Computers & Education 82 (2015) 217–227

Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

The wear out effect of a game-based student response system☆

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ARTICLE INFO

Article history:
Received 2 April 2014
Received in revised form
31 October 2014
Accepted 3 November 2014
Available online 12 November 2014

Keywords:
Game-based learning
Interactive learning environments
Student-response systems
Evaluation

ABSTRACT

The Bring Your Own Device (BYOD) wave and advancement in technical infrastructures and in learning technology opens for new ways of teaching in the classroom. The teachers' laptops connected to a video projector, access to wireless network and the students smartphones, tablets or laptops can be utilized to enhance the interaction between the teacher and students, as well as boost the students motivation, engagement and learning. The introduction of new learning technology in the classroom normally results in immediate enthusiasm and excitement both from the teacher and the students. However, the immediate positive effects might fade when the new learning technology has become familiar to the teacher and the students. This paper shows the results from investigating the wear off effect of using the game-based student response system *Kahoot!* in classroom teaching. More specifically, it compares the results from students using Kahoot! for the first time in a single motivational lecture vs. using Kahoot! in every lecture in a class for five months. The quasi-experiment focused on how the students' perception changed in relation to user-friendliness, engagement, motivation, classroom dynamics, concentration, and perceived learning. The results show a slight reduction in the students motivation and engagement, but the only statistically significant wear out effect found was related to classroom dynamics. At large, the game-based student response system managed to boost students engagement, motivation and learning after using it repeatedly for five months. The core factor to keep the students attention after heavy repeated usage was found to be the competitive nature of Kahoot!.

1. Introduction

The Bring Your Own Device (BYOD) wave and advancement in technical infrastructure and in learning technology, opens for new ways of teaching in the classroom. In 2012, Gartner said that BYOD is the most radical shift in enterprise client computing since the introduction of the PC. A survey from 2013 showed that more than 85 percent of 500 educational institutions in UK and US (K12 to college/university) allowed some form of BYOD (Bradford-Networks, 2013). The survey also showed that the devices were increasingly being integrated into the classroom and learning experience. The advancement of BYOD in schools provide a foundation to make the classrooms fully interactive – enabling students to interact with the teacher and learn subjects in new ways. The classical way of providing classroom interaction has been offered through student response systems (SRS) providing the students with handheld devices commonly called "clickers", "key-pads", "handsets" or "zappers" (Caldwell, 2007). These devices have typically been devices that resemble a TV-remote where students can give their response to a question posed by the teacher or displayed on a large screen. As most students now have their own mobile digital devices, the clicker-devices have become obsolete. The main benefit from BYOD in schools is to remove the costs and effort to administrate and maintain special devices, as well providing interactive classroom tools that provide better a user experience. In this article we will use the term student response system (SRS) for these interactive classroom systems, but note that other names are commonly used such as class response systems, audience response systems, personal response systems or electronic response systems.

James Paul Gee argues that well-designed video games are learning machines (Gee, 2003). Further he argues that schools, workplaces and families can use games and game technologies to enhance learning. The idea is that when you learn through games, you are so engaged

☆ This work is supported by NTNU Discovery and the FORNY2020 program provided by the Research Council of Norway.
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http://dx.doi.org/10.1016/j.compedu.2014.11.004
0360-1315/

and motivated that you are learning even you are not aware of it. Games have been found to be beneficial for academic achievement, motivation and classroom dynamics in K-12 (Rosas et al. 2003) as well as for higher education (Sharples, 2000). Games can mainly be integrated in education in three ways (Wang, 2011): *First*, traditional exercises or tasks be replaced by letting students play motivating games giving the teacher an opportunity to monitor the students progress in real time (Foss & Eikaas, 2006; Ke, 2008; Sindre, Nattvig, & Jahre, 2009). *Second*, game development can be used to learn other subjects like design patterns (Gestwicki & Sun, 2008), literacy (Owston, Wideman, Ronda, & Brown, 2009), software architecture (Wang & Wu, 2011), computer science (Distasio & Way, 2007), and mathematics and physics (El-Nasr & Smith, 2006). *Third*, games can be made an integrated part of a traditional classroom lecture to improve learning, motivation and engagement (Carnevale, 2005; Carver, Howard, & Lane, 1999; Wang, Øfsdal, & Mørch-Storstein, 2007; Wang, Øfsdal, & Mørch-Storstein, 2008; Wu, Wang, Børresen, & Tidemann, 2011).

This paper focuses on the latter. Kahoot! is a game-based student response system that transforms temporarily a classroom into a game show. The teacher play the role of a game show host and the students are the competitors. The teacher's computer connected to a large screen shows questions and possible answers, and the students give their answers as fast and correct as possible on their own digital devices. A distribution chart of how the students have answered is shown between questions. The chart is useful for the teacher to get feedback on how much the class knows about a topic, and opens an opportunity to explain better the parts where students lack knowledge. Between each question, a scoreboard shows the nicknames and scores of the top five students, and at the end of the game a winner is announced. Kahoot! uses playful and colorful graphics and audio to increase the engagement. Based on observations and feedback from teachers using Kahoot!, the main difference between a game-based student response system (GSRS) and an classical student response system (SRS) is the energy and engagement the gamification creates.

Bringing game-technology to the classroom can pose some challenges. When Kurt Squire introduced Civilization III in his history class, many students complained about the game being too complex and difficult, and they did not understand why they should play a game in a history class in the first place (Squire, 2005). For his students, it took some time before they actually understood that they learned something from the game. At the other end of the spectrum, introducing simple learning games can spark immediate enthusiasm that later fades away as the students have to repeat the same tasks over and over again. Boredom in computer learning environments is shown to be associated with poorer learning and problem behavior (Baker, D'Mello, Rodrigo, & Graesser, 2010). Baker et al.'s study also found that frustration was less associated with poorer learning. This study shows 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. Tom Malone's 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) (Malone, 1980). The Kahoot! GSRS was designed with these categories in mind, where the *challenge* is to answer unknown questions and try to beat other players, the *fantasy* is to be part of a game show, and the *curiosity* is provided both through inviting graphics and audio as well as solving a cognitive puzzle (finding the correct answer and wait to see if it was correct or not). To compensate for simple game play, we designed Kahoot! to be a multiplayer game where students compete for the top of the scoreboard. From experiences trying out Kahoot! in single lectures, we knew that it engaged and motivated the students. However, our fear was that if the students were exposed to using Kahoot! frequently over time, they would become bored and the engagement, motivation and learning effect would drop drastically. In this article we presents the results of a quasi-experiment were we investigate the wear out effect of a GSRS.

The rest of this article is organized as follows. Section 2 presents material and methods that include related work, a description of the game-based student response system Kahoot!, and the research goal, the research questions and the research approach. Section 3 presents the results from the quasi-experiment. Section 4 discusses the results found as well as the validity of the results. Section 5 concludes the article.

2. Material and methods

This section presents related work, the game-based student response system Kahoot!, and the research questions and the research approach.

2.1. Related work

As far as we know, there are no other studies published that looks at the wear out effect of game-based learning tools. However, there are many studies that evaluate both student-response systems (SRS) as well as game-based learning which we will cover in this section. We will also describe some SRSs with similar features to Kahoot!.

Kahoot! distinguishes itself from other SRSs as it was designed as a game or rather a game-based platform. This is why we categorize Kahoot! as a Game-based SRS (GSRS). There are however other SRSes that provide games as a part of their platform. One SRS that shares many of the same characteristics as Kahoot! and is widely used, is Socrative (Coca & Slisko, 2013). Socrative is also web-based and does not require any special equipment to be used. The core of Socrative is the ability to get feedback from the students in the form of multiple choice, true or false, or short text answers. Socrative provides a real-time formative assessment to collect data from the students through forms. Socrative also offer the game Space Race where teams of students answer questions to move their rocket as fast as possible across the screen. Another example of a learning environment that share some of the features of Kahoot! is Quizlet (Gruenstein, McGraw, & Sutherland, 2009). Quizlet is not a SRS, but a web-based learning tool where the students can study various topics through Flashcards, speller, tests and more, and it also provide also a Space Race game where the player can kill moving terms by answering the correct word and vice versa. Quizlet focuses on spelling words and giving the correct definitions for words. Poll Everywhere is a SRS that provides a system for collecting audience responses in real-time to multiple choice or open ended questions (Sellar, 2011). Poll Everywhere does not provide any game features. iClicker is a SRS similar to Poll Everywhere, but the students can respond using both specialized iClicker remotes or web-based clients, as well as the tool can be integrated with learning management systems and presentation tools such as PowerPoint, KeyNote and Prezi (Lucas, 2009). Another commonly used SRS is Learning Catalytics which makes it possible for students to give numerical, algebraic, textual or graphical responses (Schell, Lukoff, & Mazur, 2013). Learning Catalytics provides also support for grouping and performance assessment of students, and is owned by the publisher Pearson. If we compare Kahoot! to all the systems above, the most obvious difference