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Validity and Reliability of the "Gamification Applications in Education" Scale

Eğitimde Oyunlaştırma Uygulamaları" Ölçeğinin Geçerlik ve Güvenirlik Çalışması

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Abstract

With the growth of suitable applications for the gamification approach, it has becoming increasingly used in education. Although it is known that there are scales that have been developed depending on game dependency, it is necessary to determine the opinions of students about this approach in order to increase the information about the students' approach to gamification and its educational use. When the literature is examined, it is found that, although it is mentioned that gamification improves the motivation and interest levels of the students towards lectures, no scale has been developed for this purpose. The aim of this research is to develop a scale to determine the opinions of the students on an educational process in which the learning is provided by using a gamification application. As a result of the literature review made within the scope of this overall aim, characteristics which should be suitable for the gamification applications in education were determined. Stratified random sampling is a process in which certain sub groups are selected for the sample in the same proportion as they exist in the population. Data for the tests of reliability and validity were obtained from a sample of 360 students. As a result of Varimax analysis, it has been determined that it is only has one factor. The internal consistency reliability of the scale is calculated as .986. Based on this analysis, it has been determined that the scale for determining the opinions of students during the gamification process is reliable.

Keywords: *Gamification, application, scale, validity, reliability*

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Öz

eknolojik yeniliklerle geliştirilen oyunlaştırma, eğitim sistemlerini geliştirmek ve öğrencileri motive etmek için kullanılmaya başlanmıştır. Öğrencileri motive etmek için önemli bir potansiyele sahip olan oyunlaştırma öğrenciler için çok cazip hale gelmiştir. Eğitsel oyunlaştırma uygulamalarının artması ile çalışmaların sayısı da artış göstermektedir. Oyun bağımlılığına bağlı olarak geliştirilen ölçeklerin olduğu bilinmesine rağmen, öğrencilerin oyunlaştırma yaklaşımı ve eğitimsel kullanımı hakkındaki bilgileri arttırmak için öğrencilerin bu yaklaşımla ilgili görüşlerini belirlemek gerekmektedir. Literatür incelendiğinde, oyunlaştırmanın öğrencilerin derslere yönelik motivasyon ve ilgi düzeylerini geliştirdiği söylense de, literatürde bu amaçla bir ölçek geliştirilmediği görülmektedir. Bu çalışmanın amacı, öğrencilerin oyunlaştırma uygulaması kullanarak öğrenim gördükleri bir eğitim süreci hakkındaki görüşlerini belirlemek için uygun bir ölçek geliştirmektir. Bu amaç kapsamında yapılan literatür taraması sonucunda eğitimde oyunlaştırma uygulamaları için olması gereken özellikler belirlenmiştir. Oyunlaştırma uygulamalarının eğitsel amaçlı kullanımına yönelik geliştirilmesi amaçlanan ölçek için 38 ifadelik madde havuzu oluşturulmuştur. Araştırmanın çalışma grubunu Yakın Doğu Üniversitesi, Atatürk Eğitim Fakültesinde öğrenim gören ve oyunlaştırma uygulamalarını eğitsel amaçlı kullanan öğrenciler oluşturmaktadır. Güvenilirlik ve geçerlilik testleri için veriler 360 öğrenciden elde edilmiştir. Geri dönüş oranı % 97.2 olan uygulamadan sonra 350 kullanılabilir veri elde edilmiştir. Varimax analizi sonucunda, sadece bir faktörün olduğu belirlenmiştir.Ölçeğe eklenecek maddeler seçilirken madde toplam korelasyon katsayısının .30'dan yüksek olmasına dikkat edilmiştir. Ölçeğin iç tutarlılık güvenilirliği .986 olarak hesaplanmıştır. Bu analize dayanarak, oyunlaştırma sürecinde öğrencilerin görüşlerini belirleme ölçeğinin güvenilir olduğu belirlenmiştir. Öğrencilerin eğitimde oyunlaştırma uygulamalarının kullanımına yönelik görüşlerini belirleme amaçlı ölçek kullanılabilir.

Anahtar sözcükler: *Oyunlaştırma, uygulama, ölçek, geçerlik, güvenirlik*

Introduction

Games help children to prepare for different roles that they will face in their lives and during adulthood. They encourage people to acquire numerous skills, which include social development, such as sharing, building friendships, helping others, protecting their rights, participating in group activities, respecting others' rights, etc. (Durualp & Aral, 2011). Although games are perceived as something unique to children, they actually appeal to people of all ages. It is known that a total of about 91.5 billion dollars was spent in 2015 on digital games around the world (Yildirim & Demir, 2016). Gaming, as an application and industry sector, is poised to surpass US$ 11 billion by 2020 (Markets and Markets, 2016). The online game "League of Legends", which is constantly increasing in popularity, had 32 million active users per month in 2012 worldwide. It was determined that gamers played an average of one billion hours each

month in total (Lyons, 2012). Furthermore, in 2016 there were over 100 million active users. One reason behind the rapid growth of the gaming industry and online games is that users are allowed free access to their content (Tudof, 2016). It is estimated that game enthusiasts will play for a minimum of hours at a time (Aristolog, 2016).

The use of game logic in the learning process undoubtedly adds dynamism to the educational process. The growing interest in games has been the subject of numerous studies and researchers have applied the concept of games in different ways in the education process. In gamification learning environments, each student becomes a player and the course represents a game that must be completed (Sheldon, 2011).

Gamification with technological innovations is used to develop educational systems and motivate learners. It has significant potential for motivating learners and is becoming increasingly attractive for school students (Lee & Hammer, 2011). Gamification is motivating students to adapt to new behaviors, such as learning more. Gamification aims to maintain high levels of motivation in students and to encourage certain behaviors (Simões, Redondo & Vilas, 2013). Gamification is an effective application for creating positive changes in the behavior and attitudes of students (Kiryokova, Angelova & Yordanova, 2014).

There are studies that have examined the application of gamification in the educational field (e.g. Bonde et al., 2014; Christy & Fox, 2014; de-Marcos, Domínguez, Saenz-de-Navarrete, & Pagés, 2014; Denny, 2013; Domínguez, Saenz-de-Navarrete, de-Marcos, Fernández-Sanz, Pagés, & Martínez-Herráiz, 2013; Farzan & Brusilovsky, 2011; Filsecker & Hickey, 2014; Hakulinen, Auvinen, & Korhonen, 2013; Simões, Redondo, & Vilas, 2013). Many studies on the academic context have shown that gamification can be an effective application for increasing motivation and attracting users or participants to a particular activity (Morschheuser et al. 2016). In a research which aimed at increasing motivation, the development of students' motivation levels was measured over a period of time. There is another research in the literature which evaluates the impact of robotic teaching on students. From the results, it is obvious that the using gamification strategies increased the attention and motivation of the learners as well as the enjoyment levels (Sisman, 2017). In another study, it was observed that user motivation influenced the level of participation in the gamification process, and it was observed that motivation changed after the application (Thiel, & Fröhlich, 2017).

Hamari (2015) stated that gamification has an effect on changing user behaviors. Considering the studies in the literature, it is observed that students are motivated by the gamification applications and achieve success with class competition. Consequently, motivation is an important element in the success of students when the instructional design with gamification is used. It is known that gamification is used for different purposes. Software such as IBM Connections and Microsoft Sharepoint use gamification to promote communication and collaboration among employees (Meske, Brockmann, Wilms, & Stieglitz 2017). Gamification assigns users an active role in the system, and also provides a fun application. Therefore, it maintains the motivation of users and their participation in the processes at a high level along with a sense of competition. For this reason, it is aimed that employees have increased motivation and therefore productivity is augmented by integrating gamification into the business process. The marketing world also benefits from similar interactions that gamification allows (Aytekin, 2016; Dalpiaz, Snijders, Brinkkemper, Hosseini, Shahri, & Ali 2017).

In 2016, the World Government Summit published the report, Gamification and the Future of Education. It was foreseen in this report that, in the near future, gamification would be found in the educational structures of governments. It is therefore envisaged that the use of gamification applications in education will increase in line with the information given in the literature. Researchers have been invited to conduct research about the challenges, the application results, and the design of gamification, which appeals to different disciplines (Deterding et al., 2013, Mora et al., 2015 & Morschheuser et al., 2017).

As a result of the research into this field, it has been stated that gamification requires empirical studies that inform both the theories and the formats of the researchers. However, in order to explain the gamification systems, it is acknowledged that more complex explanations of how each element works individually are also required (Nacke & Deterding, 2017). It is expected that evaluation, which is an important element in many academic fields, will come to the forefront and appropriates scales for the field will be developed (Siemon & Eckardt 2017). The Game Dependency Scale (GDS) developed by Lemmens et al. (2009) has been adapted to Turkish and the reliability and validity of the scale have been subsequently analyzed. The findings from the validity and reliability studies suggest that GDS is a valid and reliable measurement tool for measuring adolescents' game dependency levels (Akin, Usta, Başa & Özçelik, 2016).

Although it is known that there are scales that have been developed depending on game dependency, it is necessary to determine the opinions of students about this approach in order to increase the information about the students' approach to gamification and its educational use. Studies on the successful integration of gamification into educational programs should be implemented in order to ensure student motivation, attitudes towards the lessons, and increased achievement levels (Yildirim & Demir, 2016). It is thought that it will be beneficial to use gamification practices in class activities to ensure that students can understand and use developing skills, adapt to innovations, and to enable the courses to remain in line with technological developments. When the literature is examined, it is found that, although it is mentioned that gamification improves the motivation and interest levels of the students towards lectures, no scale has been developed for this purpose. For this reason, this research takes the form of a scale development study, and the aim is to develop a valid and reliable Likert-type scale to find out the views of university students on gamification.

Method

The sample of the first stage of the research consisted of the students of Near East University. Totally there were 350 students who took place this research. In order to form the gamification scales, the relevant literature has been scanned (Hamari, 2015; Lee & Hammer, 2011; Thiel & Fröhlich, 2017; Kiryakova, Angelova, & Yordanova, 2014). In the study, a 38-item scale forming the item pool of the Educational Gamification Scale developed by the researcher was used for data collection purposes. The Likert-type scale consists of five responses, namely "Strongly agree (5)", "Agree" (4), "Undecided (3)", "Disagreed", and "Strongly Disagreed". The opinions of 15 field experts were taken during the first stage. According to the expert opinions, the decision was made to remove 6 items and modify 3 items. Thus, the final scale consists of 32 items.

Results

The research provides findings on the views of university students on the use of gamification applications. The data of the scale developed for the aim of finding out the opinions of the students on the use of the gamification applications were transferred to the SPSS 20 program and the distribution of the total scores was consequently examined. Since there are a total of 32 items on the scale, the minimum score is 32, the maximum score is 160, and the range is 127. The scale average was calculated as 115.65, and the standard deviation was 3.56. The skewness coefficient is -.841 and the kurtosis coefficient is -0.63. These findings show that the data obtained from the students have normal distribution.

Validity

"Factor analysis is a statistical technique aimed at explaining measurement with fewer factors, bringing together variables that measure the same quality and structure" (Büyüköztürk, 2006). Exploratory factor analysis was used to determine the factor loads of the items in the scale. In the factor analysis, content and structure validity of the scale were examined. The results of the Kaiser-Meyer-Olkin (KMO) and Bartlett's Sphericity tests were examined to determine the number of data producers of the scale and whether the sample was appropriate for factor analysis. The KMO sampling suitability coefficient in the study was .936. The Bartlett's Sphericity Test value was found at 4207.531. According to this value, the scale is valid and reliable. According to the analysis, it is shown that the KMO value is greater than 0.60 and that the Bartlett's Sphericity test is meaningful, which indicates that the scale is suitable for factor analysis (Büyüköztürk, 2006). According to Alpar (2010), the KMO value is expected to be greater than 0.80. If the value found in the KMO test is below 0.50, then it is unacceptable, above 0.50 is weak, 0.60 is moderate, 0.70 is good, 0.80 is very good and 0.90 is excellent (Sharma, 1996).

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.936
Bartlett's Test of Sphericity	Approx. Chi-Square	4207.531
	df	496
	Sig.	.000

Principal component factor analysis and varimax rotation were applied to reveal the sub-dimensions of the scale. In determining the items constituting the scale, varimax rotation analysis is based on the criterion that the result factor load is at least 0.40 and is included under one factor. This value is not the same throughout the literature. Generally, values of 0.30 and 0.40 are taken as the limit values (Tuan et al., 2000; Johnson & McClure, 2004; Tsai & Liu, 2005; Gurbüztürk & Shad, 2010). Varimax analysis has been used to bring the factors in the study together with the items that have a high correlation (Doğan, 2011). In the Total Variance Explained table, the number of factors included in the scale can be observed, as well what level the factors are to be loaded at (Table 2).

Table 2. Results of factor analysis total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	22.695	70.922	70.922	22.695	70.922	70.922
2	1.703	5.321	76.243			
3	.959	2.998	79.241			
4	.766	2.394	81.636			
5	.618	1.930	83.566			
6	.590	1.844	85.410			
7	.541	1.690	87.100			
8	.488	1.524	88.624			
9	.446	1.392	90,016			
10	.360	1.125	91.140			
11	.335	1.046	92.186			
12	.303	.946	93.132			
13	.249	.778	93.910			
14	.216	.676	94.586			
15	.196	.612	95.198			
16	.190	.595	95.793			
17	.172	.537	96.330			
18	.144	.450	96.780			
19	.136	.424	97.204			
20	.132	.411	97.616			
21	.119	.371	97.987			
22	.113	.354	98.340			
23	.092	.288	98.629			
24	.075	.234	98.863			
25	.067	.210	99.073			
26	.066	.206	99.280			
27	.061	.191	99.471			
28	.044	.137	99.608			

29	.040	.125	99.732
30	.036	.112	99.845
31	.028	.088	99.932
32	.022	.068	100.000

When Table 2 is examined, the scale is found to be one-factor. The total variance found by the single factor is 70.92%. Since it is difficult to reach higher values in the field of social sciences, a variance percentage over 40 - 60 is considered acceptable, based on various resources (Namlu & Odabasi, 2007). The variance percentages of 1 factor obtained after varimax rotation are 70.92%, indicating that they are significantly above the acceptable level of 40% (Kline, 1994).

Table 3. Mean, factor, and reliability results

Items and Factors	Mean	SD	Item Total	Component factor load
24- Gamification applications makes it easy and interesting to learn difficult subjects	3.71	1.317	.928	0.936
18- Gamification motivates me to be successful	3.71	1.300	.916	0.925
21- Gamification applications allow the students to take more responsibility in order to succeed in the lesson	3.70	1.285	.913	0.922
17- Every question I know the answer to during gamification increases my confidence	3.71	1.300	.909	0.921
27- Implementation of gamification is also successful in other lessons	3.73	1.254	.904	0.917
14- Information can be easily remembered through gamification	3.66	1.249	.893	0.904
23- Applications used in gamification allows for effective scheduling	3.65	1.334	.887	0.897
4- Gamification enhances communication with teammates	3.69	1.279	.883	0.896

7- Winning badges in the gamification application increases motivation	3.62	1.279	.881	0.894
28. Gamification reduces timid behaviors with an active learning environment	3.70	1.351	.888	0.893
2- I study more to succeed in gamification applications	3.69	1.287	.879	0.890
19- Gamification increases the class competition	3.72	1.256	.875	0.890
26- Gamification applications increase the desire to win	3.64	1.351	.875	0.886
5- I would like to use the gamification applications in other lessons	3.74	1.218	.871	0.886
13- Gamification enables knowledge-sharing between teammates	3.67	1.186	.868	0.880
20- Gamification applications increase of the speed of reply in competitions	3.94	1.225	.866	0.880
12- Gaining badges with in the gamification applications makes me feel important	3.56	1.300	.863	0.873
32- Gamification allows me to be in touch with my group of friends	3.72	1.323	.862	0.871
9- The use of gamification methods with the blended learning method enables to have a better understanding of the topics	3.55	1.349	.853	0.868
30- Gamification increases the competition among the groups	3.77	1.299	.864	0.868
1- The method of gamification increases my interest in the classroom	3.78	1.385	.856	0.866
3- Being competitive by using gamification increases my motivation	3.74	1.235	.848	0.865
8- Through gamification, I see my own achievement status and I am able to improve myself	3.68	1.246	.841	0.856
6- Using a smartphone in the gamification application makes me feel better	3.59	1.290	.841	0.855

25- I force myself for learn to increase group success in gamification	3.56	1.308	.843	0.853
11- Performing group work with gamification helps to increase success through cooperation	3.55	1.317	.823	0.840
10- Gamification is fun	3.64	1.443	.726	0.743
16- I think my reputation is improving with the badges I earned in online environments	3.52	1.225	.713	0.729
22- Sharing badges and scores on social networks makes me feel better	3.55	1.373	.704	0.719
15- I feel bad when I am not at the top of the leaderboard	3.26	1.311	.632	0.642
31- The method of gamification does not improve motivation in crowded classes	2.45	1.405	.401	0.397
29- Creating a competitive environment does not increase my interest in lessons	2.37	1.371	.337	0.332

Reliability

Cronbach α reliability is used for whole of the scale to determine whether it is reliable. This coefficient (α) is a general form of the KR20 formula to be used in calculating the reliability of items that are not scored as being correct or incorrect, as in some essay tests where more than one answer is possible (See, 1951; Ozdamli, 2009). The selection of items to be included in the scale is based on the criterion that the item-total correlation coefficient is higher than .30. The calculated reliability coefficient is calculated as .986. This finding shows that the scale is reliable.

Discussion and conclusion

This study was conducted in order to determine the views of the students towards gamification. This research tool was developed by the researchers based on the literature review and a draft scale consisting of 32 items was created based on expert opinions. In the creation of the draft structure, the gamification structure was taken as the basis and the materials were written accordingly based on the related literature.

As a result of varimax analysis, it has been determined that it is only has one factor. The internal consistency reliability (Cronbach's Alpha) of the scale is calculated as .986. Based on this analysis, it has been determined that the scale for determining the opinions of students

during the gamification process is reliable. Yasar & Anagün (2009) have obtained similar results in the attitude scale they developed for science and technology course. Resultantly, the scale can be used to determine students' views on gamification.

Based on the results obtained from the validity and reliability studies, some suggestions can be made. As with every study, this study also has some limitations. In order to increase the validity of the scale, confirmatory factor analysis will be performed as well as exploratory factor analysis. The study group on which the validity and reliability studies of the scale were conducted consisted of students who were studying at the Faculty of Education. Therefore, it is important that sample groups consisting of different ages and classes should be considered to ensure the validity and reliability of the scale. Another limitation of this study is that it was only applied to the students. Future studies should develop scales for teachers and parents. Additionally, training needs should be determined in future studies and necessary training can be given to the students, teachers and parents. Finally, it is thought that it would be beneficial to use this scale in the determination of students' opinions on the gamification applications.

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