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Contents

Research Articles / Araştırma Makaleleri

Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 8, Issue 4, October 2017: 372-395
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Research Article

The Use of Gamification in Distance Education: A Web-Based Gamified Quiz Application[1]

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Abstract

One of the basic challenges in distance education is motivational issues that distance learners encounter because of the factors such as separation in time and space from teachers, other learners, and learning sources. In an effort to minimize this drawback and increase learners' participation into learning processes by motivating distant learners, new approaches such as gamification have been integrated in distance education. Gamification is one of the

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motivational approaches to meet this need. Gamification is defined as the application of game elements and digital game design techniques to non-game situations to engage and motivate people to achieve their goals. Within this perspective, this study intends to explain the use of gamification by examining, SoruKüp, a gamified web-based quiz application designed for the use of distant learners. Within this context, the research used holistic multiple-case design which is one of the qualitative research model. The research data was collected through interviews with participants who used SoruKüp application and the data was analyzed using content analysis technique. Within the perspectives of the research, it has been argued that gamification in distance education enhances the learners' motivation, contributes to the sustainability of the learning process, and makes the learning process more fun.

Keywords: *Gamification, gamification design in e-learning, gamified web-based applications, motivation, open and distance learning.*

Introduction

Learner motivation is a key factor in learner achievement, retention of learning and learner interaction. Learner motivation is especially significant in distance learning. Distance learners' self-direction and self-regulation are highly important for attaining success and the planned learning output. Motivation is at the center of self-directed and self-regulatory processes. There are two types of motivation in the learning process: internal motivation based on learners' willingness and external motivation based on reward or the avoidance of punishment. Put simply, internal motivation arises from the learner, while external motivation stems from outside factors.

Distance Education and Motivation

An analysis of the definitions of distance education reveals that the majority focus on the fact that learners are separated in time and space from teachers, other learners, and learning resources (Simonson, Smaldino, Albright & Zvacek, 2003; Moore & Kearsley, 2005). In distance learning contexts where students are at the center, being a self-disciplined learner and having high levels of motivation are important factors that determine the learning output. While high levels of motivation increases learner satisfaction, low levels of motivation increases students' risk of leaving the distance learning platform (Park & Choi, 2009). Ensuring that learners have high motivation levels is highly important to achieve learning outcomes (Bozkurt, 2014; Ucar & Kumtepe, 2018).

Distance between learners and teachers is usually seen as a limitation that leads to lower motivation levels and negative situations in learning processes. A study by Sankaran and Bui (2001) has shown that highly motivated learners are successful both in distance and traditional learning environments. In this respect, it could be argued that increasing distance learners' motivation levels is necessary for obtaining richer learning output. At the same time, the relationship between technology and learning processes may not be effective in terms of increasing motivation and making it sustainable. This makes gamification design stand out as an appropriate way to increase students' motivation.

Gamification

Gamification is the application of game-design elements and game principles in non-game contexts (Deterding, Sicart, Nacke, O'Hara & Dixon, 2011). Werbach and Hunter (2012) have developed a three-category model of gamification. These categories form a pyramid structure comprising dynamics, mechanics and components (Figure 1).

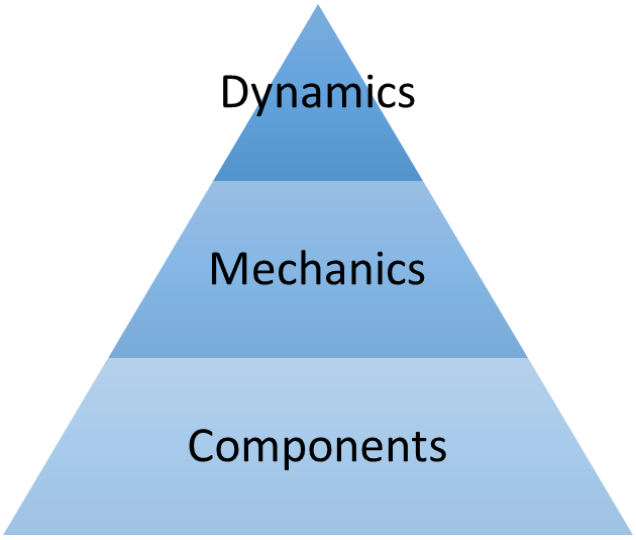

Figure 1. The gamification model and its components (Werbach & Hunter, 2012)

Dynamics: Gamification dynamics are the basic principles that guide the gamification design.

- Constraints
- Emotions
- Narration
- Progress
- Relationships

Mechanics: These elements define more observable aspects of the gamification structure..

- Challenges
- Chance
- Cooperation and competition
- Feedback
- Resource acquisition
- Rewards
- Transactions
- Turns:
- Win states

Components: These are the most striking elements of gamification. More than one component can be used in relation to a single gamification mechanism.

- Achievements
- Avatar
- Badges
- Boss fights
- Collections
- Combat
- Content unlocking
- Gifting
- Leader boards
- Levels
- Points
- Quests
- Social graph
- Teams
- Virtual goods

Gamification and education

Because of the some limitations in distance education processes, new approaches are needed to sustain learners' motivation. In this context, gamification activates the motivation that directs learners to study more (Muntean, 2011), leads learners to be more active, reinforces behaviors for cooperation and achieving goals (Glover, 2013). The tendency of e-learning environments to reflect gamified designs effectively, the ability to integrate gamification in e-learning processes easily, and the opportunity to make the gamification elements in the interface concrete through visualization make gamification as a suitable approach for e-learning (Bozkurt & Genç Kumtepe, 2014).

The Related Literature

Shi, Cristea, Hadzidedic and Dervishalidovic (2014) argue that gamification has the potential to increase learners' internal motivation in e-learning processes. Similarly, Krause, Mogalle,

Pohl and Williams (2015) found that gamification contributed to online learners' rates of participation in the learning system. Mozelius, Collin and Olsson (2015) stated that online environments visualized with gamification elements contribute to learners' online environment perceptions. Amriani, Aji, Utomo and Junus (2013) reported that gamification did not influence student participation in e-learning environments, but that when gamification elements were not present, this led to a significant difference in student performance. Lamprinou and Paraskeva (2015) reported that gamification increases learner motivation in online learning environments and contributes to reaching learning objectives. Gañán, Caballé, Clarisó and Conesa (2016a, 2016b) and Jimenez, Caballé, Clarisó and Conesa (2016) studied the gamification of e-learning platforms and found that learning analytics may be effective in gamification design processes.

Research Questions

The main aim of this study is to determine the usability of gamification practices. It sought answers to these questions:

- What are the distance learners' opinions about the gamified test application?
- How does the gamified quiz application influence the participants' motivation?

Methodology

In this section, the research design, sample, data collection procedures and the analysis methods were discussed.

The Research Design

This case study aimed to investigate the role of the SoruKüp application, which is used as an online quiz application enriched with gamification elements in Anadolu University's Open Education Faculty and to identify user opinions about improving it. As a qualitative method, case study is defined as, "the thorough description and analysis of a system" (Merriam & Tisdell, 2015). The researcher examines one or more specified cases thoroughly based on data from various resources and reports the case-related themes within a certain time period (Cresswell, 2007). The researcher interacts with the participants in natural environments where

the research takes place and examines a certain situation or situations. The concept of a case may be an individual or group, an institution or an environment (Yıldırım & Şimşek, 2011). The steps to be followed in case studies are similar to those of the scientific research process: specification of the research questions, the sub-questions, the analysis unit, the topic to be investigated, the participants, data collection, data interpretation and reporting the case study (Yıldırım & Şimşek, 2011).

According to Yin (2002), the case study approach in education studies especially aims to answer the questions, how and why. The researcher should determine a case study design suitable for the research questions and method prior to the research process (McMillan, 2004).

This study adopted the holistic multiple case study design. In holistic multiple case studies, each case is considered as a whole framework in itself and then compared with each other. Holistic multiple case study design is generally used in studies of innovations such as a new educational programs, activities or technologies (Yin, 2002), making it appropriate for this study's investigation of opinions about the use of the SoruKüp application. To do so, the distance learners' opinions about gamified application elements such as level, ranking, multi-player structure and random card selection were analyzed individually, and then their effects on the whole system were considered holistically.

Participants

The sample included students who used the SoruKüp, a web-based quiz application, in Anadolu University's Open Education Faculty in the 2015 fall semester. Purposive sampling with maximum variation was adopted. The rationale for purposive sampling is to have data-rich cases for carrying out in-depth research (Patton, 1990). In addition, in samples with maximum variation, it is possible to understand whether there are any similar or different situations among various groups, and expose different dimensions of the problem based on this variation (Yıldırım & Şimşek, 2011). The system records of the SoruKüp application were used to determine the sample. Learners from Anadolu University, Open Education Faculty, Business Administration Faculty who used the application at high, medium and low frequencies were selected. It was aimed to increase the widespread effect depending on the number of students in the selected department and class. Forty participants were invited to take part in the

interview, and 26 of them agreed to do so. The age range of the study group, which consists of 15 female and 11 male participants, varies between 20-46.

Data Collection

The data collection instruments included semi-structured interviews carried out face to face or through tele-conferencing, system records tracking user logs in the SoruKüp application and researcher diaries. Since people's feelings, ideas and intentions cannot be directly observed, the most suitable method for collecting this kind of data is interviewing (Patton, 1990). When preparing the interview questions to gain information about the users' perspectives, the research questions and sub-problems were taken into consideration. These questions were prepared on the basis of expert opinion and the relevant literature. The semi-structured interview form with open-ended questions took its final form after consulting expert opinion. Interviews recorded with the participants' permission during the interview and the researcher's notes formed the data set.

Data Analysis

Data analysis included the participants' responses, combining what the researcher saw and read, and summarization and interpretation, which were subjected to content analysis (Merriam & Tisdell, 2015). After the semi-structured interviews with the participants were recorded, these recordings were transferred to the computer environment. The emerging themes were coded and supported with related quotations, and content analysis was completed according to the guidelines of Yıldırım and Şimşek (2011) and Creswell (2013).

Validity and Reliability

Some precautions were taken to prevent any factors from threatening reliability and validity. During the preparation of the open-ended questions on the data collection instrument, the relevant literature was reviewed and expert opinion was obtained on gamification, e-learning and motivation in learning. Prior to the interviews, the participants were informed about the procedures. Participation in the interviews was voluntary, and the participants' information was kept confidential. The interviews were recorded, and the researcher took notes at the same time. All of the data were stored to maintain verifiability. Three researchers performed the data

analyses, and coordination was maintained between them. When necessary, the participants were contacted again to confirm data. The report was prepared in detail so that the study can be transferable. The researchers have been actively involved in the design of the SoruKüp application, preparation of the data collection tool, collection of data, analysis and reporting.

The Research Context

SoruKüp, which was developed for the use of Open University students, is a web-based quiz application enriched with gamification. The application can be accessed via Facebook. It uses Node.Js, PHP and MySQL technologies in the background and HTML5 as its interface. The application is supported by contemporary operating systems and works on smart phones, tablets and computers.

SoruKüp was designed as a multi-player information contest and has the following elements:

- Real-time multi-player competition system
- Post-competition ranking system
- Motivational feedback system based on competition results
- Scoring system
- Level system based on performance
- General ranking system
- Social interaction opportunities
- Making the content concrete with cards
- Chance factor

Users who enter the application are directed to a page named "Update." This page is shown in Figure 2. It shows recent users, success rank in the last game, the top 42 players and recent news related to the application.

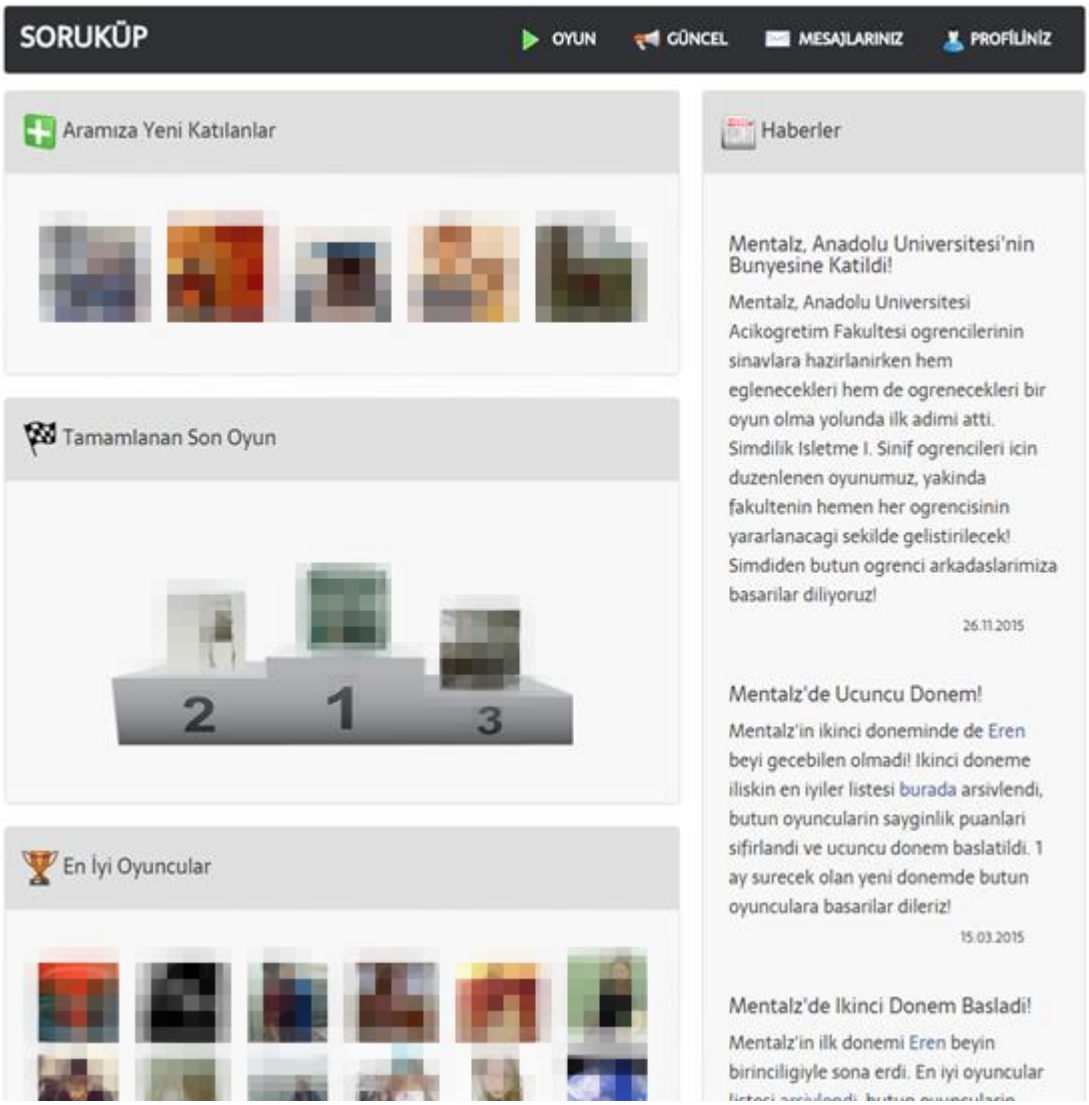

Figure 2. SoruKüp's page tagged "Update" (User profile pictures were blurred to protect privacy.)

A visitor who visits the application can click on the "Game" button and enter the web page of the knowledge contest. Later, they can reach the competition room using the button tagged "UseToken and Start."

As soon as four users have entered the room, the activity will automatically start. After a certain period, if four people cannot be gathered in the room, bot characters will enter so that the users need not wait for a long time.

The feature that distinguishes this activity from other knowledge contests is its card structure, in which every unit has been transformed into a card for gamification purposes. The visuals for

a unit, the unit title and the course name can be seen on the cards, an example of which can be seen in Figure 3.

Figure 3. Sample question card

When the activity starts, the system asks the learners to randomly select three cards out of 50 and display them in the room. After the cards are displayed, the player is asked to choose a card. After the card selection is completed, the selected card can be seen by all users and a question related to the unit is displayed. All the users in the room are required to answer the question within a certain amount of time. Their responses can easily be seen, the correct answers are explained and the scores are announced. The scores depend on the correctness of the answer and response speed.

Next, three new cards are selected and distributed. With every distribution, the right to select a card passes on to the next user. Card distribution, card selection, posing the question, giving the answer, and scoring the answers are repeated four times and the users in the room are ranked based on their scores and each of them are given feedback by the system. The merit score used in the general ranking in the game is determined based on their score at the end of the game. The merit score also determines the user's level.

The "Profile" page specific to each user is also highly significant. This page can be accessed by clicking on the users' photographs and includes data related to the user's level, scores, results of the last game and general ranking. It is also possible to write a message to the related user via this page. Messages can be seen and answered in the "Your messages" section.

As discussed previously, the SoruKüp application is a quiz activity enriched with gamification elements. In this respect, it could be argued that this provides a fun environment that has the potential to increase motivation to do exercises. The evaluation of the application by the users will contribute to the gamification literature and the development and dissemination of the application.

Findings and Discussion

This section will discuss user opinions of the gamification dynamics, mechanics and components of the SoruKüp application (Figure 4).

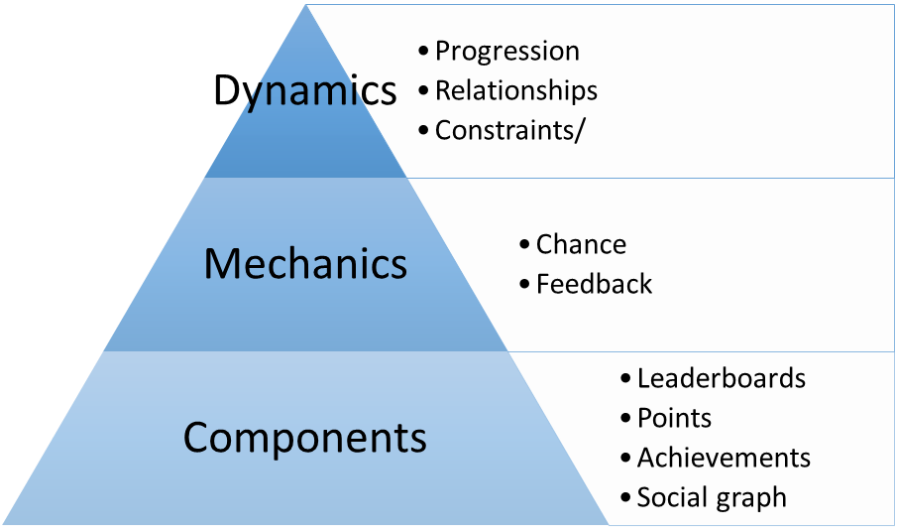

Figure 4. Gamification dynamic, mechanic and components

Leader Board

In the online interviews, the extent to which the leader board influenced learner motivation was assessed using the question, "Did you notice the rank system in the game?" The responses revealed that the leader board motivated the learners to play more and reinforced the sense of competition among the participants. The participants also mentioned that they had the chance to do more practice while trying to rise to a higher rank. Another interesting finding was that seeing oneself or other participants on the leader board promoted the perception that the online environment is a social context. The leader board is also significant in terms of seeing one's own level in a gamified social platform. The participants see the leader board as an instrument of evaluation and use it to learn about their level in comparison with others. Considering the

fact that distance learners are far apart, the leader board can be used as a self-evaluation tool and increases the perception that there is a social learning environment where there are other learners. Still, some participants said that the rank system did not motivate them. Here are some of the opinions expressed by the participants in the interviews:

> *"The rank system got my attention. It influenced my motivation positively. If I rank fourth in a game, I want to play more, wondering why I performed poorly." [P11]*
>
> *"The rank system is interesting, and it motivated to be more successful. I want to be in the highest ranks." [P6]*
>
> *"I think it will be good in terms of doing practice. I wanted to be in the higher ranks. But this has to do with me. I wanted to see my position, and what else I could do." [P28]*
>
> *"The ranking system is interesting, but it did not influence my motivation because it is nothing like a normal game. If there were no rank system, I would still play it again and again." [P8]*

Analysis of the participants' experiences of the leader board shows that it meets some important learner needs. It positively affects self-direction (Smith, 2001) and self-regulation (Palloff & Pratt, 2003), enables learners to evaluate themselves (Schunk, 1996) and the presence of other participants in the leader board promotes the idea of a social presence (Short, Williams & Christie, 1976).

Points, Achievements, and Progress

Another interview question asked about the extent to which gamification components, that is, points, achievements and gamification dynamics, influence learner motivation. The progress, achievemnts and points dimensions are presented to SoruKüp users in a single design. The participants were asked "Did you notice the level system in the game?" The scoring system is a meaningful application for making the participants' progress concrete. New levels were opened as a result of the scored points, and this provided the opportunity to reach an abstract achievement. From a complementary perspective, the progress dimension was seen as the driving force by the participants and enabled them to have a sustainable experience with the gamified application. Here are some of the related opinions stated in the interviews:

> *"The level system is ... how can I say it, the driving force in the game. But the ranking becomes more challenging as more levels are passed because you need to*

> *collect more merit points. That is somewhat demoralizing, but of course it should not be easy to pass levels in the game." [P28]*
>
> *"That also had a positive effect because as you progress you see your own level, and when you play with other players you see their level. That was also a good aspect of the game." [P12]*

One of the greatest difficulties with distance learning is high drop-out rates (Berge & Huang, 2004; Tyler-Smith, 2006) and rates of completion of the lower level system (Herbert, 2006). In this regard, it can be said that gamification has a positive effect on lessening drop-out rates by increasing learner motivation and thus supporting the sustainability of the learning process.

Social Graph

Another interview question was the social graph component that enables communication and interaction. The participants were asked, "Did you text other users?" The participants did not feel the need to use the messaging function, and many participants stated that the messaging feature was disturbing. Another point that was discovered in the interviews was that the players were not aware of the messaging feature since they did not need to text other players. Here are some of the opinions expressed by the participants in the interviews:

> *"I never felt the need to contact other players, when they contacted me, there were some bad things in the past, and I made the necessary complaints. I never felt this need, when they asked to contact me I declined the offer. I never felt the need to do it." [P28]*
>
> *"No, I did not contact them. I don't mind having such a feature. Some might use it. It is a personal choice." [P12]*
>
> *"No, no. I am kind of against such things." [P1]*
>
> *"I did not see any message. Messaging would be fine but might also change the aim of the game. It can be both an advantage and a disadvantage. I guess the game was normally intended for teaching purposes. I think messaging can alter this aim." [P19]*
>
> *"I was not aware of the messaging section in the game. Even if I had known about it, I would not have used it." [P2]*

Cultural analysis of societies shows that there is a relationship between communication and culture. Hall (1976) classifies societies as high- and low-context cultures depending on explicit and implicit communication patterns. In Hall's classification, Turkey has a high-context culture. In high-context cultures, oral communication is used more frequently and written

communication is not as common. Therefore, the reason for the unwillingness to communicate by messaging might be related to cultural context, but to explain this situation more clearly, further studies need to be carried out.

Chance

The participants were asked, "How did the random distribution of cards influence you?" to find out about the chance factor, a gamification mechanic. The participants' responses show that they perceived the chance factor positively and thought that context should be considered in the design of this factor:

> *"[Randomization of the cards] might be optional, might be in our hands. Actually, random is better. If it were optional, the person could always select the topics they know well and ignore unknown topics. But, if it is random, the person has to address the topics they do not know. [Thus] they will learn something sooner or later, so that's good." [P28]*
>
> *"More lessons should be provided in the random placement of cards, and the questions should be related to the lesson that we choose." [P8]*
>
> *"For example, there are subjects we do not know, or lessons that we have not taken yet and since we don't know that material, our answers are automatically wrong." [P1]*
>
> *"Since it is a multi-player game, and only the question I have chosen will not be asked, there would not be much difference in the game. I get the chance to learn new information, so it is not a negative aspect for me." [P12]*

The chance factor is a mechanism which is used in promoting the gamification process and makes the gamified processes less boring (Rao, 2016). The findings show that in gamified applications, when designing the chance factor, a different chance factor should be designed and integrated for each context.

Feedback

The participants were asked, "How did the feedback influence your school experience?" to find out about their opinions on the feedback from the gamified mechanics. The first person discourse used in the feedback was found to be positive and effective for measuring performance, and its contribution to participants' motivation was found to be valuable. Two participants stated that the feedback did not contribute to their motivation.

> *"I guess these are the sentences our teacher prepared himself. Very nice sentences. Suitable for student." [P28]*
>
> *"The feedback is a nice way to measure performance in the game." [P20]*
>
> *"The feedback at the end of the game is nice. When I rank the first, I am motivated by that feedback." [P8]*

In gamified e-learning applications, the feedback mechanism is a significant component. Through feedback, the participants have the opportunity to evaluate themselves and progress in the game (Muntean, 2011). In gamified applications, instant feedback influences success and unlike real life, the gamification process can be made a more sustainable experience by giving positive feedback (Groh, 2012).

Constraints

Constraints are the limits of the participants' freedom. In the SoruKüp application, the constraint dynamic is provided by the question cards. To find out about the participants' opinions on this topic, the question, "How did the game's question card structure influence your game experience?" was asked. The participants in general found the question card-based design positive. One of the findings of the interviews was the need to offer the participants more freedom to choose. In other words, the participants' limitation should be related, and they expressed the need to individualize their learning processes by stretching the constraints. Another suggestion was to enrich the content and options in the question card structure. The participants said that rather than having the constraints at a minimum level, more enriched processes might be more meaningful.

> *"As I said before, there are not many questions from my own cards. For instance, in the same topic there may be questions from the first or second term, or from the first or second year. A card from the same category arises twice in the first or second term or year. We should be able to choose the cards. Or if we choose our department before the game, it would be more advantageous." [P19]*
>
> *"I choose cards related to my department, but the question number and departments should be increased." [P26]*
>
> *"The question card structure is pretty good. The period is short I guess, maybe the period for that question might be increased because you need to read quickly and answer. Sometimes you can click on the wrong option." [P28]*

> *"As for the question cards, there were many questions from other courses not related to my own course. The random distribution of the cards is nice, but as there aren't many courses. The few questions related to my topic is a weakness." [P20]*

The individualization of the learning processes influences motivation positively (Riding & Rayner, 1995). One of the aims of gamification is to increase motivation. Therefore, increasing the options of individualization by offering more options in gamified contexts could increase the effectiveness of the gamification application.

Relationships

Another question was the extent to which the multi-player structure design in the SoruKüp application influenced the participants' relationships and motivation. To find out about the participants' experiences, the participants were asked, "How did the multi-player structure influence your game experience?" The multi-player structure increased competitive feelings among the participants, making the players want to be more successful in this competition:

> *"The multi-player structure influenced the competition positively because you can measure your knowledge in comparison to a lot of people." [P20]*
>
> *"You can test yourself. You get more passive if you play it alone, but you can also see others' performance in addition to yours. You can compare yourself with others. It affected my motivation positively." [P12]*
>
> *"It increases personal attention. You need to pay attention to others' responses, and this becomes the driving force, I mean the desire to be more successful." [P28]*

The multi-player structure of the SoruKüp application was designed to have bot users keep participation constantly active. The participants' responses to this were of two types. They preferred real participants rather than bots in order to experience the feeling of real competition. While there were some arguments in favor of the use of bots to increase the game's functionality, some participants suggested that the bots should be designed more realistically in a competitive environment. The participants stated that sometimes it is not possible to win against the bots, which influenced their motivation negatively:

> *"In the multi-player structure, competing with real people rather than bots makes me try harder." [P6]*
>
> *"Competing with others in the game positively influenced my motivation. Competing with real people rather than computers is more competitive." [P2]*
>
> *"The multi-player structure increased competition and influenced motivation positively. I liked competing with the other players. The use of bots reduced the time to start a new game, so it's nice." [P11]*
>
> *"The multi-player structure is nice, but the bot issue is really annoying. They answer instantly, within a second, and it is impossible to win against them after they give the right answer. That is a little annoying." [P19]*

Human-machine interaction is considered to be an important factor in learning processes due the increased capacity of today's information and communication technologies (Latour, 2005). According to connectivism, which is regarded as the digital age's learning theory, learning is not solely a biological process (Siemens, 2004). Thus, the use of bots in gamified learning applications has a rich potential in future studies. As the participants' responses show, bot design can influence learners' perceptions and the success of gamified processes.

Conclusion and Suggestions

In this study, a gamified web-based quiz application was examined in a qualitative case study. Distance learners' opinions were gathered on how it influences their motivation and user opinions on dynamics, mechanics, and components used in the web-based quiz application.

According to research findings, students in a distance education system stated that the gamified application influenced their motivation positively in the learning process. The leader board, a gamification component, enabled them to evaluate their level and see other participants on the board, which increased their perception of social presence. Qualities such as points, achievement and progress supported their learning experiences and made the learning experience a sustainable process. The participants found the social graph component that enabled communication with other participants unnecessary, and some of them stated that they were not even aware of this feature. Some of the participants mentioned that they were disturbed by the potential contact with participants they did not know in person. The negative opinions related to the social graph component could be related to the cultural context, which

implies that presenting this gamification element as an option would result in a more effective gamification design.

The participants thought that it was necessary to give the user the option to choose in chance factor design. There were positive feedbacks on the feedback mechanism, and the participants stated that they had the opportunity to evaluate themselves through the feedback mechanism, which influenced their motivation in a positive way. Another theme was that the first person discourse used in the feedback maintained warm communication.

The participants also mentioned that the features presented in the context of constraints should be more flexible, and if possible, individualized. With regard to relationships, the multi-player structure was found to be positive. This dynamic reinforced competition and increased the learners' participation. One interesting idea that was discovered concerned the use of bot users in distance learning processes. Although some participants preferred real users to bot users, there was positive feedback on the use of bots, and the need for more realistic bot designs was expressed.

The data obtained suggest these recommendations for future research:

- Further studies on gamified learning applications and processes should focus on cultural differences for better gamification design
- The gamification elements can easily be designed and integrated with online environments. Therefore, the use of learning analytics in gamified applications, platforms and similar online contexts could provide information on what type of dynamics, mechanics and components are effective and yield data based on real-time monitoring. Further studies need to be carried out on the effectiveness of gamification elements based on learning analytics.
- The research findings of this study suggest that the use of bots has a high potential in distance education, specifically in gamified learning processes, making the development of bots beneficial for the use of gamification and learning processes. Design-centered research is recommended for future studies.
- This study used the qualitative method of case study to gather learners' opinions and analyze them in detail. To contribute to the relevant literature and to verify the

hypothesis that gamification increases motivation in distance learning processes, more qualitative studies are needed.

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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.

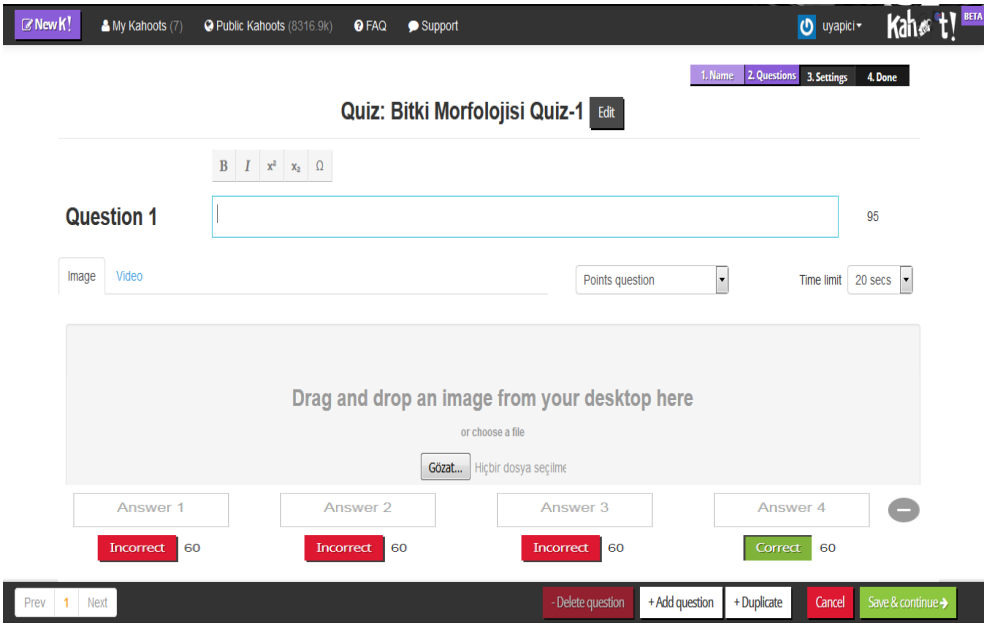

Figure 1. Screen for adding quiz questions

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 enters 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).

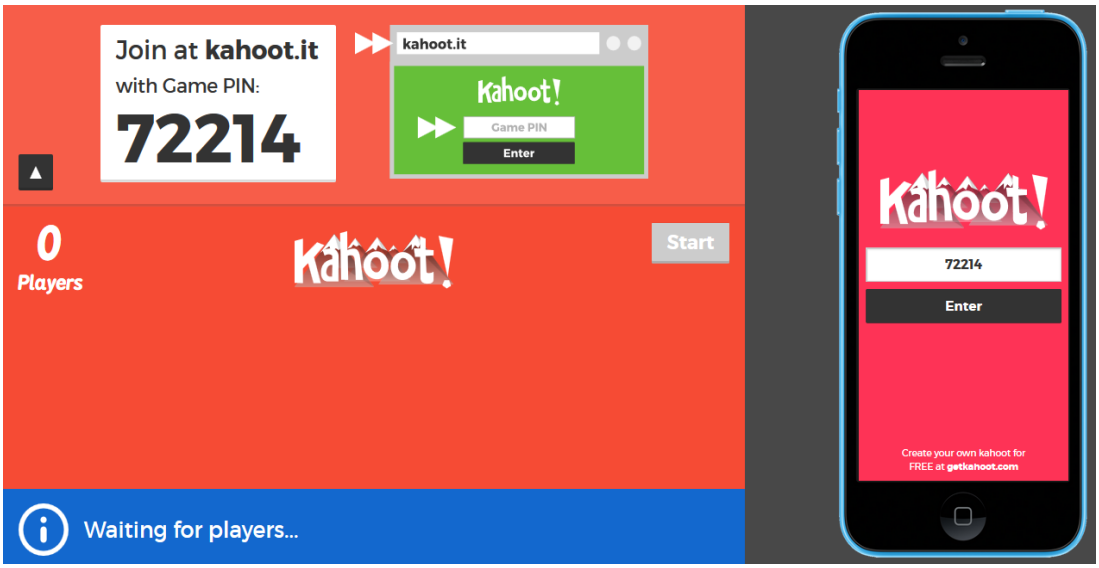

Figure 2. Quiz access screen

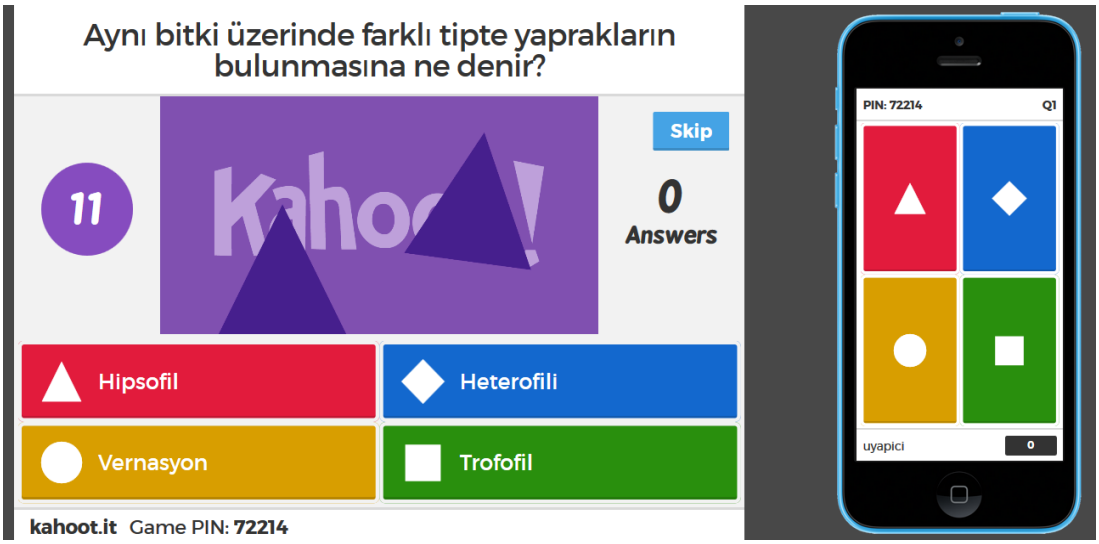

Figure 3. Quiz question-answer screen

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*".

One 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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Research Article

Primary School Students' Encounters Against Online Risks from the Perspectives of Schools Counselor Teachers[1]

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Abstract

Digital technologies bring about some online risks as they become a regular part of daily life. Online risks cover a range of threats such as cyberbullying, inappropriate communication, exposure to explicit content, and personal information theft. The individuals' chances to face with online risk increase as the digital technologies become widespread. Within the community, children are more vulnerable to online risks. In this context, the purpose of this study was to identify the children's state of facing online risks based on the perspectives of

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school counselor teachers. In doing so, the researchers contacted with 21 school counselor teachers during the seminar sessions of the 2014-2015 school year's second semester. The participating teachers answered four open-ended questions and handed in their answers in written form. The data then analyzed employing deductive analysis methods and descriptive statistics. The results indicated that the students were exposed to seven online risk groups titled sexuality, commercial interests, banning, identity theft, inappropriate communication, addiction, and violence.

Keywords: *online risks, internet addiction, school counselor teachers*

Introduction

Recent studies report that the Internet has become a regular part of children's lives (Kaşıkçı, Çağıltay, Karakuş, Kurşun, & Ogan, 2014; Livingstone, Mascheroni, & Staksrud, 2017). The literature also suggests that children tend to mobilize and gain autonomy (Livingstone, Haddon, Görzig, & Olafsson, 2011). In addition to opportunities such as online learning, e-commerce, self-actualization, and digital citizenship development (Smahel et al., 2012), the children who use the Internet are exposed to the risks including explicit content, cyberbullying, cyber-harassment, and e-fraud (Chang, 2010; Gasser, Maclay, & Palfrey, 2010). Despite often being named as digital native, new millennium learner, and net generation, children are known to be adversely affected by online risks and experience problems (Jones, Mitchell, & Finkelhor, 2012; Livingstone, Davidson, Bryce, Hargrave, & Grove-Hills, 2012; Valcke, Bonte, De Wever, & Rots, 2010; Valcke, De Wever, Van Keer, & Schellens, 2011; Walrave, 2011). In a study conducted with 9 to 16 years old children in the European Union, it was found that one in every three children experienced online risks (Livingstone et al., 2011). The study also reported that the children ran into sexually explicit content (14%), victimized by cyberbullying (6%), made friends online (30%), and encountered disturbing content (21%). In the Turkey section of the study, it was found that one of every four children in Turkey were exposed to online risks (Kaşıkçı et al., 2014). The study also reported that Turkish children encountered online risks such as seeing sexually explicit content (13%), making friends online (14%), being victimized by cyberbullying (3%), and receiving sexually explicit messages (12%). These results indicate that the children's chances to experience online risks are too high to neglect.

The studies report that the rate of children's encounters with online risks increases in response to their internet use patterns (Livingstone et al., 2011). Besides, the children who have not attained the necessary e-literacies are more prone to harms caused by online risks (Dönmez et al., 2017). This situation increases the importance of the studies that examine online risks and develop measures for prevention. The literature on defining online risks started to emerge back in the late 1990s. In their early studies, Jantz and McMurray (1998; as cited in Chou & Peng, 2011) examined online risks within the scope of communication and sexual content. Similarly, Aftab (2000) investigated the online risks of inappropriate content, stalking, harassment, e-fraud, personal information lost, and inappropriate communication. Poftak (2002), on the other hand, utilized the titles of sexually explicit content, copyright infringements, inappropriate communication, personal information lost, and cyberbullying. Using a thematic approach to

the categorization of the risks, DeMoor et al. (2008; as cited in Valcke, De Wever, Van Keer & Schellens, 2011) listed online risk themes as content (e.g., inappropriately sexual and violent content), commercial interest (e.g., encouraging overspending or selling personal information to 3rd parties), and communication (e.g., cyberbullying and sexual harassment). Hasebrink, Livingstone, Haddon, and Olafsson (2009) investigated online risks under the titles of sexuality, violence, commercial interests, values, and ideologies. Considering all these previous efforts, the present study's significance stems from its attempts to examine the ways that children interact with the online risks. In the study, children take different roles based on their interactions with the online risks. While the children exposed to risky content take the role of the recipient; the ones exposed to risky communications become interactors, and the ones initiating risky behaviors are called actors. Twelve risk foci were generated through a cross-tabulation of the risk categories and the children's roles. For instance, the sexuality title covers risks such as seeing explicit sexual content (recipient role), receiving inappropriate proposals (interactor role), and sharing explicit content (actor role).

The scope of online risks appears to extend as developments in online technologies take place. While the focus of the early studies was mostly on inappropriate online contents, recent studies have emphasized some new communication-related risks due to the rise of technologies like social networks. This situation has also increased the importance of sustaining the studies on identifying online risks. Various stakeholder groups should take part in the investigations of the current state of child-internet relationships and emerging risk factors should be identified early on. Thus, the purpose of this study is to examine the child-internet relationships from the perspectives of school counselor teachers.

Methodology

Participants

It is desired to reach the guidance teachers working at the primary and secondary education level schools in Eskisehir. However, not all of the teachers wanted to participate in the research. Therefore the participants of the study were 21 school counselor teachers the researchers contacted during the seminar sessions of the 2014-2015 school year's second semester.

Data Collection

The participating school counselor teachers were asked to provide written answers to some open-ended questions. Open-ended questions are frequently used in qualitative studies to obtain the participants' opinions, and they can be utilized without referencing the literature or a specific theory (Creswell, 2013).

The participants wrote their answers to the following questions and handed them to the researchers:

- What are the internet-related questions the children ask you?
- What do you think are the individual factors that determine the children's experiences with internet-related problems?
- What do you think are the social factors that determine the children's experiences with internet-related problems?
- What do you recommend in preventing harms to children due to internet-related problems?

Data Analysis

The data were analyzed through deductive analysis utilizing descriptive statistics. In the inductive analysis, researchers determine whether there exist sufficient data to support the emerging themes (Creswell, 2013). Deductive analysis provides sound results once the data regarding a theme reaches saturation. The steps taken in a deductive analysis are as follows: (a) testing and verifying the theory, (b) testing the hypotheses or research questions stem from the theory, (c) defining and operationalizing the variables derived from the theory, and (d) obtaining scores regarding the variables via a measurement tool or observation.

The evidence gathered here about the online risks were categorized based on the sexuality, commercial interests, violence, and values/ideologies dimensions of the online risks framework developed by Hasebrink, Livingstone, Haddon, and Olafsson (2009). In other words, the current study considered the aforementioned dimensions of online risks as themes. In the process, the framework was extended with other themes emerged from the data or suggested in the literature. Added themes include addiction, identity theft, inappropriate communication, and banning. Two researchers from the research team individually analyzed the data based on

the extended framework. Then, a third researcher verified the analyses and finalized the process.

Findings

In the prescribed themes, children's roles are recipient, interactor, and actor. The child takes the role of the recipient when he or she reaches the online content independently. If somebody else initiates the communication or interaction, the child regarded as an interactor. Finally, the child takes the actor role when he or she initiates communications or interactions with others. The new structure developed through the cross-tabulation of the roles and risk factors is presented in Table 1. The observed frequencies were also provided in the table.

Table 1
Online risk observed by the counselor teachers

	Sexuality	Commercial Interest	Violence	Values / Ideologies	Addiction	Identity Theft	Inappropriate Communication	Banning
Receipent	0	1	0	0	0	0	0	0
Interactor	2	0	12	0	0	3	4	3
Actor	0	1	9	0	6	1	2	0

As Table 1 indicates, the counselor teachers observed a variety of online risks. The risks within the violence theme were the most frequently mentioned risks. They were followed by the risks fell within the addiction and inappropriate communication themes. The teachers also observed identity theft, banning, sexuality, and commercial interest risks. On the other hand, the teachers did not report any observations regarding the values/ideologies theme.

The risks observed under the violence theme were part of threatening, humiliation, cyberbullying, and harassment subdimensions.

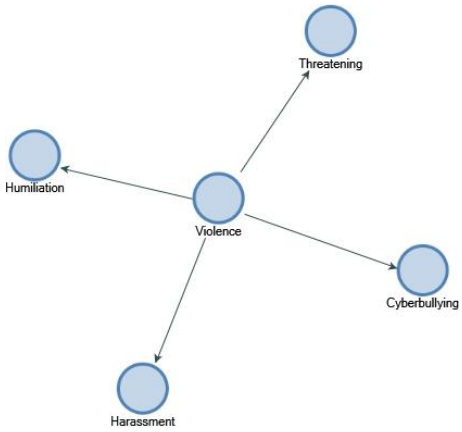

Figure 1. Incidents regarding the violence theme

A significant finding concerning the violence theme was that violent online behaviors often had reflections in the school life. For instance, threatening remarks students made online usually ended up in heated arguments and fights. Moreover, it was found that students could orchestrate complicated cyberbullying schemes. For example, students could alter their peers' photos and post them on social media or inappropriate websites. Such events were reported to emotionally affect the victims and impair their academic performance and sense of belonging. Its interactive nature distinguishes the violence dimension from the rest. In their responses, the participants stressed that students can take both interactor and actor roles in cyberbullying events.

In the addiction dimension, students often took the recipient role. The kinds of addictions observed by the counselor teachers were video game addiction, internet addiction, and computer addiction (Figure 2).

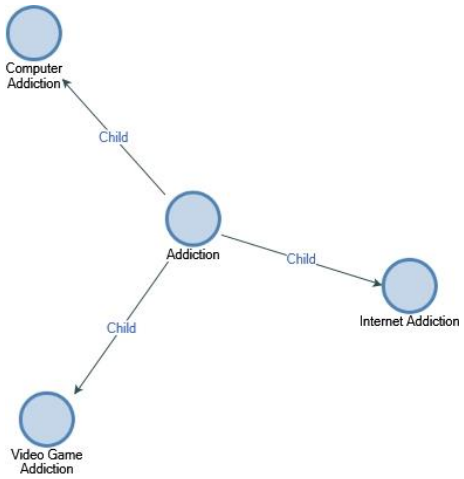

Figure 2. Incidents regarding the addiction theme

The participating teachers stated that they have observed the following addiction problems in their students:

- Students play video games on computers and they often prefer highly addictive online games.
- Internet and computer addictions are prevalent among students.
- Video game addiction has adverse effects on the students in both educational and personal lives. One of the participants associated the students' absences with game addiction.

  "I have students who have been absent for more than 40 days due to their video game addiction."

  Another participant stated that a student with game addiction tends to link everything in the natural environment with the characters and objects from video games. These indicate that game addiction can have negative psychological side effects.
- Internet addiction has detrimental effects on academic achievement as well. A participant described the situation in a students' words as:

  "I can't stop it once I start surfing. I know I should study instead, but time quickly goes by."

In the inappropriate communication theme, the student can take roles of interactor and actor. Within this theme, offline and online communication subthemes were identified (Figure 3).

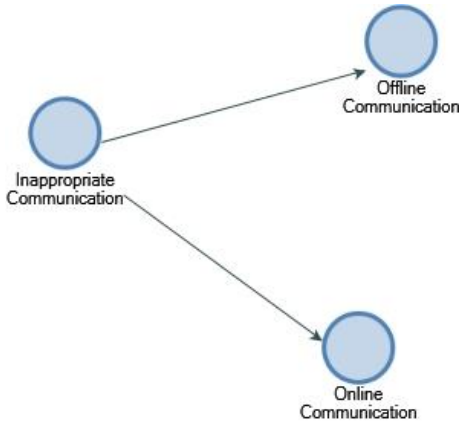

Figure 3. Incidents regarding the inappropriate communication theme

The students were known to receive friend requests from strangers on social media, communicate with older people, arrange meetings with people they have met online, and share inappropriate content when communicating with the opposite sex.

Students can also be actors or interactors in identity theft. The subdimensions identified under this theme were account theft, unauthorized use of personal pictures, and fake accounts (Figure 4).

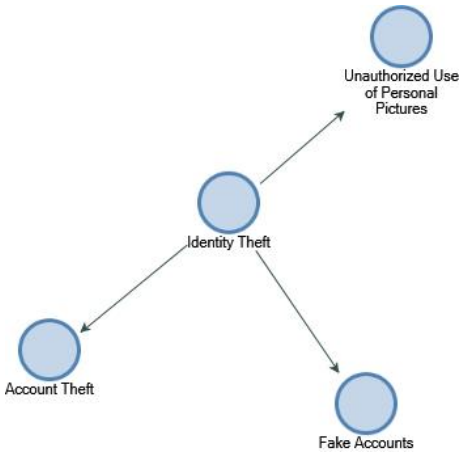

Figure 4. Incidents regarding the identity theft theme

The counselor teachers reported that students usually got their social media accounts stolen and suffered from the consequences. For instance, account thieves may establish undesired contacts with 3rd parties on the students' behalves. The situation may then escalate into fights in real life. Another aspect of identity theft is creating fake accounts using one's pictures. Similar to the stolen accounts, fake accounts may be used to contact 3rd parties on the students' behalves.

Another dimension where students take an interactor role is banning. The students consulted with their teachers when others intruded into their personal lives and did not allow them to connect to the Internet or play video games.

The least frequently observed online risk dimensions were sexuality and commercial interests. Students tend to question the validity of the advertisements with sexual content. One of the participants reported that once a student consulted with the service about meeting an older person online and receiving private photo request from him. In the commercial interest dimension, it was reported that students spent money on online games to level up and purchase in-game characters or items. It should be noted that commercial risks, by their very nature, can be considered together with other risk dimensions. The previous example of spending money on games can be investigated under the video game addiction dimension as well.

It was observed that students who were affected by online risks reached out to school consultancy service and legal processes were started as the situations required. The students were often threatened under the violence theme or had negative experiences under the sexuality theme.

Conclusion, Discussion, and Suggestions

This study investigated child-internet relationships based on the school counselor teachers' perspectives. The online risks groups identified in the study are presented in Figure 5.

Figure 5. From school counselor teachers' perspectives, the online risks that students encounter

The risks reported by the school counselor teachers fall within seven online risks groups. While each one of banning, sexuality, and commercial interest risks constitutes a risk factor by itself, the remaining themes have multiple subdimensions. The identity theft risk group covers stolen photos, fake accounts, and account theft. The inappropriate communication risk group consists of online and offline communication. The addiction risk group includes internet addiction, computer addiction, and video game addiction. And finally, the violence risk group contains cyberbullying, humiliation, harassment, and threatening each other.

Berson, Berson, and Ferron (2002) reported that counselor teachers observed the risk groups of identity theft, inappropriate communication, and violence. In another study by Liebermann and Stashevsky (2002), commercial interests, identity theft, violence, and addiction risk factors from Figure 5 were present. In the studies conducted before the widespread adoption of digital tools, the commercial interests dimension was a significant factor (Donthu & Garcia, 1999, Introna & Pouloudi, 1999; Miyazaki & Fernandez, 2001; Park & Jun, 2003; Tan, 1999). In those studies, online risks were organized under the themes of communication and sexuality (Jantz & McMurray, 1998; as cited in Chou & Peng, 2011); inappropriate content, stalking, harassment, e-fraud, personal information lost, and inappropriate communication (Aftab, 2000); sexually explicit content, copyright infringements, inappropriate communication, personal information lost, and cyberbullying (Poftak, 2002). Figure 5 also covers all risk groups mentioned here.

Considering the rapid developments in technology and ever-increasing access to digital tools, a variety of online risks continue to occur. In a sense, increased access results in increased exposure to the online risks. As online risks take different forms in response to available digital tools, future studies can focus on identifying new risk dimensions in relation to new tools. Studies, then, can develop ways to prevent harms to children and adults exposed to those risks, and employ experimental and descriptive methods in the process.

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Research Article

Education on Programming with Robots: Examining Students' Experiences and Views[1]

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Abstract

The present study aimed to determine the success and views of students receiving education on programming with robots. In the study, which was carried out with the mixed research method, the data were collected via a creative problem-solving test, applied performance evaluation test for programming with robots, a semi-structured interview form. The creative problem-solving skills test was taken from PISA 2012 conducted by OECD. The study was carried out with 9 secondary school students. In the application process, first, the students were asked to fill in the creative problem-solving test. The creative problem-solving test included interactive simulations in online environment and questions regarding these simulations. Following this, the students were given education on programming with robots for one week. At the end of this education, a performance evaluation test regarding this education was given. Lastly, an interview form was used to determine the students' views about the activity carried out.

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Consequently, depending on the results of the applied performance evaluation test, the education could be said to be beneficial. As a result of the correlation test conducted, a moderate level of positive significant relationship was found between the students' creative problem-solving skills and their performance scores. When the students' responses to the interview questions were examined, it was revealed that the students generally had positive attitudes and that the education given was motivating and entertaining and contributed to their learning of programming.

***Keywords**: Pisa 2012, education on programming, robots, creative problem-solving skills*

Introduction

The number of information companies in the list of biggest companies in the world is gradually increasing (Witherspoon, Schunn, Higashi, & Baehr, 2016). The US Bureau of Labor Statistics (2014) predicts that the labor based on the computer science will keep growing with a rate of 11% until 2022. The importance of computer programming is emphasized with the Hour of Code activity carried out for millions of students in more than 180 countries every year, and countries support this activity to a great extent. As a consequence, in a number of countries, various attempts are made to include the course of computer programming in related curricula as a compulsory course. Obviously, computer programming is increasingly considered to be among the basic skills that students are expected to acquire (Passey, 2017; Wong, Cheung, Ching, & Huen, 2016).

Computer programming requires students to solve problems by making use of their imagination and creativity. Programming and coding are similar concepts in meaning. In the present study, the word 'programming' was adopted. In studies reported in related literature, it is pointed out that programming with a programming language can help develop students' problem-solving and cognitive skills (Czerkawski & Lyman, 2015; Lau & Yuen, 2011; Wang, Li, Feng, Jiang, & Liu, 2012).

Creative problem-solving, which is closely related with programming, refers to a mental process of findings solutions to a complex problem which requires creative thinking. In their daily lives, people encounter with complicated problems. It is important for people to have the ability to find creative solutions to complex problems at the end of a structured process of solving such problems so that they can become successful in life. Organization for Economic Cooperation and Development (OECD) regards creative problem-solving skills as one of the key skills necessary for people to become successful in their future jobs. Parallel to this, with the Program for International Student Assessment (PISA) conducted by OECD, the problem-solving skills of students in member countries have been being measured at regular intervals since 2003.

Traditional programming languages are likely to be found too complex and hard to learn by K12 students (elementary school, secondary school and high school students) (Álvarez &

Larrañaga, 2015; Kelleher & Pausch, 2005; Kurebayashi, Kamada, & Kanemune, 2009; Major, Kyriacou, & Brereton, 2012). This situation causes students to end up with failure in courses of introduction to traditional programming and thus to develop negative attitudes towards courses of programming (Ala-Mutka, 2004; Korkmaz, 2016; Robins, Rountree, & Rountree, 2003).

Several tools such as scratch and code.org have been developed to do programming with the use of code blocks, which does not require any programming by writing and to teach a simple algorithm of programming to students. This type of tools allows students to learn in a more entertaining environment by removing the complexity of the authoring language. Another alternative in programming education is programming with robots. Similar to programming with robots, the softwares developed in a scratch-like programming environment can run on a robot. In this way, students can program the robots they have developed themselves, and they have the opportunity to witness the results of the program they have developed.

In related literature, there are several studies demonstrating that programming with robots is a more effective and entertaining method when compared to traditional programming education (Kurebayashi et al., 2009; Liu, Newsom, Schunn, & Shoop, 2013; Major et al., 2012). Patterson (2011), who examined 19 studies in literature, and found that use of robots in 14 of these studies had positive influence on programming education. It is reported that education on programming with robots is engaging and motivating and that robots could sometimes be dreadful as they require mechanical installation (Liang, Fleming, Man, & Tillo, 2013; Lykke, Coto, Mora, Vandel, & Jantzen, 2014). Therefore, it is important to provide students with guidance in the process of mechanical installation of robots.

Teaching computer programming to K12 students is thought to develop their thinking skills involving information processing and to improve the learning outcomes at university level (Mayer, 2013; Wong et al., 2016). Similarly, it is pointed out that robotic programming plays a very important role in the development of students' thinking skills involving information processing and that it is increasingly regarded as one of the basic skills at K12 level (Alimisis, 2013; Barr & Stephenson, 2011; Eguchi, 2015; Grover & Pea, 2013; Witherspoon et al., 2016).

In related market, there are a number of tools for robot use in programming education. Among these tools, the most popular one is MindStorms developed by Lego company. Lego produced

its first programmable MindStorm robots with MIT in 1998. These first robots were called MindStorms RCX. In 2006, MindStorms NXT was developed, which was followed by MindStorms NXT 2.0 in 2009 and lastly by MindStorms EV3 in 2013 (Patterson, 2011). In the present study, the Lego MindStorms EV3 basic education set was used. In Lego MindStorms EV3 robots, there is one programmable brick. On this brick, four ports are found to connect the engines and sensors. In addition, in the basic education set, there are two big and one small engines, a color sensor, a touch sensor, gyro sensor, an infrared sensor and various plastic parts to produce simple robots. It is possible to produce a wide variety of robots by using these parts. It is necessary to develop a different programming logic for each robot produced (Koç & Böyük, 2013). Figure 1 presents a MindStorms robot designed in a way to move on two wheels. In order for this robot to stay in balance on two wheels, the Gyro sensor should be programmed.

Figure 1. Lego MindStorms robot able to move on two wheels

In order to program MindStorms robots, code blocks are used in a visual environment which does not require code writing. These blocks allow doing such basic programming functions as defining the variables, doing calculations, making decisions and establishing cycles. Also, specific to EV3, blocks are found for use of engine and sensors. Figure 2 illustrates a sample program written for EV3.

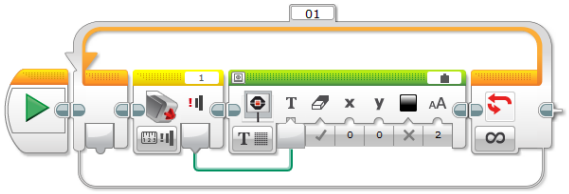

Figure 2. Sample program for MindStorms EV3

In an experimental study carried out by Korkmaz (2016) with a pretest and posttest control group, Lego MindStorms EV3 robots were used in the course of C++ programming in the department of Computer Engineering. The results of the study demonstrated that the students in the experimental group who used the Lego MindStorms EV3 robots had significantly higher levels of academic achievement when compared to those in the control group. In addition, the study also revealed that the Lego MindStorms EV3 robots had positive influence on the students' attitudes towards computer programming.

In another experimental study which lasted two years and which was conducted within the scope of Basic Programming Course in the department of Computer Engineering at Bask University in Spain, the influence of Lego MindStorms robots on programming education was investigated. In the study, a significant increase was observed in the students' motivations and in their perceptions of their own learning, and a decrease was found in their drop-outs of the course. On the other hand, in the same study, no significant difference was found between the experimental and control groups with respect to the students' levels of academic achievement (Álvarez & Larrañaga, 2015).

When other related studies in literature were examined, it was seen that there was an increase in the number of such studies on programming with robots. Figure 3 presents the numbers of studies on programming with robots for the years 2012 to 2016 according to the Scopus database.

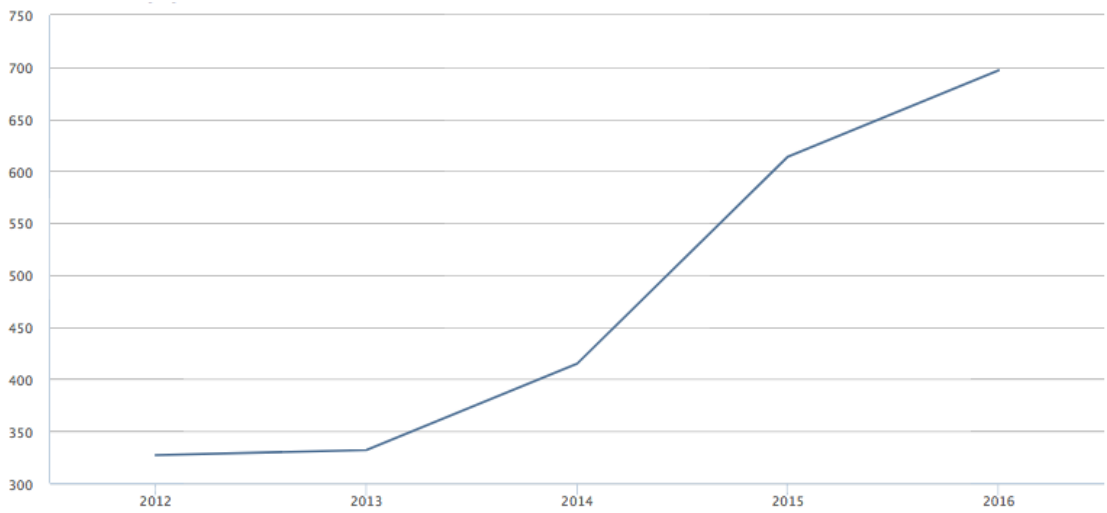

Figure 3. Numbers of studies on programming with robots by year

When Figure 3 is examined, it is seen that there was a rapid increase in the number of studies on programming with robots by year. Therefore, it could be stated that programming with robots is a popular and important field. Programming with robots is not just field related to programming education but an important field of research which contributes to students' thinking skills involving information processing as well as to their creative problem-solving skills. In Turkey, a very few related studies have been conducted. Considering the importance of programming with robots in international literature, more studies in number are expected to be conducted in our country. Therefore, the purpose of the present study was to examine the performances and views of students taking education on programming with robots.

Method

This part includes the research model, data collection tools, participants, data analysis, validity and reliability studies and the application process.

Research Design

In the study, the mixed research design involving the combined use of qualitative and quantitative methods was applied. According to Creswell (2009), mixed methods require use of qualitative and quantitative data together and include the phases of data collection, analysis

and interpretation. In addition, mixed methods allow collecting more detailed data thanks to the two methods. This study also has a correlation research design due to its quantitative aspect.

When the related literature is examined, it is seen that there are a number of classification methods for mixed method studies. In a classification provided by Johnson and Onwuegbuzie (2004), a three-dimensional typology was used: (1) Level of mixing (partially mixed versus fully mixed), (2) time orientation (concurrent versus sequential) and (3) emphasis of approaches (equal status versus dominant status). Depending on the typology mentioned above, the present study can be regarded as partially mixed method research being sequential in terms of time orientation (first quantitative and then qualitative) and dominant in terms of status.

Participants

The participants in the study were nine students from the sixth and seventh grades of Zağnospaşa Secondary School in the city of Balıkesir. While determining the number of the participants, the number of robots to be used during the education was taken into account. Of all the participants, five of them were male, and four of them were female. Among the participants, only one student learned the subject of scratch within the scope of the course of Information Technologies, and none of the other students had any experience in programming.

Data Collection Tools

Within the scope of the study, the research data were collected via the Creative Problem-Solving Test (CPST), applied performance evaluation questions and a semi-structured interview form.

1. *Creative Problem-Solving Test (CPST)*: CPST included the problem-solving questions found in PISA 2012. In CPST, there were open-ended multiple-choice questions. The answer key of the test was prepared by OECD, and the students' responses to the test were scored using this answer key. In this test, the participants were exposed to real-life case problems (for example, buying a train ticket) in a two-dimensional simulated environment. The simulations were presented to the students in a web-page environment

in which HTML5 Canvas was used. The students interacted with the simulations and responded to the questions related to the simulations.

2. *Applied Performance Evaluation Questions*: These questions were those directed at the end of the education in relation to the subjects the students learned. The exam was conducted in an applied manner, and the students tested the questions on robots. The exam questions were prepared by one of the researchers and arranged and finalized in line with the suggestions of the other two researchers.
3. *Semi-Structured Interview Form*: The semi-structured interview form was made up of seven open-ended and one close-ended questions. The interview form was developed collaboratively in line with the related studies in literature.

Data Analysis

Within the scope of the study, for CPST applied to the students, the evaluation key of PISA was used, and the scores obtained were noted down. As for the analysis of the participants' responses to the applied performance evaluation questions, their responses were evaluated first individually. Following this, different aspects were evaluated together for consistency. The qualitative data were analyzed using the thematic analysis method. This process included three phases: description, analysis and interpretation. In the description phase, what the students said was determined. In the analysis phase, relationships were established between the data and the themes obtained via the data. With the interpretation of the findings within the context of the study, the qualitative research process suggested by Yıldırım and Şimşek (2008) was completed.

Validity and Reliability

For CPST, one of the data collection tools used in the study, the evaluation key of PISA was used. For the applied performance evaluation questions, the researchers formed the scoring system collaboratively, and all the questions were evaluated together. In this way, the purpose was to ensure consistency. The data collected via the semi-structured interview form were evaluated one by one, and each researcher created his or her own coding key. The reliability of the coding schemes formed by the researchers was examined by a field expert, and the coding schemes were found to be consistent with each other. After ensuring consistency, the data were

divided into themes. In addition, by providing frequent quotations, the students' views were reflected strikingly.

Application Process

On the first education day, the students were informed first about the purpose of the study and then about how the process would function as well as about what they would meet. Before starting the education, CPST prepared by PISA (2012) was applied to the students via a web form. Following this, the robots were distributed to the students, and few sample applications were carried out in relation to what the robots could do. During the education, the focus was first on algorithm and on basic programming. Next, related examples were given. Following this one-week phase of education, the applied performance evaluation questions prepared by the researchers were directed to the students. Lastly, individual interviews were held with all the students regarding the robot education they had taken.

Findings and Discussion

This part presents the findings in Tables, and the findings were interpreted in comparison with the findings obtained in other studies in related literature.

Table 1
Distribution of Students' CPST Scores and Their Performance Evaluation Scores

Student Code	Performance Evaluation	CPST*
S1	100	82
S2	55	64
S3	75	36
S4	75	55
S5	50	23
S6	55	32
S7	90	59
S8	85	45
S9	80	45
Mean	74	49

*CPST scores were given out of 100.

The CPST coding key is originally evaluated out of maximum 22 points. Therefore, the scores were converted into scores out of 100 to make it possible to make comparisons with the performance evaluation scores. When the students' scores in the CPST test applied before the education were examined, it was seen that they had a mean score of 49 out of 100. This mean score could be said to be generally low except for one or two students. At the end of the one-week education, the applied performance evaluation questions were directed to the students, and the students' mean score was calculated to be 74. When their performance scores were examined, it was seen that they had high scores except for one or two students. Depending on this situation, it could be stated that the education the students took was beneficial. In most of the studies reported in related literature (Kurebayashi et al., 2009; Liang et al., 2013; Liu et al., 2013; Lykke et al., 2014; Major et al., 2012; Patterson, 2011), findings supporting the situation in question were obtained.

In the study, the relationship between the students' CPST scores prior to the education and their performance scores was examined. For this purpose, "Spearman's rank-order correlation analysis" was conducted on the data.

Table 2
Relationship between the Students' CPST Scores and Their Performance Scores

			Performance	CPST
Spearman's rho	Performance	Correlation Coefficient	1,000	,624*
		Sig.	.	,036
		N	9	9
	CPST	Correlation Coefficient	,624*	1,000
		Sig.	,036	.
		N	9	9

* Significance level was taken as 0.05.

When Table 2 is examined, it is seen that Spearman's rank-order correlation analysis applied to determine whether there was a relationship between the students' applied performance scores and their CPST scores revealed a moderate level of positive significant relationship between two variables (r=,624; p<,05). This finding was found consistent with those obtained in other studies in related literature (Czerkawski & Lyman, 2015; Lau & Yuen, 2011; Wang et al., 2012).

Students' Views about Education on Programming with Robots

Table 3 and Table 4 demonstrate the themes and sub-themes obtained via the interviews held with the students.

Table 3
Students' Views Before the Education on Programming with Robots

Themes	Frequency (f)
Experience in Education on Programming	
Yes	1
No	8
Experience in Education on Programming with Robots	
Yes	0
No	9
Views before Education	
Feeling of curiosity	6
Expecting it to be entertaining	5
Expecting it to be difficult	2

When Table 3 was examined, it was seen that almost all the students did not have any previous experience in programming education. Similarly, it was also seen that the students did not have any experience in programming education with robots. Before the education, the students' most frequent responses to the question of "what were your thoughts when you first heard about such an education?" included "I was curious about it" and "I thought it would be entertaining". Among the students, two of them reported that it would be difficult. In relation to this, one of the students, S2, said *"I thought it would be beautiful and entertaining"*, while another student, S8, said *"At the beginning, I was curious about it, and I thus got excited. I was also happy to receive education on coding"*. S1, another student who thought it would be difficult, said *"...I expected it to be nice, but I thought it would be difficult because I know robots are complex"*. The students' expectations that education on programming with robots would be difficult are parallel to the findings of other studies reported in related literature (Liang et al., 2013; Lykke et al., 2014). One reason for such expectations could be the fact that robots have a mechanically complex structure.

Table 4
Students' Views about Education on Programming with Robots

Themes	Frequency (f)
Your overall views about the education	
Positive	9
Negative	0
I had no related difficulty	7
I sometimes experienced difficulty	2
Robots' contribution to programming education	
I prefer education on programming with robots	9
I prefer education programming without robots	0
This education programming contributed to my learning	7
This education programming did not contribute to my learning	2
Motivation & interest in programming	
It increased my motivation	9
It increased my interest in programming	9
Spread of education on programming with robots	
It should be spread	9
Programming education should be given at earlier ages	5

In the study, the students were asked to report their overall views about the education on programming with robots and to state whether they experienced any related difficulty or not. It was found that all the students reported positive views about the given education. In relation to this, one of the students, S4, said *"We learned really necessary things via the education, and the lessons were quite entertaining."* During the education, a great majority of the students stated that they did not experience any related difficulty. In literature, it was reported that during an education on programming with robots, certain compelling situations are likely to be encountered especially in the installation phase of robots (Liang et al., 2013; Lykke et al., 2014). In order to avoid such difficulties, students could be provided with guidance regarding the installation of robots at the beginning of such an education. Another finding obtained in the present study was that the Lego MindStorms EV3 robots used during the education had a relatively simple structure when compared to other similar robots. On the other hand, two of the students pointed out that they experienced difficulty in certain applications. In relation to this, one of the students, S1, said *"While doing the codings with robots, I found the mathematical operations difficult."* Following the education on programming with robots, all the students stated that they preferred to take the education on programming with robots. Regarding this, S5 said *"I prefer the coding education given with robots because I learned more easily when tested it on robots"*, while another student, S1, said *"I prefer the coding education with robots not only it is entertaining but also because it contributes to our*

concentration". In the study, most of the students stated that the education they had taken contributed to their learning programming, while two of the students reported that the education did not make any related contribution. In relation to this, S5 said *"I don't think it made any contribution to my learning. As it mainly has a structure similar to the coding language, I think we will be able to write codes much more easily if we learn the coding language".* All these findings are consistent with those obtained in a number of studies examined by Patterson (2011), who reviewed the related literature. As a response to the question directed to examine the influence of programming education with robots on the students' motivations, all the students stated that it increased their motivation and that the education increased their interest in programming. In relation to this, one of the students, S6, said "*I was already interested in coding, but with this education, my interest in coding increased more".* Another student, S9, said *"... of course, it increased my motivation. Also, my interest in coding increased as well".* All these findings are supported by those obtained in other related studies which revealed that programming with robots contributes to students' motivation (Álvarez & Larrañaga, 2015; Kurebayashi et al., 2009; Liu et al., 2013; Major et al., 2012; Patterson, 2011). Lastly, the students were asked to report their views about the spread of programming education with robots in future, and all the students reported that such educations should be spread. In addition, most of the students suggested giving such educations at earlier ages. In relation to this, one of the students, S4, said *"It should be spread because it is both entertaining and productive. I really would like to go on taking such education", while* S5, another student, added *"Also, it should be given throughout Turkey".*

Conclusion and Suggestions

The present study, which aimed to determine the views of students taking programming education with robots about the method, was limited to a total of nine students attending a secondary school in the city of Balıkesir. In the research process, where qualitative and quantitative methods were used together, the education given could be said to lead to positive results. It was seen that the students who had not taken any programming education before had a high achievement mean score in the evaluation done at the end of a one-week education. The results revealed a moderate level of relationship between the students' creative problem-solving skills and their post-education performance evaluation scores. Therefore, students with a high

level of creative problem-solving skills could be said to be more successful in programming education.

In addition, the students reported that they found the given education entertaining and that it increased their motivation. Considering the fact that all the students preferred programming education with robots to traditional programming education, it could be stated that the spread of such applied education should be spread. Depending on the findings obtained in the study, the following suggestions could be put forward:

- Experimental studies could be conducted to reveal the differences between traditional programming education and programming education with robots.
- Attitude scale development studies could be designed regarding programming education with robots. In this way, students' attitudes could be examined with respect to several variables.
- In line with the positive findings, it is important to use robots in programming education especially at K-12 level and to include programming education more in curricula.

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