Chapter 10
Implementing Quiz Apps as Game-Based Learning Tools in Higher Education for the Enhancement of Learning Motivation

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Introduction

Game implementation in the learning process is one of the oldest and most useful ideas in pedagogy (Ferreira et al., 2016) and is applicable as a pedagogical method not only for children but for adults as well. But it is important to distinguish different concepts related to games and game elements' application in learning – game-based learning, gamification, serious games, etc. What is the difference?

In some cases, gamification and serious games are considered as similar concepts, but there are some essential differences between them. Serious games are a contemporary pedagogical strategy designed for learning in a virtual or mixed reality environment with predefined learning objectives (Landers & Landers, 2014; Karagiorgas & Niemann, 2017) to promote learning and solve problems with game-based techniques. Although serious games use game elements and game design, the purpose is not to entertain people but to train and instruct (Dreimane & Upenieks, 2020). On the other hand, gamification is a concept whereby game design elements are used in a nongame context (Deterding et al., 2011; Doherty et al., 2017; Woodcock & Johnson, 2017), not as a whole game as in the case of serious games, but as particular game elements or meaningful combinations of game elements applied to nongame processes (Landers & Landers, 2014). In this case, the purpose is not related to entertainment either (Karagiorgas & Niemann, 2017) but to motivation, engagement, and changing the attitude of the student in order to improve learning outcomes (Landers & Landers, 2014) with or without technology. Serious games try to improve knowledge and skills through the game, while gamification uses game elements to make the learning more engaging and thus improve the learning.

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But what distinguishes game-based learning from these two concepts? Game-based learning refers to the use of video games to support teaching and learning (Gros, 2006) and can be described as games that teach students. But it must be added that when talking about game-based learning, we can distinguish two concepts: game-based learning and digital game-based learning. The term "digital game-based learning" was coined by Prensky and refers to any form of the use or integration of digital games into learning environments (Prensky, 2001). This means that game-based learning is not always constructed through digital platforms and technology. Game-based learning combines game design used to fulfilling learning objectives and games that are developed for fun while pursuing learning objectives (Gros, 2006) with or without technology. In 1982, James Paul Gee published "What Video Games Have to Teach Us About Learning and Literacy," in which he explains several learning principles that are incorporated in good games; in his later works, he argues that well-designed video games are efficient learning machines that engage students in the learning without being aware of it (Gee, 2003). Some authors propose that modern education faces a whole series of complex challenges related to technological development (Liu et al., 2020), but on the other hand, it can also be seen as an opportunity to grab students' attention, motivate and engage them, and make learning more interesting using the tools that they may find relatable. But despite the potential of the games that many researchers describe, some studies reveal a lack of implementation of games as a learning tool in formal education (Gros, 2006).

In many cases in the learning process, knowledge assessments have negative associations related to stress and fear. But there is scientific evidence that games are one of those things that can make people happy. When a person experiences excitement during a game, gets a prize, or wins, a substance called dopamine is released in the middle of the brain, which is closely linked to a person's desire to enjoy various things that make them happy, including food, money, gambling, computer games, etc. (Kapp, 2012; Howard-Jones & Demetrious, 2008). So, some game-based learning tools have been created to address many unpleasant learning activities – to make knowledge assessments more enjoyable, engaging, and even fun. An example that can be mentioned is the so-called game-based student response system, where the classroom is temporarily transformed into a game show where the teacher is the game show host and the students are the contenders (Wang, 2015). The most well-known and most studied game-based student response system is called Kahoot!, which is known to be the first student response system using game design principles from theory on intrinsic motivation to provide a game experience (Malone, 1981; Wang & Tahir, 2020).

This study focuses on this particular game-based learning tool – the game-based student response system that can also simply be called a quiz app that provides a safe environment for learning and mistakes by integrating elements of games that make the learning process and knowledge assessment more interesting and motivational and with which students are more likely to become more actively involved. Quiz apps can be defined as digital game-based learning tools because tests designed to be used through digital platforms use game elements and game design to make

learning and knowledge assessment more fun. This kind of knowledge assessment is confused in many studies with gamification because of the use of game elements, but the opportunity to provide learning and assess knowledge through the activity makes quiz apps a digital game-based learning tool, not a gamification of learning.

When talking about game-based learning, a word that often follows is motivation, so it is important to understand what makes game-based student response systems motivational and which techniques and game elements they use to enhance students' learning motivation.

Research conducted in 2019 searching for the most commonly used motivation theories in contemporary research articles related to technology-enhanced learning showed that these were the self-determination theory of Richard M. Ryan and Edward L. Deci and the self-efficacy theory of Albert Bandura (Dreimane, 2019). Self-determination theory was coined by Ryan and Deci in 1970, and in this theory they identify the three basic psychological needs of a person: (1) the need to feel competent; (2) the need for connectedness and commitment, i.e., to know that someone cares about you; and (3) the need for autonomy, which is very important for a person to feel good – it is a feeling of self-affirmed action that you have given your consent and acceptance (Ryan & Deci, 2000; Forster-Heinzer et al., 2016). All these three needs nourish the self-determined motivation of a person. Self-determination theory also posits that there are two types of motivation – intrinsic and extrinsic – which are important in explaining the potential impact of game-based learning on the development of learning motivation. Extrinsic motivation is characterized by an immediate or faster result, but the effect is not as long-lasting as intrinsic motivation; it is not a real interest to acquire knowledge or perform an action. Extrinsically motivated behavior is characterized by reward and punishment systems. On the other hand, with intrinsic motivation, the person has a real interest in the action to be taken; intrinsic motivation is thus desirable because it ensures the persistence and depth of knowledge and interest in the subject is long-lasting. In the context of the game-based student response system, some elements of these tools provide extrinsic motivation, like points, competition, time limits, etc., but on the other hand, an engaging and game-based way of assessing knowledge can help to achieve intrinsic learning motivation.

On the other hand, Bandura's self-efficacy theory refers to our overall belief that a person can successfully achieve a particular result, and students with high self-efficacy can achieve better results in their learning activities (Chang et al., 2018). Self-efficacy and motivation are determined by four components: (1) performance outcomes, i.e., past performances and achievements, that is, a person's own positive or negative experiences; (2) vicarious or substitute experience, which means that a person can be motivated to lift their own self-efficacy through the observation of other people's experiences; (3) verbal persuasion or influence, which includes the influence on a person by other people's comments, both positive and negative, because verbal encouragement or critique can increase or decrease self-efficacy; and (4) physiological feedback, where physical well-being and anxiety affect a person's performance, thus also affecting self-efficacy (Bandura, 1977). Previous performance, the belief in one's own ability to perform the task, verbal praise,

comments, and feedback are very important aspects for the enhancement of learning motivation, and the game-based student response system can enhance increases to self-efficacy and learning motivation, both extrinsic and intrinsic.

Game applications in the learning process and game-based learning have been researched and described from their theoretical and empirical aspects, and motivation theories in the context of technology-enhanced learning have also been studied for years, but it is important to understand how to use game-based learning tools in a reasonable, thoughtful, and meaningful way that meets the needs of the education system and students of the twenty-first century. Thus, such research is essential to understand how to provide teachers with knowledge about digital tools that can make the learning process more interesting and provide students with opportunities to learn.

Methodology

The aim of this study is to explore the game-based student response system – quiz apps as game-based learning tools for the repetition and mastery of a subject and to enhance students' learning motivation in higher education. To achieve this aim, a survey was carried out involving bachelor's and master's study program students at a Latvian university. Students replied to the survey sharing their opinion on the quiz apps and what elements they find engaging and motivational. Students were also asked about game-based applications in lessons – do academic staff implement them, how often are they implemented, what are the most common quiz apps if used in classes, what the purpose of these apps is, and what feedback is provided by the apps and academic staff. The questionnaire was designed by the author to achieve the research objectives considering the theoretical framework of learning motivation and game-based learning and contained nine questions. The survey was developed on the platform *latvia.questionpro.com*, which allows students to answer questions at a time and place that is convenient for them, either using a smart device or a computer. Students were informed about the purpose of the study and that all answers will only be used in a summarized way, guaranteeing their anonymity and data security.

Results

The survey carried out gathered a total of 129 bachelor's and master's study program students' opinions and experiences connected with quiz apps' implementation in their classes by academic staff. Of the 129 students who participated in the study, 50% ($n = 64$) said that academic staff do not apply game-based apps for the assessment and repetition of knowledge, but almost the same amount of respondents (47%, $n = 61$) gave a positive answer, saying that game-based apps are used in their

classes. The remaining 3% of respondents chose the answer "Other," writing that only one teacher uses this kind of app or that they have been used "once," "two times," or "sometimes."

The questionnaire revealed that the most applied game-based student response system is Kahoot! (40%), followed by Mentimeter (19%), Quizizz (16%), and Nearpod (10%), but 15% of the respondents marked "Other," answering that they have not encountered the use of quiz applications in classes or gave examples like Peardeck.com, Edpuzzle, Padlet, or QuizUp.

Respondents who answered that quiz apps are not used in their classes had the opportunity to skip certain questions in the survey that were applicable to the subject. Thus, 111 respondents answered the question about the frequency of the apps' application, where 45% (n = 50) gave the answer that they are used rarely, 33% (n = 37) said "never," and 19% (n = 21) "sometimes," while only two respondents said that quiz apps are used "often" and just one person said "every lesson."

When assessing knowledge, there always is a place for errors, but it is important for the student to get feedback about any questions answered incorrectly. That is why students were asked, "Do academic staff provide any explanations if any questions are answered incorrectly?" Half (51%) of the respondents gave a positive answer to the question, 21% said "sometimes," and 17% marked the answer that some professors give explanations, but 7% of respondents said that teachers do not give them feedback after tests.

Students were also asked their opinion about the purpose of the implementation of quiz apps in their classes (see Fig. 10.1). They were asked to answer statements about the purpose of the knowledge assessment by marking points on a Likert scale. Giving answers to the statement that quiz apps are used to prepare students for exams, 36% of the respondents marked the answer "rather agree," 24% marked "agree," 20% chose the answer "rather disagree," and 13% disagreed with the statement. The other 7% of the respondents said that it is hard to say.

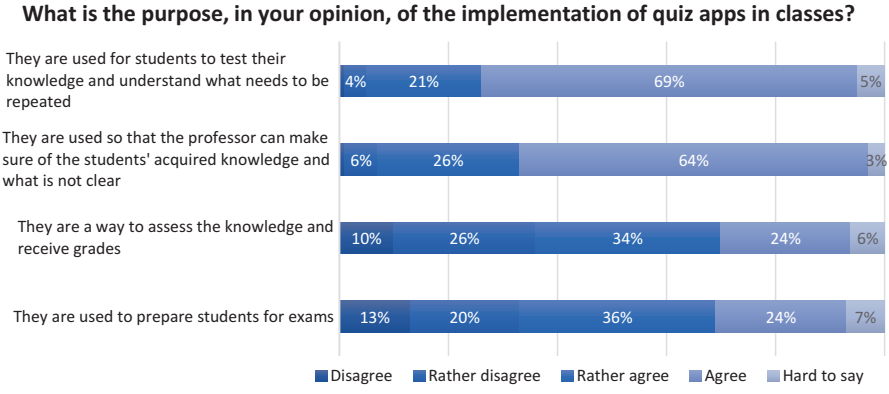

Fig. 10.1 Students' answers to statements about the purpose of the knowledge assessment

To the statement "They are a way to assess knowledge and receive grades," 34% of respondents said that they "rather agree," followed by those who answered "rather disagree" (26%) and "agree" (24%). This shows that students see game-based knowledge tests as a way to assess knowledge and receive grades.

Unlike the last two statements, which received ambiguous answers, the responses to the first two statements were more clear-cut. Sixty-four percent of respondents agreed with the statement that game-based knowledge tests are used so that the academic staff can make sure of the students' acquired knowledge and what is not clear, and 26% marked the answer "rather agree."

For the statement that game-based knowledge tests are used for students to test their knowledge and understand what needs to be repeated, 69% of the respondents agreed, and 21% marked that they "rather agree" with this statement. This shows that game-based knowledge tests have a positive impact on the knowledge acquisition of the students and are good for providing feedback that is useful both for the teacher to prepare lessons and also for students who are interested in self-directed learning.

Next, students were asked to evaluate the statements about game-based quiz apps for knowledge assessment by ticking the most appropriate answers on a Likert scale (see Fig. 10.2). Forty-seven percent of respondents agreed and 36% rather agreed with the statement that quiz apps are motivational. Ten percent of the respondents marked that they rather disagree, just 2% disagreed, and for 5% of the respondents, it was hard to say. Fifty-three percent of the respondents agreed that game-based quiz apps help to strengthen knowledge, 31% rather agreed, but 7% of the respondents rather disagreed and 2% disagreed. For 6% of the respondents, it was hard to say. Positive responses can also be seen for the statement that game-based quiz apps help students to understand the topic better – 39% of the respondents agreed and 35% rather agreed with this statement, but 17% said that they "rather disagree." A significant predominance is observed in the statement that quiz apps are an interesting way of learning, as 67% of the respondents agreed and 17% rather agreed with the statement. For the statement that there are no positive aspects concerning

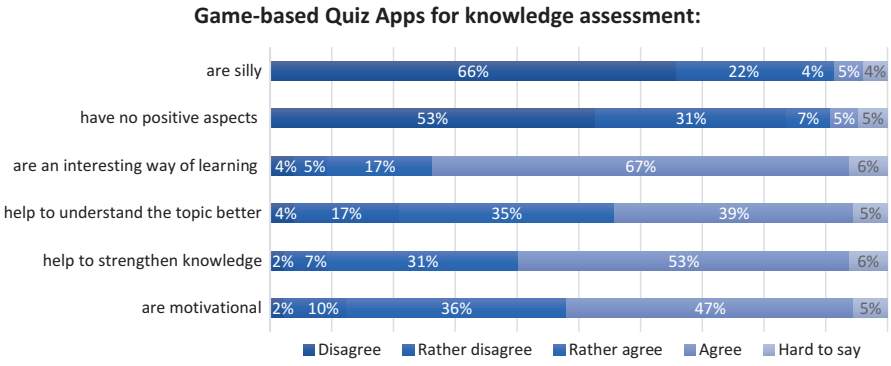

Fig. 10.2 Students' answers to statements about game-based quiz apps for knowledge assessment

game-based quiz apps, the largest part of the respondents (53%) disagreed and 31% rather disagreed, while 66% disagreed with the statement that quiz apps are silly. These data show that students see positive effects of game-based knowledge tests' application in the learning environment.

When the students were asked whether they agreed with the statement that lessons seem more attractive if game-based apps are used, there was a significant predominance of the response "Yes" (85%); only 15% of respondents disagreed with this statement.

Students were also asked about what type of knowledge evaluation they prefer and had a chance to mark several choices; 33% of the respondents said that they prefer knowledge tests on a mobile device or computer. Opinions were divided on the issue of obtaining a grade for the knowledge test, as 26% noted that they prefer tests for which a grade is received, but 23% disagreed and said that they prefer not to be graded after knowledge tests. This correlates with the answers that show that students like to receive feedback to understand the development and level of their knowledge.

The last question was about the elements of game-based quiz apps that students find engaging and motivating. They were allowed to mark several answers and choose elements that they find most appealing. As Fig. 10.3 shows, 19% of responses (n = 104) state that giving the correct answers and results immediately to provide instant feedback is very important. Points (n = 70) and cooperation (n = 57) are also considered to be motivational elements, followed by grades (n = 52), and 44 respondents noted that the aesthetics of the graphic is a very important aspect as well. Interestingly, 38 students marked that they find competition engaging and motivational, but this is understandable because it is possible to distinguish four player types after Bartle's player typology – explorers, killers, achievers, and socializers – and even more according to other authors (Monterrat et al., 2017). That means that

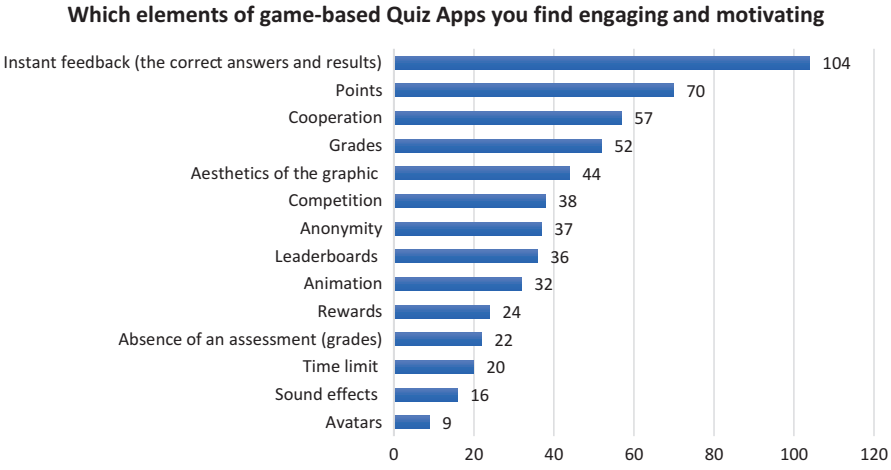

Fig. 10.3 The elements of game-based quiz apps that students find engaging and motivational

each player participates in an activity with different purposes and likes different game elements and mechanics. Games and game-based learning will not always meet the needs and desires of every participant (Vassileva, 2012; Harviainen, 2014).

As shown in Fig. 10.3, 37 respondents marked anonymity, but 36 respondents noted that they find leaderboards engaging and motivating. This contradicts the statement about anonymity. Animation (n = 32), rewards (n = 24), absence of an assessment (grades) (n = 22), time limit (n = 20), sound effects (n = 16), and avatars (n = 9) were also mentioned.

Conclusions

The main conclusion that can be drawn is that the students who participated in this study considered quiz apps as motivational and engaging game-based tools for the assessment and repetition of knowledge in higher education that provide instant feedback about errors. Consequently, they help students to identify their weak spots and the parts of the subject that must be repeated and to which more attention must be paid. For the academic staff, they help to identify the weak spots in the general performance of the students and draw attention toward specific topics or questions that were answered incorrectly. Students find the instant feedback about knowledge that these tools provide (without affecting their final grade at the end of the semester) and the possibility to learn from mistakes made during the activity to be very enjoyable. This is in line with Wang's (2015) opinion that knowledge assessment can be more enjoyable, engaging, and even fun if done via game-based learning tools.

This study has also revealed some consistencies with the theoretical framework of motivation theories. According to the self-efficacy theory, motivation is determined by previous performance and achievements that resonate with game-based student response systems that allow knowledge to be practiced in an engaging way and show students' strengths and weaknesses, and in exams, students' self-efficacy could be higher than in situations where the knowledge is being assessed for the first time. According to Bandura, feedback and positive comments or explanations about the errors students made from academic staff or the student response system can encourage the student in the further acquisition of knowledge.

On the other hand, Ryan and Deci's self-determination theory highlights the external factors that promote engagement and enhance learning motivation like points, competition, time limit, leaderboard, etc. that are offered by quiz apps and provide engagement during the activity. This engagement can lead to an increase in internal motivation that can provide more long-lasting interest in the subject and greater depth to the acquired knowledge.

The negative traits that were revealed during the study and correspond to Gros' work (2006) are that there is a lack of implementation of games as learning tools in formal education and that academic staff do not implement game-based knowledge assessment tools in the lessons as much as they could. Only half of the respondents

mentioned that a game-based student response system is implemented in their classes. Academic staff in higher education should consider the possibilities provided by technology-enhanced learning and game-based learning and use them in the future to ensure students' engagement with and deeper understanding of the subject.

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