings of this study are consistent with the literature on digital games and their use as a tool for fun and engagement in education (Griffiths, 2002; Anyanwu, 2014; Janssen, 2015). In our study, the observed classroom environment benefits can be listed as higher attendance and participation, and more focused and engaged students in class. The instructor can get regular feedback and evaluate the understanding of the students in a motivated way. Additionally, there is no need to purchase any device or application; Internet connection plus students' cell phones or tablets are sufficient to participate in the activity. These positive points encourage us to elaborate this activity to whole anatomy program and to propagate our experiences as well as the students' feedback to other departments of the medical school.

Malone's (1981) theory of intrinsically motivating instruction lists three categories to make things fun to learn: Challenge (goals with uncertain outcomes), Fantasy (captivate through intrinsic or extrinsic fantasy), and Curiosity (sensor curiosity through graphics and sound, and cognitive curiosity where the player should solve something unsolved), and using Kahoot! as a closure activity in our teaching covers all these three categories. All in all, students who are more motivated are more likely to persevere in the difficult cognitive processes necessary for creating and organizing knowledge (Gerace *et al.*) which, in our case, essential in anatomy learning.

The wear out effect of the Kahoot! has been evaluated as "not a major issue" for Kahoot! (Wang). His study showed how important it is that a GSRS keep students engaged, not only the first time it is introduced but also for repetitive usage over time. Based on observations and feedback from teachers using Kahoot!, the main difference between a game-based student response system (GSRS) and a classical student response system (SRS) is the energy and engagement the gamification creates.

Implementation of new technical concepts into medical education does not mean to rule out various learning techniques of students and to put aside all the classical teaching modalities, but to support them. Traxler writes: "so, mobile learning is not about 'mobile' or about 'learning' as previously understood, but part of a new mobile conception of society" (Traxler, 2007). Research and reflections on mobile learning should stimulate multidisciplinary and interdisciplinary thinking and methods in education. They should facilitate our understanding of outdated concepts and rigid assumptions about learning and what it may be in a society that has changed (at least from a technological point of view) out of all recognition in the past few decades. This reflects the reason why we suggest Kahoot! as an alternative tool for summarization.

From a different point of view, intensive cell phone use in school and classroom, particularly the activities such as video game playing, surfing the internet and monitoring social media sites have been associated with lower grade point average (GPA) (Jackson *et al*., 2011). Total cell phone use was found to be a significant negative predictor of GPA (Lepp *et al*., 2015). Conversely, low levels of internet use have been associated with improved academic performance (Chen & Peng, 2008). However, Lepp *et al*. underlined the fact that there may be specific uses of cell phones those are positively related to academic performance.

Barriers have been reported to adopt the mobile devices in medical education however; all items were not related to educational concerns but about the technical constraints, such as wireless access, installation process or knowing what resources are available (Boruff & Storie, 2014). Along with the use of new technologies in education, Wallace *et al*. (2012) mentioned potential problems as superficial learning, not understanding how to find good learning resources, distraction from normal classroom activities, inappropriate use and concerns about access privacy. Challenges to introduce new technologies into medical education have been listed as decrease in learning with repetition and relative experience, technical challenges (such as small screen, low resolution, etc.), maintaining professionalism and privacy standards when deploying mobile computing devices (incidents of students posting unprofessional online content) (Chu *et al*., 2012). All the above mentioned disadvantages of implementing mobile technologies into medical education should be seriously considered but should not restrain its integration because future medical professionals have to be more capable of using new technologies.

Learning is often considered complete when a correct answer is produced by a student. However, to consolidate learning retrieval practices play a critical role. Kahoot!, as a closure activity, can be an alternative tool to support long-term retention of the knowledge. Further research can measure the retrieval aspect of GSRS in medical education.

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RESUMEN: La educación sobre la anatomía en las escuelas de medicina siempre ha sido considerada exigente, ya que los estudiantes necesitan aprender y recordar gran cantidad de información sobre el cuerpo humano. Debido a que la innovación tecnológica en curso, principalmente en lo que respecta a la web, está cambiando la forma en que los humanos interactúan con la información, la integración de la web en educación anatómica puede proporcionar a los estudiantes una manera de revisar lo que han aprendido de manera interactiva y competitiva. Se han realizado investigaciones sobre el uso de sistemas de respuesta basados en juegos para involucrar a los estudiantes durante las clases; sin embargo, existe una brecha significativa para demostrar el valor del aprendizaje basado en juegos para motivar a los estudiantes de medicina a aprender anatomía. Este estudio tiene como objetivo revelar los efectos del uso de teléfonos móviles y un sistema de respuesta en el aula basado en juegos como una actividad de cierre para fomentar el aprendizaje de la anatomía. Con ese fin, ¡45 estudiantes de medicina relizaron una prueba con Kahoot! Una prueba al final de cada conferencia de anatomía durante dos semestres. Mayor asistencia y participación y más estudiantes enfocados y comprometidos en clase han sido los beneficios observados de la aplicación. Los hallazgos sugieren que los sistemas de respuesta basados en juegos se pueden usar en las materias básicas como la educación de la anatomía como una actividad de cierre.

PALABRAS CLAVE: Aprendizaje móvil; Educación sobre anatomía; Sistemas de respuesta en el aula basados en juegos; Actividades de cierre.

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