Digital Educational Game Usage Scale: Adapting to Turkish, Validity and Reliability Study

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Abstract

The purpose of this study is to adapt Digital Educational Games Usage Scale (DEGUS) that was developed by Bonanno & Kommers (2008) to Turkish with the companion of a group of university students studying in department of English Teaching. In order for scale items to be the same in terms of language, firstly the translations of the items were carried out both from English to Turkish and Turkish to English, afterwards examining the forms gathered from the students, significant and positive correlations were detected among the data. Exploratory and confirmatory factor analyses revealed that the scale had four dimensions. In item total correlation calculation of the scale it was observed that all the items were above .40, item factor loads varied between .51 and .68, Cronbach Alpha internal consistency coefficient was .78 and test retest correlation was .88. Significant relations were in the calculations regarding the correlation analyses of the scale.

Keywords: digital educational games, scale, adaptation, reliability, validity

1. Introduction

We are living in an era where scientific and technological developments take place. Especially in technological stage, every year recent improvements occur newly produced tools, equipment and materials are placed on the market commercially. These rapid changes in technology have influenced the educational systems by time and new tools and materials have begun to appear in educational environments (Rock & Brumbaugh, 2010). Softwares, especially the development in digital games related to software raised the idea of using digital games in education.

One way of relieving the classroom atmosphere in education is to take advantage of stories and games (Dönger, Özkartal & Sarıgöz, 2017). When the games are used for the purpose of the lesson, they are very suitable tools especially for the children of primary school age to love lessons (Gelen & Özer, 2010: 72). Similarly, when designed in a way to meet the needs of students, digital games contribute to the education (Prensky, 2003). In literature it was seen that many digital games that were designed for students were beneficial in education, especially on mathematics (Feng, 2008; Kim & Chang, 2010; Chen et. al., 2012). Not only in the education of mathematics but also in language (Jong, Hong & Yen, 2013), science (Clark, Nelson, Sengupta & D'Angelo, 2009), engineering and positive sciences (Mayo, 2007), health and medical sciences (Boulos, Hetherington & Wheeler, 2007), physical education (Papastergiou, 2009) and many more fields, digital games contribute to the teaching and learning.

Digital games have many other benefits to students besides learning (Sarıgöz, 2016). Mainly, by digital games, students actively participate in class (Chen et. al, 2015). Also, digital games can be used effectively in problem solving activities and can provide the necessary environment for students to improve their problem-solving skills, thus developing conceptual learning (Admiraal, Huizenga, Akkerman & Dam, 2011). Utilizing the main characteristics of digital games, students can create models and representations to be used in problem solving activities (Van Garderen, 2007). In addition, with digital games students can develop their reasoning skills and make up different cases without having to be confined to a single setting (Virk, Clark & Singapurk, 2015). Also, digital games present to students the opportunity to go back to steps of problem solving or start all over again (Bartek & Nocar, 2016).

It was also seen that digital games develop the critical thinking skills of students (Yang & Chang, 2013). While

playing digital games, it was found that students were required to use their critical thinking skills (Ennis, 1989). Digital games not only help student develop cognitively but also help them develop affectively and kinesthetically (Sarıgöz, 2012)

Moreover, digital games help students have fun while learning. They help student learn and have increased attention to class, greater academic success and motivation (Li et. al., 2016). Digital games are more enjoyable than traditional classes as well as the classes with activities involving the use of materials such as paper, scissors, glue etc. (Castellar, All & Looy, 2015). Especially the sound and visual effects of digital games and the fact that ranking during the game presents the instant feedback attract the attention of students and influence their motivations along with their manners (Foster &Shah, 2016). The fact that digital games teach while making you have fun and depend on abilities contributes to the positive manners the students towards the lessons (Klawe, 1999; Rosas et. al., 2003; Prensky, 2003; Papastergiou, 2009).

1.1 Purpose of Study

The aim of this study is to adapt Digital Educational Games Usage Scale that was developed by Bonanno & Kommers (2008) to Turkish language. For this purpose, firstly to ensure the validity of the scale linguistically, adaptation to Turkish language was conducted. After the Turkish language validity of the scale, item total correlation of the scale was examined. After the item analyses, structural validity of the scale were tested with CFA and EFA. After the validity effort was finalized, to carry out the reliability analyses of the scale, split-half and test-retest methods were used and data regarding to these analyses and operations were detailed below.

1.2 Digital Educational Games Usage Scale (DEGUS)

In these section sub-dimensions of the scale, definitions of the sub-dimensions and the meaning of the concept of game were included. Digital Educational Games Usage Scale consists of four sub-dimensions. These dimensions are; affective component, perceived usefulness, perceived control and behavioral component. The definition of 'game' is frequently stated in the scale, as well. The intent by the word 'game' is educational digital games. Digital educational games are designed by the help of technological tools to support learning of the student by involving emotional dimensions and social behaviors for determined targets. In these types of games, usually the determined acquirements are targeted for students to obtain. The attraction for student here is having fun in the process of learning and not getting bored of it. Briefly educational games aim to satisfy student while conducting teaching.

➢ **Affective Component [A]:** Affective component represents the emotions of fear, hesitation and nervousness of the individual before the game and during the game.

➢ **Perceived Usefulness [U]:** Perceived usefulness includes the behaviors of the individuals that stem from the beliefs of the individual about the advantages of educational games.

➢ **Perceived Control [C]:** Perceived control defines the emotional and reactional behaviors of the individual while manipulating technological tools (using educational games). These abilities include self-learning the skills of the duty, having control abilities while using game tools and software and helping the others while carrying out the missions.

➢ **Behavioral Components [B]:** Includes the positive behaviors to show willingness to play the educational games or the unwillingness to play the games.

2. Method

2.1 Operation I: Method

2.1.1 Study Group

DEGUS' adaptation to Turkish in terms of language validity is performed by 40 undergraduate students (59,3% male, 40,7% female) studying in the department of English Teaching in Education Faculty of Mustafa Kemal University in 2017-2018 academic year.

2.1.2 Operation

In order to gain the DEGUS measurement tool used by Bonanno & Kommers (2008) for Turkish literature of the field, firstly the permissions of the researchers that developed this scale were granted via e-mails and the efforts of adapting to Turkish began.

Scale items were prepared from the beginning in forms and translated to Turkish by two academicians of Foreign Languages department. Afterwards, the scale items that were translated to Turkish by language experts were

evaluated separately and finalized in a single form. The resulting Turkish form again was delivered to two different academicians in Foreign Languages department and scale items were translated back to English. It was found that re-translated form of DEGUS was similar and closely related to its English form. After that English and Turkish forms of the scale were delivered to faculty members of Assessment and Evaluation, Computer and Educational Information Technologies and Education Program and Teaching Departments in order to gain their opinion about the Turkish validity of the scale items. In the lights of the feedback and advices of the scholars, necessary changes were made and the final form of the scale was reached before the application.

2.1.3 Findings

As a result of the applications, a high level of correlation (r=.92; p<.01) was found between the original form and translated form of the scale. This high level of correlation indicates a strong similarity between the actual scale and Turkish-adapted scale. Therefore, structural validity analyses were also performed on the scale.

2.2 Operation II: Method

2.2.1 Study Group

In the analyses to determine the structure of DEGUS in terms of factor, 150 students (% 65,7 female, % 34,3 male) studying in Education Faculty of Mustafa Kemal University participated. While determining sample size or study group size in scale research, a special care was shown to have a sample size of at least 5 times the number of scale items (Erkuş, 2012). Thus, the scale research was performed with more than 21*5=105 people that is 150 people.

2.2.2 Operation

Exploratory factor analysis (EFA) AND Confirmatory factor analysis (CFA) were conducted to reveal the structural validity of DEGUS. These analyses on DEGUS were performed on independent sample groups and exploratory factor analysis was initially applied on scale data. In the determination of scale items, the eigenvalues of the items were at least 1.00, factor load of the items were at least .30, items only take place at a single factor, items existing on two factors should have at least .10 factor load difference rules were considered (Büyüköztürk, 2017; Shevlin & Lewis, 1999; Martin & Newel, 2004; Schriesheim & Eisenbach, 1995).

Data gathered from the exploratory factor analysis were tested together with item-factor structure for model suitability, also multiple fit indices were used. On fit indices >.90 for IFI, RFI, GFI, NFI, NFNFI and CFI; <.08 for RMSEA were utilized as criteria (Şimşek, 2007; Hu & Bentler, 1999; Büyüköztürk, 2017). Besides, in terms of reliability of the scale, internal consistency operations, split-half reliability operations and test-retest operations were carried out. SPSS 15.0 and LISREL 8.80 software's were used for the reliability and validity analyses of the scale. In Table 1, Kaiser-Meyer-Olkin (KMO) and Bartlett test results regarding the factor analysis suitability of the data were shown.

Table 1. KMO and Barlett Sphericity Test Results

Kaiser-Meyer-Olkin Sampling Adequacy Measurement		0.782
Barlett's Sphericity Test Results	Appr. Chi-square	1223,400
	Degree of Freedom	253
	Significance	0.00

To determine the suitability of the student data for exploratory factor analysis of DEGUS, KMO coefficient and Bartlett Sphericity Test were applied. The analyses showed that KMO coefficient was .90. Significance level of Bartlett Sphericity Test was calculated as .00. The fact that KMO value is more than .60 and is close to 1 shows the suitability of the data for the factor analysis and Bartlett sphericity Test's significance(p<.05) shows that correlations between the items ate meaningful (Bolat, 2017). In addition, the findings of the KMO and Bartlett Sphericity Tests implies that sample size is adequate and suitable for factor analyses.

3. Findings

3.1 Related to Exploratory Factor Analysis (EFA)

Eigenvalues pertaining to the final form of the factor structure and exploratory variances as a result of exploratory factor analysis were presented in Table-2.

Table 2. Factor Eigenvalues and Exploratory Variances

Factor	Initial Eigenvalue		
	Total	Vari %	Cumul %
1	5,782	18,575	18,575
2	3,198	10,274	28,849
3	3,089	9,924	38,772
4	1,918	6,162	45,934

As seen in table 2, there are four factors with eigenvalues of more than 1.0. The variance explained by these four factors constitute % 45, 934 of total variance. Comparing the eigenvalues and variances of the factors after the beginning and rotation, it was observed that eigenvalue of the first factor was decreasing while the eigenvalues of the other factors increase and distribute among each other homogeneously. The scree-plot graph, from which the breaking points of the scale are visible, is shown in Figure 1.
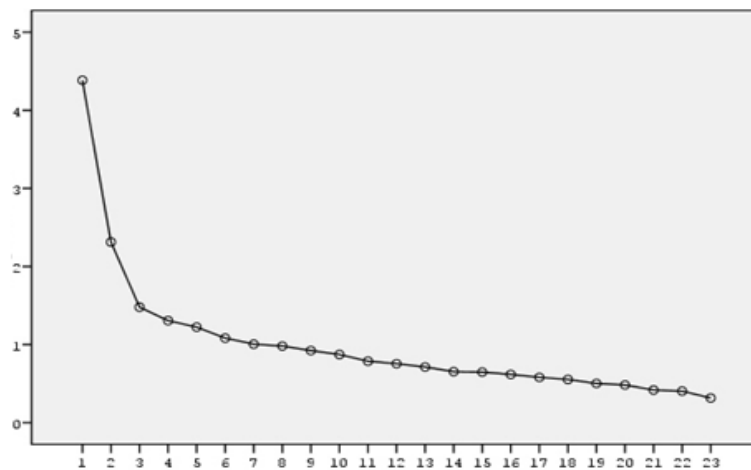
Figure 1. The Scree-plot Graph Related to Digital Educational Games Usage Scale

Investigating the figure-1, four different breaking points can be detected. The scree-plot graph states that the scale is composed of four factors. It is obvious that this figure is similar to the factor structure figure of the original scale. Factor load values and item total correlation values related to the four-factor structure of the scale are presented in Table-3.

Examining the Table 3, Digital Educational Games Usage Scale were applied to 137 teacher candidates and obtained results were subjected to factor analysis, without losing any item 21 items were distributed in a four-factor structure. For the reliability of DEGUS, examining each item's Cronbach Alpha reliability coefficients; internal consistency coefficient of "Affective Component(A)" sub-factor's items were 0.79, internal consistency coefficient of "Perceived Usefulness(U)" sub-factor's items were 0.77, internal consistency coefficient of "Perceived Control(C)" sub-factor's items was 0.79 and that of "Behavioral Components(B)" sub-factor's items was calculated as 0.80. Reviewing the reliability coefficients of the sub-factors of the scale, it is clear that the scale had a high level of reliability. Tezbaşaran (1997) states that in a likert type scale the reliability coefficient should be as close to 1 as possible. Kalaycı (2009) argues that Alpha coefficients of 0.60 or more are acceptable and valid. In this sense it can be observed that the values of the scale related to sub-dimensions are in adequate levels. This shows us the general structure and all the factors of the scale are reliable.

Table 3. Factor Load Values, Item Total Correlation Values and Reliability Coefficients of Items

| Item | Factors | | | | Item Total Correlation | Cronbach Alpha Reliability |
	1 Affective Component (A)	2 Perceived Usefulness (U)	3 Perceived Control (C)	4 Behavioral Components (B)		
M1	0,60				,602*	
M5	0,51				,534*	
M8	0,59				,619*	0,79
M12	0,50				,546*	
M16	0,58				,555*	
M20	0,61				,655*	
M2		0,57			,591*	
M6		0,52			,572*	
M13		0,71			,553*	0,77
M17		0,66			,647*	
M21		0,51			,509*	
M3			0,66		,550*	
M7			0,59		,531*	
M9			0,53		,524*	
M11			0,59		,556*	0,79
M15			0,61		,584*	
M19			0,59		,553*	
M4				0,68	,673*	
M10				0,56	,583*	0,80
M14				0,62	,652*	
M18				0,61	,664*	

3.2 Related to Confirmatory Factor Analysis (CFA)

In order for DEGUS' original form to be validated with Turkish form, DFA was performed. Standard values after the DFA of DEGUS that is composed of factors and 21 items are given in Table 4.

Table 4. Adaptation Values of the Digital Educational Games Usage Scale

Fit Indice	Value
Chi-sqr (X^2)	657.80
P – value	0.00
Degree of freedom	376
Chi-sqr/sd	2.7453
RMSEA	0.059
SRMR	0.052
NFI	0.94
NNFI	0.97
CFI	0.97
IFI	0.97
GFI	0.83
AGFI	0.80

Many fit indices can be used to evaluate whether the model of the DFA is sufficient (X^2 =657.80; p < 0.05; sd = 376; X^2/sd = 2.7453; RMSEA = 0.059; SRMR = 0.052; NFI = 0.94; NNFI = 0.97; CFI = 0.97; IFI = 0.97; GFI = 0.83; AGFI = 0.80). Calculated factor loads of the scale items range between 0.47 and 0.79. RMSEA value of less than .10 shows good fitting (Jöreskog & Sörbom, 2001). Fitting values betwenn .90 and .95 are regarded as perfect inGFI, CFI, NFI, RFI, IFI ve AGFI indices (Bentler & Bonett, 1980; Marsh, Hau, Artelt, Baumert & Peschar, 2006). According to RMSEA, .08 is an acceptable value and .05 is the perfect value (Byrne & Campbell, 1999; Brown and Cudeck, 1993). As a result of the exploratory factor analysis of Turkish version of DEGUS containing 4 factors and 21 items, it was concluded that scale model was statistically valid and suitable.

3.3 The Study of Reliability

In this research, the reliability of DEGUS was investigated by calculating test-retest reliability coefficient and internal consistency coefficient. Results related to reliability are shown in Table-5.

Table 5. t-Test Results of the Scale Re-test Application

Application	N	Re-test	Internal Cons.
1	30	0.78	0.88
2	30		

The internal consistency of the scale was calculated to be .88. To determine reliability of the scale by test-retest method, the scale was performed on 30 people with a separation of 2 weeks. Consequently test- retest reliability of the scale was calculated to be .78 after the applications.

4. Conclusions

In the research towards determining the reliability of Digital Educational Games Usage Scale (DEGUS), internal consistency, half split tests and test-retest methods were utilized. In the analyses of the scale, Cronbach Alpha which is the total internal consistency coefficient of the scale was found as .82, test-retest reliability was calculated as .88. Considering that the reliability levels to be used in researches and predicted for measurement tools is .70 (Tezbaşaran, 1996), Sperman-Brown reliability coefficient that determines the coherence between internal consistency of the scale and obtained test points shows that measurement tool is reliable.

After the item analyses it was found that total item correlations ranged between .50 and .66. The items with total item correlation of .30 and more are accepted to distinguish the measured characteristics sufficiently (Büyüköztürk, 2017). Therefore, it can be stated that scale item's total item correlations are in adequate levels.

Validity and reliability analysis results of DEGUS reveal that DEGUS is a valid and reliable measurement tool reaching the required levels. The Turkish version of the scale might be used for measuring high level thinking skills. The scale developed by Bonanno & Kommers (2008) and adapted to Turkish is a reliable and valid scale with all four of its dimensions.

The survey of the study only uses university students as the sample group. However, it is thought that DEGUS is an appropriate scale to gather the opinions of students on educational digital games. With the help of this scale, the reason why students do not prefer to use digital games can be enlightened. The scale can be utilized for the purpose of obtaining the reviews of the students on digital games. Thereby, a way for designing more effective and useful digital games can be opened.

5. Suggestions

Digital games alter the cognitive and affective development of students through some variables. In literature it is seen that male students are more successful and confident on the use of digital games compared to female students (Klimmt & Hartmann 2006; Habgood & Ainsworth, 2011). Consequently, male students become more accomplished in activities involving digital games with respect to the female students. Therefore, there should be the necessary studies to get female students to higher levels in this sense.

One of the most crucial variables of the digital games is the designation of the game. The digital games should be designed such that individuals of all kinds and levels of ability may play (King-Sears, 2009).

Digital games should be intuitional and provide easy-use to the students. Some students cannot play every game by using the combination of different letters on keyboard. Therefore, the games should be designed such that every student can easily play from the keyboard (Hall et. al. 2012).

In digital games, in-game feedbacks must be comprehendible, stating clearly what the user should do (Mace, 2007). For this reason, in-game feedbacks, information and content should be appropriate for students with different perception levels (King-Sears, 2009).

In order for digital games to be used in education successfully, teachers should also have a positive attitude towards educational digital games and have enough self-confidence towards the use of digital games (Foster & Shah, 2016).

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Appendix I. Digital Educational Games Usage Scale Items (Turkish)

No	MADDELER	Hiç Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Tamamen
1	Popüler bir dijital oyunu oynama fırsatı verildiğinde oyun içerisinde gezinirken sorun yaşayacağımdan korkarım.	(0)	(1)	(2)	(3)	(4)
2	Eğitsel dijital oyunlar beni rahatlattığı için daha iyi çalışıyorum.	(0)	(1)	(2)	(3)	(4)
3	Dijital bir oyun hakkında bilmem gereken birçok bilgiyi kendi kendime öğrenebilirim	(0)	(1)	(2)	(3)	(4)
4	Eğer bir konu dijital oyunla öğretilirse öğrenmekte zorlanırım.	(0)	(1)	(2)	(3)	(4)
5	Aptal gibi görünebilirim endişesiyle eğitsel dijital bir oyunu kullanmakta tereddüt ederim.	(0)	(1)	(2)	(3)	(4)
6	Eğitsel dijital oyunlar fazladan çaba gerektiren bir dereceye kadar öğrenme deneyimlerimizi zenginleştirir.	(0)	(1)	(2)	(3)	(4)
7	Bilgisayarda oyun oynadığım zaman oyunu tamamen kontrol etmekte zorluk yaşıyorum.	(0)	(1)	(2)	(3)	(4)
8	Eğitsel dijital bir oyunu kullandığımda tedirgin olmuyorum.	(0)	(1)	(2)	(3)	(4)
9	Eğitsel dijital bir oyun oynarken ne yapmak istiyorsam bilgisayarda yapabilirim.	(0)	(1)	(2)	(3)	(4)
10	Eğitsel dijital oyunları sadece söylendiğinde oynarım.	(0)	(1)	(2)	(3)	(4)
11	Eğitsel dijital bir oyunu kullanırken yanımda deneyimli bir kişiye ihtiyaç duyarım.	(0)	(1)	(2)	(3)	(4)
12	Eğitsel dijital oyunları oynamak beni hiçbir şekilde korkutmuyor.	(0)	(1)	(2)	(3)	(4)
13	Eğitsel dijital bir oyundan elde edeceğimiz veya ulaşacağımız birçok kazanımı başka yollarla da elde edebiliriz.	(0)	(1)	(2)	(3)	(4)
14	Eğitsel dijital oyunları oynamaktan kaçınırım.	(0)	(1)	(2)	(3)	(4)
15	Eğitsel dijital bir oyunu kullanırken bir problemle karşılaştığımda genellikle o problemi bir ya da birden fazla yolla çözebilirim.	(0)	(1)	(2)	(3)	(4)
16	Düzeltemeyeceğim hatalar yapmaktan korktuğumdan dolayı bilgisayarı oyun oynamak için kullanmakta tereddüt ederim.	(0)	(1)	(2)	(3)	(4)
17	Eğitsel dijital oyunlar, öğrenmek için daha ilginç ve yaratıcı yollar sunar.	(0)	(1)	(2)	(3)	(4)
18	Okul boyunca düzenli olarak eğitsel dijital oyunları kullanacağım.	(0)	(1)	(2)	(3)	(4)
19	Eğitsel dijital bir oyunu kullanmanın en iyi yollarını bana anlatacak birine ihtiyaç duyarım.	(0)	(1)	(2)	(3)	(4)
20	Eğitsel dijital oyunlar beni rahatsız eder.	(0)	(1)	(2)	(3)	(4)
21	Eğitsel dijital oyunlar daha verimli öğrenmeler için olanaklar sağlar.	(0)	(1)	(2)	(3)	(4)