Macrothink Institute™

Journal of Educational Issues
ISSN 2377-2263
2022, Vol. 8, No. 1

Development of the Educational Game Scale

Tuba Aydin Gungor

Faculty of Education, Artvin Coruh University, Artvin, Turkey

Tel: 046-6215-1000 E-mail: tuba.gngr@artvin.edu.tr

Cenan Isci

Buca Faculty of Education, Dokuz Eylul University, İzmir, Turkey

Tel: 00-(232)-420-4895 E-mail: cenan.isci@deu.edu.tr

Sedef Celik Demirci (Corresponding author)

Faculty of Education, Artvin Coruh University, Artvin, Turkey

Tel: 046-6215-1000 E-mail: sedefcelik@artvin.edu.tr

Received: February 7, 2022 Accepted: April 25, 2022 Published: May 9, 2022

doi:10.5296/jei.v8i1.19537 URL: https://doi.org/10.5296/jei.v8i1.19537

Abstract

In recent years, the importance of educational games for students is increasing. Therefore, the points of view of students about educational games are among the issues that gain importance. In this study, a scale was developed that determines students' perceptions of educational games. For this purpose, after a literature review, a 33-item question pool was created by a field specialist. The draft scale was prepared and applied to 445 students studying at secondary school, and after that exploratory and confirmatory factor analysis was applied to the obtained data. As a result of the exploratory factor analysis, 10 items collected under 2 factors explained 55.71% of the total variance. These factors were grouped as 'mental adaptation' and 'physical adaptation'. The Cronbach-Alpha internal consistency coefficient of the scale, which was finalized by factor analysis, was found to be $\alpha = 0.90$. These results show that the scale is valid and reliable. Analysis results show that the developed scale can be used to determine students' perceptions about educational games.

Keywords: Educational game, Scale development, Secondary school students

1. Introduction

1.1 Introduce the Problem

Games are a way for children to communicate and share their world with others, and are the most natural, most frequently used and healthiest way of communicating (Habgood & Ainsworth, 2011). Games assist the child in knowing themselves and gaining awareness of how they are different from others (Erbay & Durmuşoğlu Saltalı, 2012). Games like house, imaginative and mimic games and which dramatize diverse occupations, especially, provide significant contributions to the child's social development (Esen, 2008). Games, forming the basis of physical, cognitive, linguistic, emotional and social development liked and enjoyed by children, are a part of real life and an effective learning process (Arslan, 2000). For this reason, educational games are worth investigating in depth.

1.2 Explore Importance of the Problem

In a child's life, vitality, knowing the world, existence and everything is play. Games are one of the most effective tools expressing a child's desires and purposes and preparing them for social life (Özer, Gürkan, & Ramazanoğlu, 2006).

Play has different significance in every period of life, especially in the early childhood period (Backlund & Hendrix, 2013). Individuals in every age group have types of games that they enjoy playing or watching (Kiili & Ketamo, 2007). In the early childhood period, children enjoy playing active roles in games mainly and are known to want to transform every experience into a game (Ayan & Memiş, 2012). However, what makes games different in this period compared to other periods is children's use of games as a tool in terms of understanding and giving meaning to life (Konur, 2014).

Children's play has an important place in the education of the child and development of their personality. Children's education is important in terms of educational sciences, just as it is important in terms of social culture (Coşkun, Akarsu, & Kariper, 2012). Increasing the effectiveness of play and learning is a complex effort. It is necessary to keep the context broader to understand how we learn (Kaya & Elgün, 2015). For this reason, a critical element is how game science fits in the framework of the broader discipline. When examined from this educational perspective, the concept of 'game science' is a part of the field we can call 'educational science' and is placed as a subdiscipline of learning developed by technology, generally due to its digital nature (De Freitas, 2018). Many rules taught with difficulty to the child can be taught more easily during games (Coşkun, Akarsu, & Kariper, 2012). However, games have some rules and features. These rules and features are what make the game interesting and important. The features of games are as follows; there is no requirement for the player to be included in the game, the game ceases to be attractive and enjoyable when it loses this feature, games emerge spontaneously, they provide happiness and comfort, there are time limits and rules in games, experiences are repeated in games, they mimic the environment and attempt new things, how the game will the develop and the outcome are not certain initially, the situation in the game is different from life, and games are a dynamic process (Pivec & Kearney, 2007).

During play, children create game scenarios similar to real life or imaginative ones, with many different events and problems and make decisions within the game (Gürsoy & Arslan, 2011). This situation ensures children use cognitive abilities to find the answers to questions and increases their cognitive development level for new situations and questions (Munz, Schumm, Wiesebrock, & Allgower, 2007). Thus, the child has the opportunity to perform self-assessment and self-regulation and develop the feature of acting linked to this situation. The most pronounced features observed in children are rules, targets and clear outcomes, feedback and rewards, problem-solving, stories, player(s), secure environment, and feeling of mastery (Apostol, Zaharescu, & Alexe, 2013). In other words, educational games increase the value of teaching procedures in organizations and the working world and the emergence of educational games has made it easier to adopt student-centered education on a broad scale and make other changes to educational implementations (Giannakos, 2013). However, due to many reasons including rapidly increasing urbanization, parent's lack of time to pay attention and play with children due to intense working tempo, and children being held captive by computers, children may not find the environment to play as they wish (Aleven, Myers, Easterday, & Ogan, 2010). As is known, the basis of education and teaching is to activate the sensory organs and to make as many sensory organs as possible active. If this occurs, the education and teaching given will be effective, productive, successful and permanent (Kavcar, 1985).

1.3 Describe Relevant Scholarship

Games are defined as entertainment developing abilities and intelligence with certain rules ensuring enjoyment according to the Turkish Language Society (2020). Just as games prepare children for real life, they are an effective tool to externalize their inner world. They attempt to perceive the world through roles undertaken in games, form identities and thus personality begins to form and develop (Gaydos, 2015). The information acquired by children when playing games is more permanent and effective. Games ensure the child thinks through experience and the child gains experience through playing (Akgün, Nuhoğlu, Tüzün, Kaya, & Çınar, 2011). They learn the necessary knowledge, skills and experiences for life on their own during games (Lamb, Annetta, Firestone, & Etopio, 2018). For this reason, the most effective route in education of children is games. Games comprise the first stage of learning by entertaining the child. Games are one of the most important pastimes in all periods of life. Games should never be considered a leisure activity for a child (Varışoğlu, Şeref, Gedik, & Yılmaz, 2013).

Certain conditions should occur for planning related to games. These were determined by Özer et al. (2006) as determining the educational purposes related to the game, selection of activity within the scope of the game, listing of activities, determining the duration of activities, and determining the tools and materials required for the game.

Development represents functional changes in the individual (Aksoy & Dere Çiftçi, 2014). In order for a child to be able to function at high levels, it is necessary for their talent to emerge and progress. Maturation and learning are elements playing key roles in developmental processes (Çoban, 2006). Learning is a concept encountered as a product of experiences. The

child should not complete learning which exceeds their peers (Seçkin Kapucu & Çağlak, 2018). Games contribute to the physical, mental and social development of the child (Büyükuygur, 2018). The child's continuous desire to play represents their movement toward the future (Gürbüz, Çeker, & Töman, 2017). Children perceive concepts, objects, social rules, rights and struggles within games, later they understand, and later learn and develop. Games affect children from many aspects in general and contribute to development (Deater-Deckard, Chang, & Evans, 2013). While games display differences in effect according to type, general effects can be listed as follows; effect of the game in physical terms, effect of the game in social terms, effect of the game in psychological and affective terms, and effect of the game in mental terms (Özer et al., 2006).

Considering the features found in the nature of games, they are an important tool in the educational research field of teaching and learning processes (Silveira & Villalba-Condori, 2018). In recent years, studies related to educational games are thought to have gained importance. Karamustafaoğlu and Kılıç (2020) stated that more studies were performed about educational games as the years advance in a study assessing national research about educational games. These studies were dominantly in the science discipline, with quantitative methods dominating and semi-experimental methods chosen. For this reason, it can be said there are more studies investigating the effect of different variables related to educational games in national studies. However, the perspective about educational games of teachers who will implement the educational games and students who will participate in them is important. In national and international studies related to educational games, it appears student viewpoints were measured with qualitative interview questions (Mozelius, Fagerström, & Söderquist, 2017). However, these questions are more specific to the purposes of the research and the lessons where the educational games were used. However, Varışoğlu, Şeref, Gedik, and Yılmaz (2013) dealt with the attitude of students to educational games from a quantitative aspect and considered educational games played in Turkish lessons. As can be seen, it appears the general viewpoint of students about educational games has not been dealt with in either qualitative or quantitative studies. In this context, it is necessary to investigate student perspectives about educational game implementations, not just specific to the lesson, but from a general and holistic viewpoint. It is considered that most students adopt the game-based learning method and the use of educational games is promising for the future (Liu & Chen, 2013). In this context, students are known to have positive motivation (Klein & Freitag, 1991) and attitudes (Koca, 2019) to educational games. Additionally, it is thought that game-based learning provides students with the opportunity to learn (Charlton, Williams, & McLaughlin, 2005; Seo, 2003) and positively affects academic success (Korkmaz, 2018; Özer, 2017; Şahin, 2015; Kılıç, 2010; Songur, 2006).

1.4 State Hypotheses and Their Correspondence to Research Design

Considering the effect of educational games on the sensory and cognitive factors in student learning processes, the perspective about educational games of students who will participate in educational games is important. Hence, there appears to be a need for a measurement tool which can be used to determine the general viewpoint about educational games of students. In this research, the aim was to develop a scale which can be used to determine the

perspective of students about educational games.

2. Method

This is a quantitative study using survey method aiming to describe participants' views of educational game. Within the scope of this study Educational Game Scale was developed and implemented to a group of students. In the following subsections, characteristics of the participants, scale development procedure, data collection procedure and analyses of data are explained.

2.1 Participants

Participants in the research were a group of secondary school students attending state schools in Artvin province. Participants were selected by using the convenience sampling procedure. The total number of participants in the study was 445.

2.2 Procedure

Within the scope of the research, literature related to educational games was screened, and previously developed scales were investigated. As a result of investigations, a draft scale consisting 25 items with 5-point Likert-type rating was prepared and expert opinions were sought to identify the content validity and face validity of this scale. In this context, opinions of 5 experts were used. After expert opinions, 8 items were removed from the 25-item pool and scale items were revised again. A personal information form was added and the initial form of the scale comprising 17 items was created. In line with the aims of the research, this scale was called the Educational Game Scale and applied online to a total of 445 students attending secondary school.

2.3 Analyses

Data belonging to the scale were analyzed with SPSS 19 and STATA 14.2 software. With the aim of testing whether the scale was suitable for factor analysis or not, the Kaiser-Meyer-Olkin (KMO) sampling adequacy coefficient was calculated and the Bartlett's sphericity test results were investigated. To determine the construct validity of this scale, exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and item response theory analysis were performed. With the aim of determining the reliability of the scale, one of the most common reliability statistic of the Cronbach alpha value was calculated and interpreted.

3. Results

3.1 Exploratory Factor Analysis (EFA)

The Kaiser-Meyer-Olkin sampling adequacy test had KMO = .909, and Bartlett sphericity test was x^2 = 2169.759 sd = 45 and p = .000 for the scale. The KMO value being larger than .90 shows it has perfect fit and that the scale is suitable for EFA. The Bartlett sphericity test findings calculated p = .000 and this was significant at $p < .05$ level. The findings for the KMO sampling adequacy test and Bartlett's sphericity test are shown in Table 1.

Table 1. Kaiser-Meyer-Olkin (KMO) sample adequacy test and Bartlett sphericity test findings

KMO Coefficient		.909
Bartlett sphericity test	chi-square value	2169.759
	Sd	45
	p ($p < .05$)	.000

To decide whether an item is related to the conceptual construct, the factor load for that item should be at least .40 (Şencan, 2005). The EFA results identified the item factor load values were below .40 for items 1, 2, 3, 6, 12, 14 and 16 and these items were removed from the scale. All items on the scale had factor loads from .473 to .866 and a 2-factor pattern was obtained. The first factor included items 4, 7, 8, 9, 10 and 11, while the second factor included items 5, 13, 15 and 17. The Cronbach alpha reliability value for the whole scale was .900. The eigenvalues and variance findings related to the scale are given in Table 2, with item factor loads in Table 3.

Table 2. Factor eigenvalue and variance findings for educational game scale

Factor	Eigenvalue	Variance (%)	Cumulative (%)
1	4.873	48.371	48.371
2	.734	7.342	55.714

The eigenvalue for the first factor was 4.873 and the variance rate was 48.371%, while the eigenvalue for the second factor was .734 and the variance rate was 7.342%. The two factors emerging in the EFA results explained 55.714% of the total variance in educational games. The scree plot for the scale is presented in Figure 1.

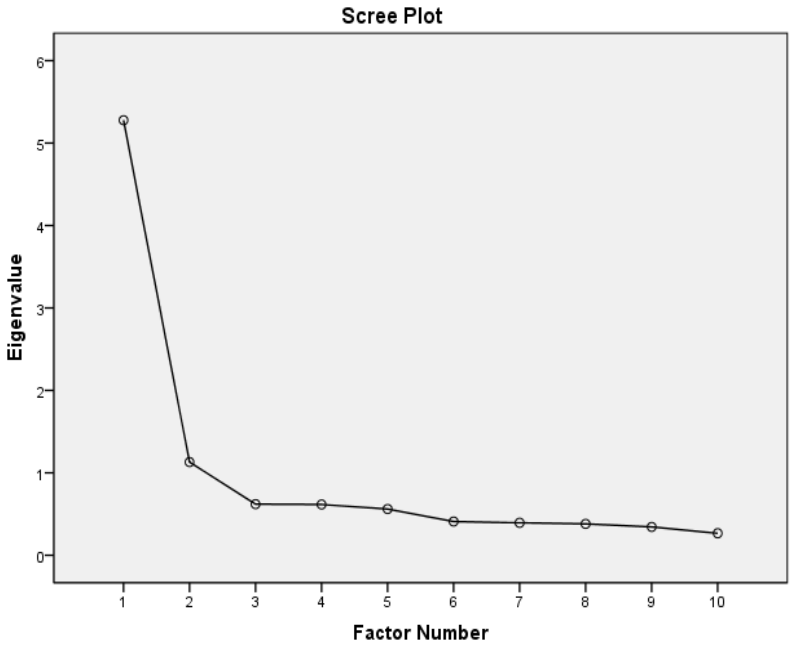

Figure 1. Scree plot for educational game scale

From the scree plot given above, it appears the plot begins to flatten from the second factor. This situation means that data from the pilot applications contained two significant factors.

Table 3. Factor loadings related to educational game scale

Candidate items	Factor load value	Factor load value
S4	.527	
S7	.695	
S8	.779	
S9	.866	
S10	.507	
S11	.736	
S5		.826
S13		.473
S15		.824
S17		.722

The factor loads for the first factor varied from .507 to .866, while item factor loads for the

second factor varied from .473 to .826. According to EFA results, items on the scale were loaded into different factors. This factor structure of the items is evidence of the construct validity of the scale.

3.2 Confirmatory Factor Analysis (CFA)

After EFA, the results of CFA for the scale found χ^2 = 94.661, sd = 32, p = .000, (χ^2/sd) = 2.958, RMSEA = .066, GFI = .958, AGFI = .928, CFI = .971. The structural equation model obtained from CFA results is presented in Figure 2, with the fit index values obtained from this model given in Table 5. In the study, a p significance value > .05 is an expected situation and means that data obtained from the scale are consistent with the described factor model (Kline 1994). However, this value is significant at p value < .05 many times. This situation is a problem due to the assumption of continuous data in scale items prepared with Likert type rating (Çokluk et al., 2014).

Table 4. Goodness of fit indices for educational game scale

Fit indices	Value found	Fit
χ^2/sd	2.958	Good/acceptable fit
RMSEA	. 066	Good/acceptable fit
CFI	.971	Perfect/very good fit
AGFI	.928	Perfect/very good fit
GFI	. 958	Perfect/very good fit

Figure 2 visually demonstrates the factor model consisting two factors and ten items examined by confirmatory factor analysis.

Journal of Educational Issues
ISSN 2377-2263
2022, Vol. 8, No. 1

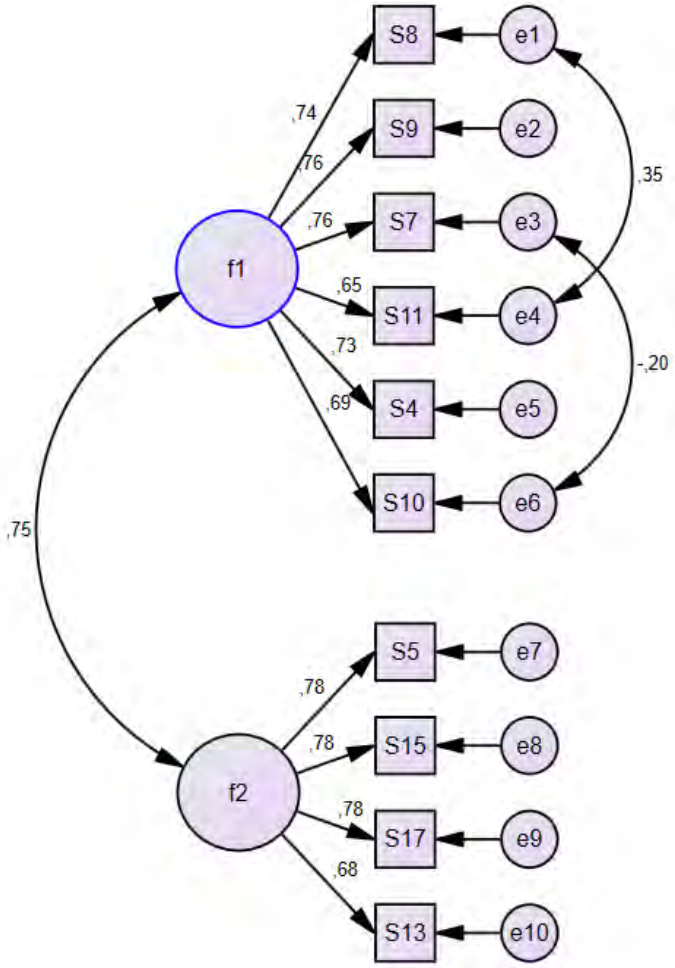

Figure 2. Factor model for educational game scale

3.3 Reliability Analysis

For a data collection tool, reliability refers to internal consistency among the items. Cronbach alpha value, which is a common reliability indicator for data collection tools, was calculated for educational game scale. Reliability findings for educational game scale are presented in Table 5.

Table 5. Reliability findings related to educational game scale

Cronbach's Alpha	Item numbers
.900	10

Cronbach alpha values of .80 and above are accepted as adequate for reliability and internal consistency in research about educational sciences and social sciences (Erkuş, 2012). The

total Cronbach alpha reliability value for the whole scale was .900. For this reason, the scale can be said to have good levels of reliability and internal consistency.

3.4 Item Response Theory Analysis

After establishing the factorial structure of the educational game scale, the discrimination, difficulty, and informativeness of the scale were examined using the item response theory, which provides more detailed and reliable information at the individual and item level than classical test theory.

In item response theory, there are different models based on the structure of the items in the measurement tool and the way they are scored. For example, if items are scored in two categories as true or false (0 or 1) in a measurement tool, the analysis is performed according to one of the logistic models of the item response theory. On the other hand, a measurement tool consisting of multi-category scored items is analyzed according to one of the nominal response, graded response or partial credit models of the item response theory. In this study, the analysis will be based on the graded response model of the item response theory, as it is suggested in the evaluation of measurement tools consisting of items scored according to a five-point Likert scale (Crocker & Algina, 2008).

In order for a measurement tool to be evaluated according to the item response theory, the assumptions of this theory must first be checked. Basic assumptions of item response theory are monotonicity and unidimensionality (Hambleton & Swaminathan, 1991). Monotonicity refers to the monotonous increase in the item characteristic curve, which is the graph of the relationship between the probability of an item to be scored high and the level of the construct that the item measures. The monotonicity assumption is checked by examining whether the item characteristic curves have an s-like shape. Unidimensionality, on the other hand, is that the measurement tool measures a single structure, in other words, the measurement tool does not have any sub-dimensions. The unidimensionality assumption is checked by examining whether a single-factor structure is formed as a result of the exploratory factor analysis of the data obtained from the measurement tool. In order to evaluate the Educational Game Scale developed in this study according to the item response theory, the monotonicity and unidimensionality assumptions of the theory were checked. The item characteristic curves (ICC) of the items of the educational game scale have an s-like shape expressing monotonicity. In addition, as a result of exploratory factor analysis of the Educational Game Scale, it was observed that all items were loaded in two factors. However, most of the items were loaded in both factors with high factor loadings (Table 3). Item parameters within the item response theory analysis are given in Table 6.

Table 6. Item parameters for the educational game scale

Item parameter estimations					
Candidate items	α	b_1	b_2	b_3	b_4
4	2.013363	-2.446637	-1.850973	-1.163005	.2501679
7	2.264239	-2.259761	-1.373663	-.4719388	.6291045
8	2.936374	-2.251306	-1.368156	-.3737052	.7109532
9	2.5977	-2.258967	-1.533817	-.407181	.8757859
10	1.823669	-2.530435	-1.923847	-1.023558	.5773215
11	2.417752	-2.148281	-1.422519	-.3355964	1.008695
5	2.822052	-2.444302	-1.825586	-1.184031	.3308512
13	1.808005	-2.663626	-1.499774	-.4755835	1.179946
15	3.211707	-2.289336	-1.734168	-1.129704	.3103912
17	2.810419	-2.438226	-1.81432	-1.128621	.2119603

When Table 6 is investigated, all items had α value > 1.0. According to Baker, values larger than 1.0 are acceptable values. Figure 3 demostrates item characteristics curves indicating monotonicity of the scale.

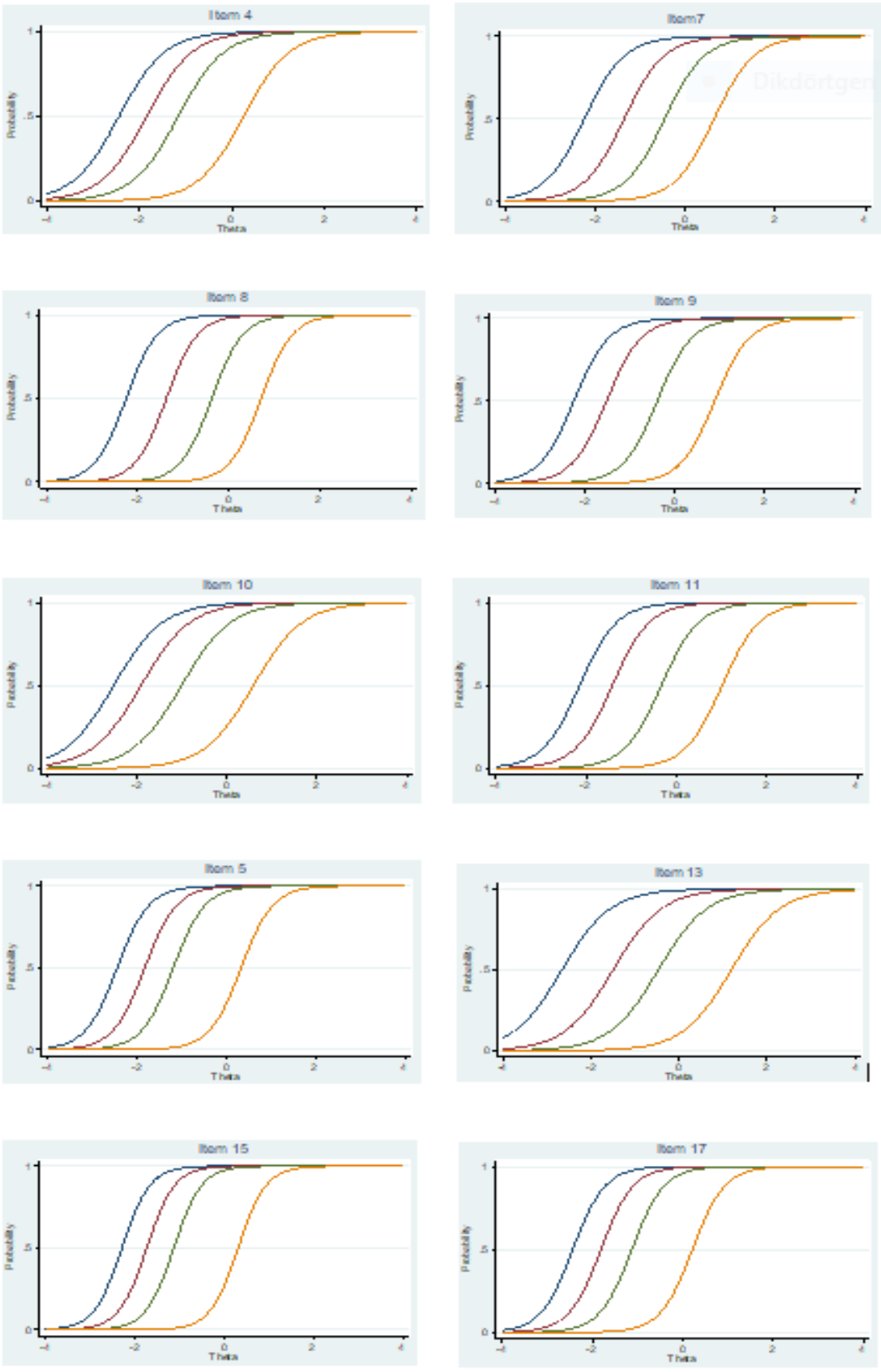

Figure 3. Item characteristics curves (ICC) for the educational game scale

3.5 Revision after Statistical Analysis and Final Form of the Scale

The final form of the scale comprised 2 subfactors and 10 questions. As a result of analyses, each subfactor on the scale was named and the first subfactor was called ‘mental adaptation’ and the second subfactor was called ‘physical adaptation’. As the scale comprises 10 questions, points on the scale can be minimum 10 and maximum 50. Within this scope, intervals were named with points from 0-20 being ‘low adaptation’, 21-30 ‘moderate adaptation levels’ and 31-50 ‘high adaptation levels’. Table 7 shows factors of the scale with their items.

Table 7. Factors, items and load values for the scale

Subfactors	Item numbers	Items	Item load values
Mental adaptation	Q4	Learning with games in lessons increases my motivation	.527
	Q7	I would choose to learn with games in lessons	.695
	Q8	I don’t forget information I learn through games in lessons	.779
	Q9	I think I learn effectively with games in lessons	.866
	Q10	I have difficulty understanding lessons taught through games	.507
	Q11	What I learn with games is permanent.	.736
Physical adaptation	Q5	I participate in games played in lessons	.826
	Q13	When learning with games I explain my thoughts about the lesson	.473
	Q15	I raise my hand to join in games played in lessons	.824
	Q17	When learning with games in lessons, I willingly fulfill the tasks given.	.722

4. Discussion

In the research, the aim was to develop a measurement device to determine perceptions of secondary school students about educational games. In this context, a scale was developed with all items gathered in 2 dimensions of mental adaptation and physical adaptation within the scope of the research. It appeared the scale had adequate psychometric features as a result of the research. The mental adaptation dimension involves students’ mental preparation process for educational games. This dimension comprises a total of 6 items. The highest points that can be obtained in this subdimension is 30, with lowest points of 5. High points indicate the students have high perception levels about educational games. The item ‘I have difficulty understanding lessons taught through games’ included in this dimension is given inverse points as it contains negative statements about perceptions of educational games. The physical adaptation dimension represents students’ participation in games in real class environments. The physical adaptation dimension comprises 4 items. This dimension has

maximum 30 and minimum 5 points. In the scale about educational games, the items in the first dimension involve students' mental preparation for educational games, while items on the physical adaptation dimension involve the students' participation in games. For this reason, items in the first dimension of the scale show the students' preparation for educational games, while the other dimension shows the transition to the implementation stages, different from mental preparation. In this context, the subdimensions of the scale appear to comprise two dimensions of 'preparation for educational games' and 'mental preparation'.

When the items for the subdimensions called 'preparation for educational games' and 'mental adaptation' are separately examined, the motivation process related to educational games among students comes to mind. In the literature, studies about educational games determined motivation of students increased (Torrente, Blanco, Marchiori, Moreno-Ger, & Fernandez-Manjon, 2010; Nicholson, 2012; Zichermann & Cunningham, 2011). Most students have encouraging positive attitudes and they are more motivated to learn using games compared to traditional methods (Ibrahim, Yusoff, Omar, & Jaafar, 2011). There are studies showing educational games positively affect academic success of students (Coşkun, Akarsu, & Kariper, 2012). For this reason, educational games have become a topic of interest for many researchers. However, it is necessary to assess educational games from the student perspective. In this research, a measurement device was developed which can measure the viewpoints of students about educational games. Varışoğlu, Şeref, Gedik, and Yılmaz (2013) developed a measurement device to determine attitudes of students about educational games applied in Turkish lessons. The results of the analysis determined three subfactors of 'valuing and personalizing', 'motivation provided by the teacher about educational games' and 'internal motivation about educational games'. The educational games scale developed in this research comprises two dimensions of 'preparing for educational games' and 'mental adaptation'. As understood from the subdimensions for items on both scales, it is thought that educational games can increase the motivation of students. The educational games scale developed in this research has a broader area of use than other studies as it can be used in all disciplines.

When the EFA and CFA results for the educational games scale developed in the research are examined, the validity of the scale was confirmed. Additionally, when the Cronbach alpha value (0.90) is examined, the scale had good levels of reliability and internal consistency. In conclusion, it appears the scale can be applied in studies of secondary school students based on the validity and reliability studies. In this context, the educational games scale, with validity and reliability determined, can be said to be a measurement device that can be applied in all disciplines to secondary school students. Apart from being useful for all disciplines, it allows measurement of student perceptions about teaching with educational games with numerical data. In short, the developed educational game scale is thought to positively contribute to the field.

The educational games scale is thought to be useful in many interdisciplinary areas. Additionally, it may guide researchers in revealing the effects of educational games on learning at secondary school level. Additionally, all educators teaching with drama or similar games in lessons may use the educational game scale to investigate the efficacy of studies. It

will be beneficial to identify the effect of educational games on students within the scope of lessons. Studies may be performed with different samples for validity and reliability of the scale. With the aim of determining the fit validity of the scale, the relationship between the educational game scale with scales assessing a variety of constructs related to educational games with validity and reliability proven may be investigated.

Acknowledgments

This study was produced as a BAP project and supported by the Artvin Coruh University BAP Coordinator.

References

Akgün, E., Nuhoğlu, P., Tüzün, H., Kaya, G., & Çınar, M. (2011). Development of an educational game design model. *Educational Technology Theory and Practice, 1*(1), 41-61.

Aksoy, A. B., & Dere Çiftçi, H. (2014). *Erken çocukluk döneminde oyun*. Ankara: Pagem. https://doi.org/10.14527/9786053648574

Aleven, V., Myers, E., Easterday, M., & Ogan, A. (2010). *Toward a framework for the analysis and design of educational games*. Paper presented at the third IEEE international conference on digital game and intelligent toy enhanced learning (DIGITEL), Kaohsiung, Taiwan. https://doi.org/10.1109/DIGITEL.2010.55

Apostol, S., Zaharescu, L., & Alexe, I. (2013). *Gamification of Learning and Educational Games* (pp. 67-72). 9th International Scientific Conference e-Learning and Software for Education, April 25-26, 2013, Bucharest.

Arslan, F. (2000). 1-3 Yaş dönemindeki çocuğun oyun ve oyuncak özelliklerinin gelişim kuramları ile açıklanması. *Journal of Cumhuriyet University School of Nursing, 4*(2), 40-43.

Ayan, S., & Memiş, U. A. (2012). Erken çocukluk döneminde oyun. *Journal of Physical Education and Sport Science, 14*(2), 143-149.

Backlund, P., & Hendrix, M. (2013). *Educational games-are they worth the effort? A literature survey of the effectiveness of serious games* (pp. 1-8). 5th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES), IEEE. https://doi.org/10.1109/VS-GAMES.2013.6624226

Büyükuygur, M. (2018). *Developing of educatonal game application for improving primary school students' english learning via using augmented reality technology* (Doctoral dissertation İstanbul Aydın University).

Charlton, B., Williams, R. L., & McLaughlin, T. F. (2005). Educational Games: A technique to accelerate the acquisition of reading skills of children with learning disabilities. *International Journal of Sepacial Education, 20*(2), 66-72.

Çoban, B. (2006). *Ortaöğretimde ve üniversitelerde eğitsel oyunlar*. Ankara: Nobel Yayın Dağıtım.

Coşkun, H., Akarsu, B., & Kariper, A. (2012). The Effects of Educational Games based on Science Stories on Students' Academic Achievements in Science and Technology Classroom. *Journal of Kirsehir Education Faculty, 13*(1), 93-109.

Crocker, L., & Algina, J. (2008). *Introduction to classical and modern test theory*. Mason. OH: Cengage Learning.

De Freitas, S. (2018). Are games effective learning tools? A review of educational games. *Journal of Educational Technology ve Society, 21*(2), 74-84.

Deater-Deckard, K., Chang, M., & Evans, M. E. (2013). Engagement states and learning from educational games. *New Directions for Child and Adolescent Development, 139*, 21-30. https://doi.org/10.1002/cad.20028

Erbay, F., & Durmuşoğlu Saltalı, N. (2012). The place of play in six-year-olds' daily life and mothers' play perception. *Journal of Kirsehir Education Faculty, 13*(2).249-264.

Erkuş, A. (2012). *Psikolojide ölçek ve ölçek geliştirme: temel kavramlar ve işlemler*. Ankara: Pegem Akademi Yayıncılık.

Esen, M. A. (2008). The instructional importance of traditional child's plays and almost forgotten akhiska child's plays. *Journal of Uludağ University Education Faculty, 21*(2), 357-367.

Gaydos, M. (2015). Seriously considering design in educational games. *Educational Researcher, 44*(9), 478-483. https://doi.org/10.3102/0013189X15621307

Giannakos, M. N. (2013). Enjoy and learn with educational games: Examining factors affecting learning performance. *Computers & Education, 68*, 429-439. https://doi.org/10.1016/j.compedu.2013.06.005

Gürbüz, F., Çeker, E., &Töman, U. (2017). Effects of educational song and game techniques on the academic achievement of students and retention of the achievement. *Journal of Bayburt Education Faculty, 12*(24), 593-612.

Gürsoy, A., &Arslan, M. (2011). *Eğitsel oyunlar ve etkinliklerle yabancılara Türkçe öğretim yöntemi* (S. 5-7, pp. 177-185). 1st International Conference on Foreign Language Teaching and Applied Linguistics.

Habgood, M. J., & Ainsworth, S. E. (2011). Motivating children to learn effectively: Exploring the value of intrinsic integration in educational games. *The Journal of the Learning Sciences, 20*(2), 169-206. https://doi.org/10.1080/10508406.2010.508029

Hambleton, R. K., Swaminathan, H., & Rogers, H. J. (1991). *Fundamentals of item response theory* (Vol. 2). Sage.

Ibrahim, R., Yusoff, R. C. M., Mohamed-Omar, H., & Jaafar, A. (2011). Students perceptions of using educational games to learn introductory programming. *Computer and Information Science, 4*(1), 205-216. https://doi.org/10.5539/cis.v4n1p205

Karamustafaoğlu, O., & Kılıç, M. F. (2020). Investıgatıon of natıonal scıentıfıc studıes about educatıonal games. *Atatürk University Journal of Kazım Karabekir Education Faculty, 40*, 1-25. https://doi.org/10.33418/ataunikkefd.730393

Kavcar, C. (1985). Örgün eğitimde dramatizasyon. *Education and Science, 10*(56), 32-41.

Kaya, S., & Elgün, A. (2015). The influence of instructional games in science teaching on primary students'achievement. *Kastamonu Journal of Education, 23*(1), 329-342.

Kiili, K., & Ketamo, H. (2007). Exploring the learning mechanism in educational games. *Journal of Computing and Information Technology, 15*(4), 319-324. https://doi.org/10.2498/cit.1001139

Kılıç, A. (2010). *The effects of educational game based learning on achievement of operational skills in the 1st grade primary school mathematics classes* (Master dissertation, Celal Bayar University).

Klein, J. D., & Freitag, E. (1991). Effects of using an instructional game on motivation and performance. *Journal of Educational Research, 84*(5), 303-308. https://doi.org/10.1080/00220671.1991.10886031

Kline, P. (1994). *An easy guide to factor analysis*. UKK Routledge.

Koca, B. (2019). *The effect of game based learning on students 'academic achievement and attitude in science education: A meta-analysis study* (Doctoral dissertation, Sivas Cumhuriyet University).

Konur, H. (2014). Preschool period children games and parents attitude. *Sakarya University Journal of Education Faculty, 13*, 88-97.

Korkmaz, S. (2018). *Development and effectiveness of educational games inscience teaching as supplementary material on students'achievement and attitude towards science* (Master dissertation, Bartın University).

Lamb, R. L., Annetta, L., Firestone, J., & Etopio, E. (2018). A meta-analysis with examination of moderators of student cognition, affect, and learning outcomes while using serious educational games, serious games, and simulations. *Computers in Human Behavior, 80*, 158-167. https://doi.org/10.1016/j.chb.2017.10.040

Liu, E. Z. F., & Chen, P.-K. (2013). The Effect of game-based learning on students' learning performance in science learning—A Case of "Conveyance Go". *Elsevier Procedia-Social and Behavioral Sciences, 103*, 1044-1051. https://doi.org/10.1016/j.sbspro.2013.10.430

Mozelius, P., Fagerström, A., & Söderquist, M. (2017). Motivating factors and tangential learning for knowledge acquisition in educational games. *Electronic Journal of e-Learning, 15*(4), 343-354.

Munz, U., Schumm, P., Wiesebrock, A., & Allgower, F. (2007). Motivation and learning progress through educational games. *IEEE Transactions on Industrial Electronics, 54*(6), 3141-3144. https://doi.org/10.1109/TIE.2007.907030

Nicholson, S. (2012). *A user-centered theoretical framework for meaningful gamification.* Games + Learning + Society 8.0, Madison, WI. Retrieved from http://scottnicholson.com/pubs/meaningfulframework.pdf

Özer, A., Gürkan, A. C., & Ramazanoğlu, O. (2006). Oyunun çocuk gelişimi üzerine etkileri. *Fırat Üniversitesi Doğu Araştırmaları Dergisi, 4*(3), 54-57.

Özer, F. (2017). *The impact of serious games on science course academic achievement, motivation and problem-solving skills of primary school 4th grade students* (Master dissertation, Anadolu University).

Pivec, M., & Kearney, P. (2007). Games for learning and learning from games. *Organizacija, 40*(6), 267-272.

Şahin, M. (2015). *The effect of gamified game based learning on students' achievements and attitudes towards science* (Master dissertation, Bahçeşehir University).

Seçkin Kapucu, M., & Çağlak, S. (2018). Pre-service science teachers' skills and experience on designing educational games: A case study. *Sosyal Bilimler Dergisi, 10*(29), 537-573.

Şencan, H. (2005). *Sosyal ve davranışsal ölçümlerde güvenirlik ve geçerlilik.* Seçkin Yayıncılık: Ankara.

Seo, K. H. (2003). What children's play tells us about teaching mathematics. *Young Children, 58*(1), 28-33.

Silveira, I. F., & Villalba-Condori, K. O. (2018). An open perspective for educational games. *Journal of Information Technology Research, 11*(1), 18-28. https://doi.org/10.4018/JITR.2018010102

Songur, A. (2006). *The effect of mathematics succes level of the students of subjects of the explanations with letter and equations learning with games and word puzzle* (Master dissertation, Marmara University).

Torrente, J., Del Blanco, A., Marchiori, E. J., Moreno-Ger, P., & Fernández-Manjón, B. (2010). Introducing educational games in the learning process. *Education Engineering*, 1121-1126. https://doi.org/10.1109/EDUCON.2010.5493056

Turkish Language Society. (2020). Retrieved from https://www.tdk.gov.tr

Varışoğlu, B., Şeref, İ., Gedik, M., & Yılmaz, İ. (2013). Attitude scale for educational games that played in Turkish lesson: study of validity and reliability. *Adiyaman University Journal of Social Sciences, 1*(11), 1059-1081.

Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. Sebastopol: O'Reilly.