

Research Article

Gamification in Biology Teaching: A Sample of Kahoot Application

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Abstract

The aim of the study is to examine the views of preservice biology teachers about the use of Kahoot in biology teaching and the effect of Kahoot use on preservice biology teachers' motivation levels. In the study, the mixed model was used. The study group included 15 sophomore pre-service teachers attending the Department of Biology Education in the Spring Term of 2015-2016. As the data collection tools, an interview form and the motivation scale were used in the study. According to the findings in the study, it could be stated that the preservice biology teachers' motivation levels increased after the application process and that they mostly reported positive opinion about the Kahoot applications. In addition, the preservice teachers said they wanted to use Kahoot in future because it resulted in more enjoyable lessons, active participation and more permanence. On the other hand, some preservice teachers stated

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that their failure in scoreboard during the application process was demoralizing and that the students' insufficient technological skills might have affected the process negatively.

Keywords: Kahoot, gamification, biology teaching, motivation

Introduction

With the influence of the rapidly developing technology, there are now great differences between the tools used in lessons in the past and those currently used. In the 21st century, smart boards and projectors are now in use in place of the traditional blackboard. These differences have resulted in transition from teacher-centered approach to student-centered approach (Elmas, Demirdöğen, & Geban, 2011; Keser, 2005). Students are now eager to use different technologies, and they are skilled and interested in these technologies (Prensky, 2001). The fact that new generations use current technological tools more intensively has led to the appearance of “digital natives”. According to Prensky (2001), the new generation, known as digital natives, is made up of individuals born into and grown up with current technologies, and they know and use these technologies just as they speak their native language. The developing technologies have changed the digital natives’ learning styles and their expectations from teachers and learning environments (Arabacı & Polat, 2013). Prensky (2001) defines teachers as digital immigrants. In order for digital immigrants to create an appropriate learning environment for digital natives, they should use the same language. Digital games prevalent in many areas can also be used in lessons to draw digital natives’ attention (Yıldırım & Demir, 2014). One approach to be applied to achieve this is “gamification”.

The concept of gamification is defined by Zicherman and Cunningham (2011) as “use of game-based thinking and game-related functions to help users solve problems and to draw their interest”. In a broader sense, use of games in an out-of-game activity means making that activity entertaining (Deterding; Dixon; Khaled, & Nacke, 2011). The concept of gamification is often confused with game-based learning. Gamification refers to application of the game philosophy to an out-of-game area, while game-based learning is to teach the outcomes of a course via games (Karataş, 2014; Yıldırım, 2016). Accordingly, it could be stated that gamification allows entertaining while teaching, while game-based learning allows teaching while entertaining (Ar, 2016).

The design of gamification is generally made up of three elements: game mechanics, game dynamics and game aesthetics. Game mechanics include various activities and control mechanisms for the gamification of a content to create user experience and interest (scores, levels, difficulties). Game dynamics refer to the outcome of experiences in the game played (reward, statue and success). Also, game aesthetics defines the desirable emotional reactions

evoked in the player, when he interacts with the game system. (Bunchball, 2010, cited in Sarıtaş & Yıldız, 2015; Hunicke, LeBlanc, & Zubek, 2004).

There are a number of applications for the gamification of a content or activity. One of these applications is “Kahoot”. It is a Web 2.0 tool that allows creating online quizzes, surveys or discussions. The questions prepared by the teacher with the help of Kahoot appear on the screen one by one, and students mark their responses and get scores via their mobile phones through the Internet. When they finish the questions, the names of the top-3 students appear on the screen. Students can also provide feedback regarding the application, and the teacher can examine the results and identify the deficiencies (Byrne, 2013; Dellos, 2015).

The aim of gamification is to make the learning process more attractive in terms of learners. With a learning environment where more fun activities are available, learners can be motivated and gain a different learning experience. So, motivation can be an important element in a learning design where gamification is applied (Güler & Güler, 2015).

Today, students are indifferent to methods which they find meaningless and uninteresting (Ar, 2016). Lee and Hammer (2011) point out that one of the most important problems experienced at schools is lack of motivation and the increasing number of school-drops. The concept of motivation, which is fairly important for learning, can be defined as a psychological state which is influential on human behavior and which increases a person’s willingness to do something (Başaran, 1991). According to Brophy (2004), it is a concept used to explain the starting point, direction, degree, permanency and quality of target-oriented behaviors. Motivation can be divided into two as intrinsic and extrinsic. If the individual takes an action to reach satisfaction, then it is called intrinsic motivation. Intrinsic motivation has a relationship with such factors as curiosity, interests and needs. As for extrinsic motivation, it refers to the development of individuals’ motivation through such external factors as reinforcers, awards and so on (Akbaba, 2006; Ercan, 2003).

There are various factors to motivate students. Whatever the model to be used in the learning process is, these factors should be taken into account with priority. Motivation can be integrated into courses in line with different learning approaches. In addition, it is quite difficult to determine the situations influential on students. Only learning environments which make

students active, which draw their attention and which allow students to reflect their own values can be influential on motivation (Ünsal, 2007).

It is a well-known fact that certain concepts related to biology are generally perceived by students to be abstract, complex and difficult (Kılıç & Sağlam, 2004). This situation may cause students to get bored. Gamification, which helps increase motivation by making boring and difficult jobs entertaining and achievable, can be regarded as an effective approach (Yıldırım, 2016). Researchers state that intrinsic motivation can be increased via a well-organized gamification process and that students can eventually spend more time on course-related materials (Muntean, 2011; Nicholson, 2012).

In this respect, the purpose of this study was to investigate the use of the gamification approach in biology teaching, to determine preservice teachers' views about the application and to examine the effects of the application on their levels of motivation. Depending on this purpose, the following research questions were directed;

1. What are the views of preservice biology teachers about the positive aspects of Kahoot application?
2. What are the views of preservice biology teachers about the negative aspects of Kahoot application?
3. What are the suggestions of preservice teachers regarding Kahoot application?
4. Does Kahoot application affect the motivation of preservice teachers?

Method

In the study, the mixed model was used. Mixed model is an approach involving combined use of qualitative and quantitative methods, and use of both qualitative and quantitative methods together allows understanding the research problem better when compared to separate use of each method (Creswell & Clark, 2007). Mixed method is classified under two headings: sequential and concurrent. Concurrent designs fall into three categories such as concurrent triangulation, concurrent nested, and concurrent transformative. Concurrent nested designs mostly include quantitative or qualitative data depending on the dominance of the data. In such designs, since some part of data types is included in other data, less importance is given to the

inner data type (Creswell, 2003). The qualitative data obtained in the present study dominated the quantitative data. Therefore, the concurrent nested design was used in the study.

Participants

The participants were 15 preservice teachers taking the course of plant morphology in their second academic year in the Department of Biology Teaching at Ziya Gökalp Education Faculty of Dicle University in the Spring Term of the academic year of 2014-2015.

Data Collection Tools

The research data were collected with the Motivation Scale developed by Özerbaş (2003) and with an interview form including 5 open-ended questions directed to 15 participants attending the Department of Biology Teaching. The purpose of the open-ended questions in the interview form was not just to determine preservice teachers' views about the positive and negative aspects of Kahoot use in biology teaching but to ask for their related suggestions as well.

Motivation scale

The Motivation Scale developed by Özerbaş (2003) includes a total of 30 5-point Likert-type statements (17 positive and 13 negative). The items in the motivation scale used in the study were graded as “I Totally Agree”, “I Agree”, “I am Neutral”, “I Disagree” and “I Totally Disagree”. The Cronbach Alpha reliability coefficient of the original version of the scale was reported to be .88, and it was calculated as .79 in the present study.

Application Process

The study was conducted 14 weeks within the scope of the 2nd grade course of biology morphology in the Spring Term of the academic year of 2015-2016. In the research process, researchers participated as participant observer. In the first week, the motivation scale was applied to the preservice teachers as the pretest, and they were given training on use of Kahoot and gamification. Kahoot is a Web 2.0 tool that allows producing online quizzes, surveys and discussions. In order to log in the system and become a member, the website of getkahoot.com is used. After creating an account, quizzes are formed by typing the questions and their answers

on the web (marking the correct answers) (Figure 1). In addition, related photos and videos can also be included in the questions.

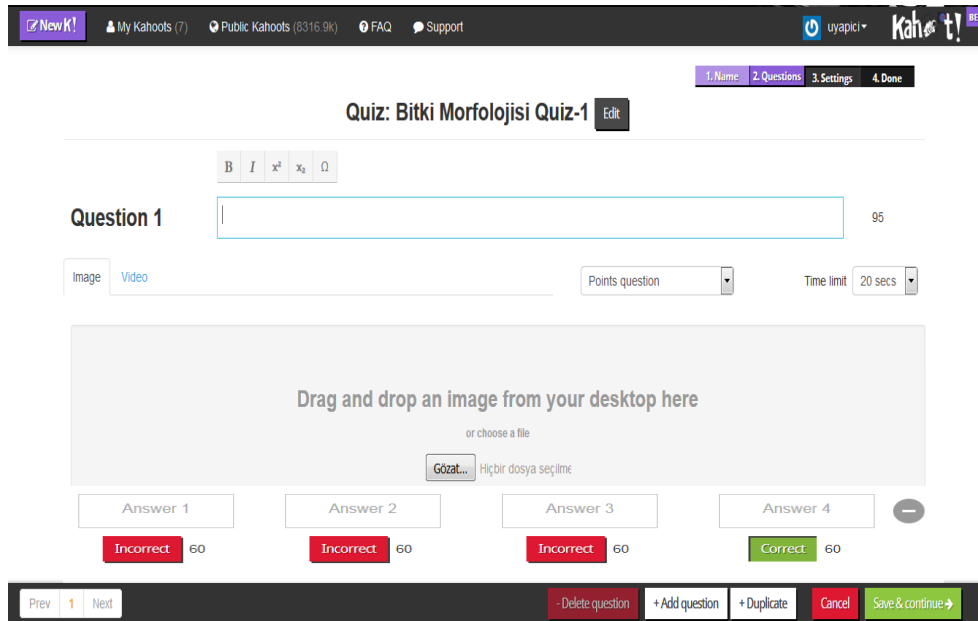


Figure 1. Screen for adding quiz questions

After typing the questions, several settings related to language, difficulty level, privacy, target population, labels and so on can be done. While starting a quiz, the system produces a code. Preservice teachers enter the web address of kahoot.it via their mobile phones and access the quiz using their names or nicknames with the help of the code given to them (Figure 2). Those included in the game are shown in the main screen, and the game starts after all the students are included in the game. With the help of their mobile phones, the preservice teachers respond to the questions reflected on the main screen (smart board) in a certain period of time (Figure 3).

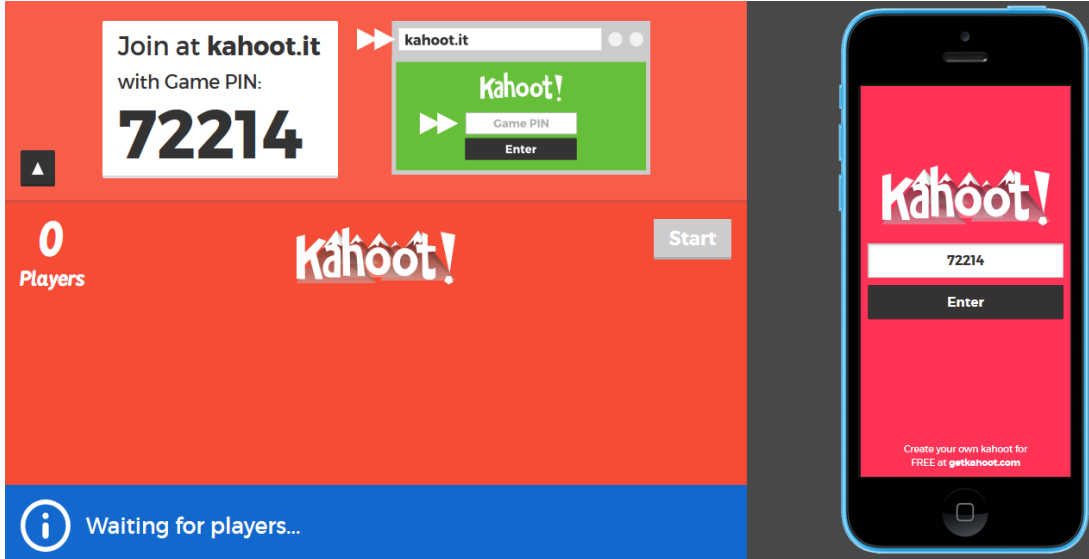


Figure 2. Quiz access screen

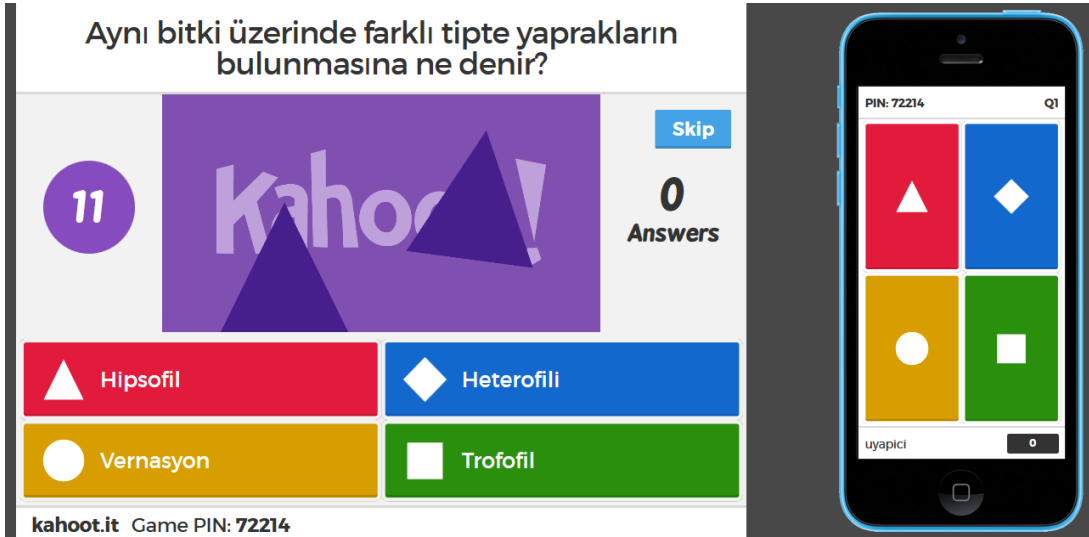


Figure 3. Quiz question-answer screen

After the end of the time allocated, the score obtained in line with the number of correct responses and with the response time is reflected on the screen, and those with the leading scores are announced. In addition, students can provide feedback regarding the application, and the teacher can examine the results and identify the deficiencies. In the present study, six quizzes were administrated at the end of lessons for 12 weeks at different intervals (once in three weeks, two weeks and a week). At the end of each application, the students with the leading scores (the first three) were awarded. As for the students with the highest overall degree, they received the non-system award (book). In the last week, the preservice teachers were asked for their views about the applications, and the motivation scale was conducted as the posttest.

Data Analysis

In order to analyze the qualitative data collected in the study, the content analysis method was used. In content analysis, the basic purpose is to reach the concepts and relationships that allow explaining the data collected (Yıldırım & Şimşek, 2011). With the help of content analysis, the data are defined, and the facts latent within the data are revealed (Yıldırım & Şimşek, 2011). The research data collected from the biology preservice teachers were analyzed by the researchers using the software of NVivo 11.0 and were evaluated within the framework of themes covering not only the positive and negative aspect of kahoot use in biology teaching but also the related suggestions put forward by the preservice teachers. As for the quantitative data, they were analyzed with Wilcoxon signed ranks test, non-parametric equivalent to paired sample t-test, using the software of SPSS 20. The Wilcoxon signed rank test was used because the data of the study did not show a normal distribution.

Findings

Positive Aspects of Kahoot Use

Findings obtained via the interview form

What are the positive aspects of using Kahoot in lessons? Why?

Table 1 presents positive aspects of using Kahoot application in lessons.

Table 1
Positive aspects of using Kahoot application in lessons

Views	Frequency
Entertaining	6
Providing concentration	2
Increasing attention	3
Providing memorability	6
Providing enhancement	8

As indicated in the Table 1, a number of preservice teachers reported that use of Kahoot in biology made the course more entertaining. One of the preservice teachers (A5) said “*Use of Kahoot makes the lessons more entertaining*”. Similarly, another preservice teacher (A3) said

“One positive aspect of Kahoot is that it really turns boredom with the course into entertainment”. In addition, most of the teachers agreed that Kahoot contributed to permanency of learning in the course. In relation to this, one of the preservice teachers (A1) said *“Kahoot application carried out at the end of the lesson helped us learn more permanently”*. Another preservice teacher (A3) reported a similar view saying *“it really made our knowledge permanent”*. In addition, the preservice teachers stated that Kahoot reinforced what they had learned in the course. One preservice teacher (A10) said *“The application helps reinforce the subjects we learned in class”*. Similarly, another student (A8) said *“The application was conducted following the lesson; thus, it reinforced our learning”*. Lastly, some of the preservice teachers pointed out that the application increased their concentration and interest in the course.

Would you like to use Kahoot in your lessons in the future? Why?

When the views of the biology preservice teachers about whether they would use Kahoot in their future professional lives were examined, it was seen that all of them thought of using it in future. When the reasons why they were willing to use Kahoot in their future courses were examined, it was found that most of them believed Kahoot to increase active participation in lessons and to make lessons more entertaining. In relation to this, one of the preservice teachers (A11) said *“if students use Kahoot in their lessons accompanied by awards, it may increase their participation in class, which will make students’ learning more permanent.”* Another preservice teacher (A13) said *“I absolutely think of using this application in my future lessons. I believe that it is useful for students; it increases students’ active participation in lessons; and it prevents them from losing their interest in lessons”*.

In addition, some of the preservice teachers pointed out that lessons will be taught more effectively since use of Kahoot will make lessons more entertaining and that it will increase productivity of students. Regarding this, one preservice teacher (A3) said *“Well, I think yes, I will use it because thanks to this, I will be able to have my students participate more actively in lessons. I think lessons will be more productive since students will not get bored; in contrast, they will find lessons more entertaining.”* Similarly, another preservice teacher (A7) said *“I will use Kahoot not only because it makes lessons more effective but also because lessons will be more entertaining”*.

Findings obtained via the motivation scale

Table 2 presents the standard deviations and the pretest and posttest mean scores obtained by the biology preservice teachers from the motivation scale.

Table 2

Statistical Results Regarding the Motivation Scale Pretest and Posttest Scores

	n	\bar{X}	SD	Min	Max
Pretest	15	3,60	0,29	2,97	4,03
Posttest	15	4,07	0,22	3,73	4,47

Table 2 presents the standard deviations and the pretest-posttest mean scores of the students participating in the study. According to Table 1, the students' pretest and posttest mean scores were 3,60 and 4,07, respectively.

Table 3 demonstrates the Wilcoxon signed ranks test results regarding the preservice teachers' pretest-posttest scores for the motivation scale.

Table 3

Wilcoxon Signed Ranks Test Results Regarding the Motivation Scale Pretest and Posttest Scores

	Posttest- pretest	n	Mean Rank	Sum of Ranks	z	p
Motivation	Negative rank	1	1,00	1,00	-3,235*	,001
	Positive rank	13	8,00	104,00		
	Equal	1				
	Total	15				

*Based on negative ranks

According to the test results presented in Table 3, there was a significant difference between the motivation scale pretest and posttest mean scores of the participants ($p < ,05$). Considering the rank totals of the difference scores, the difference was found to be in favor of the positive ranks for the posttest score. Depending on these findings, it could be stated that use of Kahoot in biology teaching increased the students' motivation.

Negative Aspects of Kahoot Use

What are the negative aspects of using Kahoot in lessons? Why?

Table 4 presents negative aspects of using Kahoot application in lessons.

Table 4
Negative aspects of using Kahoot application in lessons

Views	Frequency
Failing in the quiz	1
Technological insufficiency	1

As indicated in the Table 4, when the negatives of the preservice teachers about the use of Kahoot in biology teaching were examined, it was seen that most of the preservice teachers did not mention any disadvantage of use of Kahoot. On the other hand, two preservice teachers reported negative views about the application. One of them stated that it was demoralizing to be ranked at the bottom in the score list, while the other preservice teacher reported that students' lack of technological skills would have negative reflections upon the use of Kahoot. A7, one of the preservice teachers, said “*When I fail, I lose my motivation. Wrong answers and being at the bottom in the score list are really saddening*”. Another preservice teacher (A2) said “*to me, one negative side of use of Kahoot could be students' lack of adaptation to technology*”.

Suggestions for Kahoot Use

What are your suggestions for effective use of Kahoot in biology teaching?

Table 5 presents suggestions for effective use of Kahoot in biology teaching.

Table 5
Views for effective use of Kahoot in biology teaching

Views	Frequency
More questions can be asked	1
Applicable in other courses	1
Visually supported questions can be used	2
Students can be awarded	3

As indicated in the Table 5, when the preservice teachers' views about use of Kahoot in biology teaching were examined, it was seen that most of the preservice teachers found it more appropriate to use visual questions and to award students after the application of Kahoot. One preservice teacher (A14) mentioned the award system saying *"I would award all the students participating in this application"*. Another preservice teacher (A12) said *"students should first be subjected to a test in relation to use of Kahoot and then be awarded as a result of this test"*. Some of the preservice teachers thought that use of visual questions during the application of Kahoot in biology teaching would be likely to increase permanency of learning. One preservice teacher (A9) said *"If visual questions are directed regarding biology subjects, it will make these subjects more permanent in mind"*. Another preservice teacher (A8) said *"for different courses, questions including figures could be added"*. In addition, some of the preservice teachers pointed out that Kahoot should be applied in other courses as well and that more questions should be directed within the scope of the application.

How frequently should Kahoot be used in lessons? Why?

Table 6 presents frequency of Kahoot use in lesson.

Table 6
Frequency of Kahoot use in lesson

Views	Frequency
Biweekly	3
At the end of each lesson	5
At the end of lesson unit	1

As indicated in the Table 6, when the preservice teachers' views about how frequently Kahoot should be used in biology courses were examined, it was seen that most of the preservice teachers mentioned the need for the application of Kahoot at the end of every lesson. In relation to this, two of the preservice teachers (A9 and A4) stated that use of Kahoot at the end of lessons when students have fresh knowledge about subjects would reinforce their knowledge and increase permanency of their knowledge. One of the preservice teachers (A9) said *"application of Kahoot at the end of every lesson is more productive because it is easier for us to keep in mind what have just learned in lessons, and when we use Kahoot a week later, we are most likely to forget what we learned in previous lessons"*, while another preservice teacher (A4) said *"it should be applied at the end of all lessons to make our knowledge more permanent"*.

On the other hand, some of the preservice teachers thought that Kahoot should be used once in two weeks, while one preservice teacher stated that it should be applied at the end of each lesson unit. In relation to this, one of the preservice teachers (A13) reported that students might get bored when Kahoot was applied every week and that Kahoot would not be effective if students did not learn the subjects well. The same preservice teacher said “*Kahoot should be applied once in two weeks because if applied every week, it will be boring; also, the application will result in failure if the knowledge has not become permanent in mind, and this will not be good*”. Another preservice teacher (A1) who thought it should be applied at the end of a lesson unit said “*I believe it should be applied at the end of each lesson unit to provide permanency of knowledge and to raise awareness of wrong knowledge*”.

Conclusion and Discussion

The findings obtained in the study revealed a significant difference between the motivation scale pretest and posttest scores of the students in favor of the posttest. Depending on this, it could be stated that the preservice teachers' levels of motivation increased after the application process. This situation is supported by the students' views as well. Similarly, in one doctorate thesis conducted by Rouse (2013) in the field of science education, the researcher examined the influence of gamification on students' achievement and motivation in the course of microbiology. In the study, the lessons were taught with the gamification approach in the experimental group. At the end of the research process, it was found that gamification had positive influence on the students' levels of achievement and motivation. In another study carried out by Lee and Hammer (2011), it was revealed that gamification had positive influence on students since it allowed effective use of the learning process via mistakes and that it supported students in emotional and social aspects. In their study, the researchers also reported that gamification will allow overcoming such problems as lack of motivation and interest in lessons. In one other study conducted with 131 students in the control group and with 80 students in the experimental group, Domínguez, Saenz-de-Navarrete, de-Marcos, Fernández-Sanz, Pagés and Martínez-Herráiz (2013) examined the effects of a gamified education process on students in cognitive, affective and social respects. The results of the study demonstrated that students taking part in the gamification process had high levels of intrinsic motivation and that they achieved better results in general.

In addition, most of the biology preservice teachers reported positive views about Kahoot applications and thought of using Kahoot in their future professional lives. The preservice teachers participating in the present study found Kahoot applications more entertaining and interesting and reported that Kahoot contributed to permanency of learning and reinforced their knowledge. In related literature, there are several studies reporting similar findings. In one experimental study, for the purpose of examining the influence of gamification on the course process, Barata, Gama, Jorge and Goncalves (2013) compared a gamified course with the course they did not gamify in the previous year. The results of the study revealed that gamification had positive effects on active participation as well as on attendance in class and that the students found the gamification process more pleasing, motivating and interesting when compared to the traditional teaching process. Similarly, in a Master's Degree thesis conducted by Ar (2016), it was reported that the students found teaching with the support of gamification more competitive, entertaining and beneficial and that their interest in the course increased thanks to the application.

In the present study, most of the biology preservice teachers did not report negative views about Kahoot applications at all. Only two preservice teachers reported that being at the bottom in the score list was demoralizing in the application process and that students' lack of technological skills had negative reflections upon the process. Examining the results of experimental studies reported in related literature, Hamari, Koivisto and Sarsa (2014) investigated whether gamification helped achieve the desired outcomes or not. Most studies conducted in the field of education revealed positive results regarding motivation and active participation in the learning process. However, it was pointed out in these studies that there were several negative aspects to consider in relation to the increasing competitiveness and design-based features. Also, in the study, it was pointed out that removing gamification from the environment would have negative reflections upon the learning environment. On the other hand, Glover (2013) reported that gamification helps overcome learners' negative attitudes in the competitive environment and encourages them to demonstrate more productive behaviors.

The biology preservice teachers participating in this study put forward suggestions regarding use of Kahoot applications in biology teaching and stated that there should be more questions including visual elements and that all those participating in the application should be awarded. In the present study, symbolic awards were given to the successful students. According to

Deterding and colleagues (2011), when players are successful, they feel pleased with external awards, yet the actual factor that encourages the player to be successful in the game is internal.

In the study, regarding how frequently Kahoot should be applied in lessons, most of the biology preservice teachers thought that it should be used at the end of every lesson. They believed that application of Kahoot every week will be more effective in terms of permanency, reinforcement and feedback. In addition, the preservice teachers also reported that they thought of using Kahoot applications in future since these applications increased permanency, made lessons more entertaining and allowed active participation.

Innovative learning approaches and applications like gamification are increasingly mentioned in related literature. Experimental studies examining the effects of these applications, which are quite new to the literature, on the education process are few in number, yet most of these studies demonstrate that these learning approaches can meet the 21st century students' needs and demands and provide innovative solutions to current pedagogical problems (Deterding et.al, 2011; Zicherman & Cunningham, 2011; Sarıtaş & Yıldız, 2015).

Suggestions

Based on all these findings, the following suggestions could be put forward;

- With the help of gamification applications, lessons that students find boring could be made more entertaining, which is likely to increase students' motivation.
- The gamification approach can be used for different subjects via different applications, and its effects could be examined.
- More visual elements can be used in the application process in biology teaching.
- New features of Kahoot (team mode and so on) can be tested.

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