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A SCALE DEVELOPMENT STUDY: GAME AND EDUCATIONAL MATERIAL USE SCALE (GaEMUS)

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Abstract

The game is an important tool that provides motivation for the individual at almost any age while entertaining it, as well as providing achievements to the individual and socially. The use of this tool as an educational tool or material can help increase the success of learning-teaching processes. For this reason, the aim of this research was to develop a measurement tool that could be used to efficiently collect data or diagnose the preparation, planning, implementation, and evaluation processes of education and training processes. The sample size of this study, in which the validity and reliability of the scale were carried out, consists of 677 people who have different levels of learning. In this study, Kaiser-Meyer-Olkin, Barlett's Sphericity Test, Explanatory Factor Analysis, Cronbach's Alpha, substance total correlation, and Confirmatory Factor Analysis were performed to ensure the validity and reliability of the game and educational material use scale. At the end of these statistical operations, GaEMUS consisted of 22 items. An Exploratory Factor Analysis was performed on this structural condition. It was determined that the scale provided a four-factor scale structure: The Cognitive Process Dimension, The Psychological Dimension, The Psychomotor Development Dimension, and The Social Dimension.

Keywords: education, game, material, scale, GaEMUS

Introduction

In education and social life, the concept of games and game materials seem to contribute to people throughout life. Especially for children to realize themselves and express themselves, the game is a must for the child. Because the game involves interaction, experience acquisition, socialization and skill acquisition. Thanks to these achievements, the skills that the child will reveal are shaped. Development of individual reading, including academic achievement, can be achieved through game-based teaching (Smutny & Saal, 2021; Mao et al., 2021).

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For centuries, the game has been studied by theorists. In the game for a particular purpose, or non-canonical or is performed without rules, but in each case the child willingly and chicks which takes place on the physical, cognitive, language, emotional and social development which is the basis of real and active part of life is seen as a learning process (Arslan, 2000). In the game, making decisions, remembering, observation, reasoning, problem solving and creative thinking skills they gain, and has a significant impact on children's learning of the play (Russ, 2003; Zabelina & Robinson, 2010; Bolat & Tekin, 2017; Mao et al., 2021). Although increasing interest in educational games and materials in recent years, little study of educational games and educational games were obtained to improve the design or effectiveness (Gaydos, 2021). This situation is compromised on educational games and materials and effective research.

Literature Review

Through the game, individuals acquire basic and social skills. It is useful to recognize the situations and rules that individuals will encounter in life, reveal their natural abilities and use their imagination. The game is an important tool that supports all areas of development, but also provides fun and learning (Henniger, 2005; Xu, 2010). Student success is positively impacted in hybrid learning environments supported by educational games and game materials (Yang et al., 2021). For this reason, emphasis should be placed on the use of games and educational materials for all learning environments. In addition, learning and teaching environments should be configured in this way. Besides, play and game-based learning has a positive effect for critical thinking. Many studies in the literature list are listing the results associated with this situation (Mao et al., 2021).

The game is the most effective way for children to get to know their environment and make sense of the world in the first years of life, to express feelings such as love, jealousy, happiness (Kaugars & Russ, 2009). *"The physical and mental skills of the game, social harmony, and made from real life in order to develop emotional maturity in a different environment, the end that does not provide a financial interest in their own specific rules delimited in space and time to last through voluntary participation and the attendees created a social group holds a fun activity that is completely under the influence"* (Işılak & Durmuş, 2004, p.78). If the child does not play games, he cannot fully complete his physical, cognitive, emotional and social development. Therefore, it cannot be stated that a child who cannot meet the need for play is physically and spiritually healthy (Hirose et al., 2011). In order for children to be developmentally healthy, they need food, sleep, as well as play. Failure to meet or limit this basic requirement can lead to unhealthy development of children who make up the core of society (Erbay et al., 2012). Games also create the opportunity to establish brothers, family members and educators, if there are their own peers, family individuals and educators (Lifter et al., 2011).

In our age, children have game dough, animal figures, cars, Lego, educational toys, musical instruments, digital game consoles, phones and filling toys that they will use in a physical sense as toys (Özyürek & Akça, 2015), as well as the number of toys owned is quite large. The game is a critical process for children who can learn the social and communication skills of children and to practice their learning (Trimlett et al., 2021). This important process can be transformed into a more systematic teaching process with educational material or game materials. But reasons such as increasing the buying power of toys for families and trying to eliminate children's limited playground requirements with toys can lead to uncontrolled and purposeless use of game materials (Özyürek & Yavuz, 2016). Parents have a lot of serious work to do when it comes to adjusting game environments and Game materials. Parents give their children the opportunity to play, create the necessary environments, pay attention to where toys are

located and participate in their children's games will allow their children to better complete their development (Kandır, 2000; Erden, 2001; Barton et al., 2018). Because parents provide the best game environment for the child in preschool period and thus help children acquire the necessary knowledge and skills (Tezel Şahin, 1993).

In view of the studies, it is seen that playing games and using game material bring serious benefits to children. In his study, Saracho (2001) observed improvement in the literacy skills of children in the classrooms of kindergarten teachers who made arrangements in playgrounds and corners in educational environments. When the child finds the required media and material, it is always directed to produce new things with its body, their movements, senses, sensations and expression of feelings. In terms of physical and mental health in children's lives, games and toys are of great importance. These factors, which have an important place in each stage of development, help the child develop many skills (Uğurlu et al., 2012; Alexander 2003). The game is an action that humanity has continued since its existence, starting with life, continuing by differentiating and developing in eperiod of life. The game is a vital necessity and requirement for mankind (Şen, 2010). Besides, through game and material-based teaching methods and game-based movement training, the development of a sense of self, belonging and community is achieved (Smith et al., 2021). This can be demonstrated among the sociological benefits of using games and educational materials. Many scientific research emphasizes the importance of educational game, which emphasizes the educational process of individuals with special learning difficulties with the help of the game and educational material (Trimlett et al, 2021).

Gökşen this sentence is important; "*Children who grow up stuck between four walls without sharing anything with anyone but themselves do not feed good things to each other in schools. This is one of the most important reasons behind the increase in murders, fights and the behavior of young people to harm themselves in our schools recently.*" (Gökşen, 2014, p. 236). When the relevant literature supporting this promise is examined, it can be easily seen that learning through play, game-based learning and educational material affects important developmental tasks such as cognitive skills, positive psychological development, self-awareness, socialization and socialization of individuals. It has been found that these effects are reported separately or as a whole in many scientific studies (Tsai et al., 2016; Smith et al., 2021; Yang et al., 2021; Smutny & Saal, 2021; Trimlett et al, 2021; Gaydos, 2021).

Purpose of Research

The game is an important tool that entertains the individuals at almost any age while providing motivation, as well as providing achievements to the individual and socially. The use of this tool as an educational tool or material can help increase the success of learning-teaching processes. For this reason, the aim of this research is to develop a measurement tool that can be used to efficiently collect data or diagnose the preparation, planning, implementation and evaluation processes of education and training processes. In this study, which uses methods to ensure validity and reliability from a scientific point of view, it aims to develop Game and Educational Material Use Scale (GaEMUS).

Method

This research Kaiser-Meyer-Olkin (KMO), Bartlett's Sphericity test, Exploratory Factor Analysis (EFA), Cronbach's Alpha, item total correlation, Confirmatory Factor Analysis (CFA) statistical operations contain a number of measurement tools such as educational development.

Study Group

Data on participants participating in the development of The Game and Educational Material Use Scale (GaEMUS) are provided in Table 1. In order for data to deliver stronger results in scale development processes, it is necessary to reach as many participants as possible, taking into account the number of items. The fact that there were 677 people involved in the scale development process in this study can be interpreted as a "*good*" number of participants due to the number of 300 and above participants in the scale development process (Comrey & Lee, 1992). In the literature, although there are different opinions for exact determination of sample size of article number 10 times the number of participants in this study as in the literature of knowledge and the criteria of the working group of the research to be fit enough to the number above it is observed that (Pallant, 2005; Şahin et al., 2018). All this data points to an efficient sample size for the scale development process (Balcı & Ahi, 2017). However, the second data collection process of the study was carried out with 275 participants forming the second working group using the final 22-point structure of the scale.

Table 1
Study Group

		N	%
Gender	Male	352	51.99
	Female	325	48.01
Age	14-18	277	40.90
	19-23	271	40.02
	24 and 24+	129	19.05
Graduate	Primary	17	2.51
	Secondary	144	21.27
	High School	276	40.76
	University	240	35.45
Playing Time for Educational Purposes (Weekly)	None	34	5.02
	5-10	458	67.65
	15-20	127	18.75
	25-30	31	4.57
	35-40	27	3.98
The type of sports	Individual Sports	335	49.48
	Team Sports	330	48.74
	None	12	1.77
	Total	677	100.00

Creation of Scale Items and Trial Form

During the development process of the Game and Educational Material Usage Scale (GaEMUS), whose validity and reliability were provided in the research, a pool of items related to the subject was created first. Literature, scientific research and expert opinions were scanned and written on the scale. 32 items considered covering games and educational materials were taken into the article pool. These items were sent to 5 field experts who have studies on the subject and their opinions about the items were taken. The group referred to in the opinion consists of 2 (Associate Professor) educational programs and training, 1 Primary Education (Associate Professor) and 1 Measurement and Evaluation (doctor) field specialist. In addition, a linguist with the title of Doctor has ensured the understanding of substances in a purposeful manner by examining items in the direction of their meaning, grammar and expression. It was

decided to remove 9 items taking into account the opinions of experts on the scale of the items sent to the field experts. Thus, 23 items are included in the Test form of the scale. It was decided that the Game and Educational Material Use Scale (GaEMUS) should be in a Likert structure of 5. Expressions related to extracurricular learning activities on the scale consist of "*I disagree at all*", "*I agree less*", "*I agree moderately*", "*I agree much*", "*I fully agree*", and no article that should be reverse encoded on the scale is included. The entire trial form includes positive scale items and decided to scoring the substance scoring of "*1*", "*2*", "*3*", "*4*" in the form of "*5*".

During the development process of the of the Game and Educational Material Usage Scale (GaEMUS), the distributions obtained at the end of the first application were eventually removed due to the fact that 1 item remained below the required values, and the second trial process consisting of 22 items was conducted. Confirmatory analyses of the scale were made with the data from this experiment. Data obtained on the scale development process are presented in detail in the results section.

Data Analysis

Kaiser-Meyer-Olkin (KMO) coefficient, Barlett's Sphericity test, Explanatory Factor Analysis (EFA), Cronbach's Alpha, and substance total correlation were performed with the data collected using the trial form prepared for the Game and Educational Material Use Scale (GaEMUS) intended to be developed in the study. However, descriptive statistical analyses such as percentage, frequency and arithmetic mean were performed for some descriptive conditions. The second application was made by delivering this form of the scale to 275 participants from the same study group using the 22-point scale obtained at the end of these processes. Confirmatory Factor Analysis (CFA) of the data obtained from the second application was performed through the LISREL program. In this way, the accuracy of the final structure and factor distribution of the scale was checked. Analyses, findings and results related to all operations carried out in the scale development process are reported and presented in accordance with scientific rules.

Findings

GaEMUS Factor Analysis

Table 2 shows the values of Barlett Sphericity Tests with KMO. The KMO value of the scale is 0.80. The eigenvalues of the structural dimension of the scale, calculated as 0.00 in the significance level of the Barlett Sphericity Test, and the described hypothetical percentages are presented in the Table 3.

Table 2

Game and Educational Material Use Scale (GaEMUS) KMO and Bartlett Test

Kaiser-Meyer-Olkin Sample Compliance Measurement		0.80
Barlett's Sphericity Test	X2	2237.89
	Sd	360.00
	p	0.00

GaEMUS Explanatory Factor Analysis (EFA)

As can be seen in Table 3, four factors with eigenvalues above 1 were formed in the results of factor analysis. It explains 60.07% of the total variance of the four-factor scale: (a) Cognitive Process Dimension, (b) Psychological Dimension, (c) Psychomotor Development Dimension, (d) Social Dimension. The distributions of substances and

substance charges that make up the resulting four-dimensional structure for the scale are given in Table 4.

Table 3
Factor eigenvalues and explanation variances

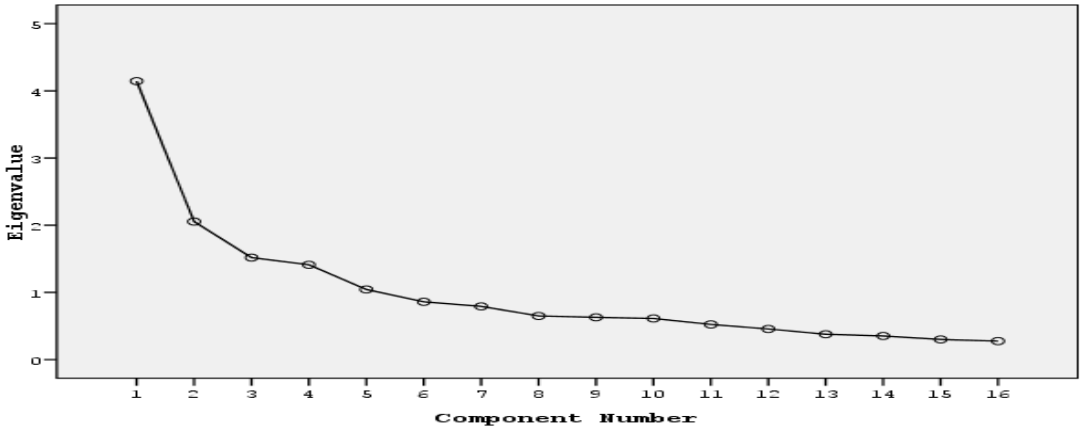
	Initial Eigenvalue			Total After Rotation		
Factor	Total	Variance %	Cluster %	Total	Variance %	Cluster %
Cognitive Process	3.98	23.78	23.91	2.66	18.62	18.58
Psychological	2.42	18.67	34.04	2.31	14.14	42.21
Psychomotor Development	1.90	10.1	51.12	2.11	13.18	48.21
Social	1.67	9.68	60.07	2.08	12.71	53.17

Table 4
Factors, factor loads and reliability values of GaEMUS

	Factors					
	Cognitive Process	Psychological	Psychomotor Development	Social	Substance Total Correlation	Cronbach Alpha
M1	0.71				0.71*	
M2	0.77				0.60*	
M3	0.70				0.60*	0.86
M4	0.64				0.62*	
M5	0.60				0.61*	
M6		0.72			0.64*	
M7		0.60			0.60*	
M8		0.61			0.60*	0.81
M9		0.73			0.63*	
M10		0.67			0.60*	
M11		0.71			0.60*	
M12			0.61		0.56*	
M13			0.62		0.60*	
M14			0.67		0.64*	0.75
M15			0.63		0.60*	
M16			0.64		0.57*	
M17				0.66	0.63*	
M18				0.60	0.61*	
M19				0.55	0.54*	0.78
M20				0.62	0.52*	
M21				0.60	0.60*	
M22				0,60	0.61*	

The breaking points of the values of the 22-items and 4-subdimensional structure of the Game and Education Material Usage Scale (GaEMUS) formed in Table 4 are presented in the Scree Plot Chart below (See Figure 1). Cronbach Alpha internal consistency coefficient is examined. The Cronbach Alpha reliability coefficient of the 22-point scale structure was calculated as 0.80. Besides, the Cronbach Alpha reliability coefficients for each lower dimension are calculated respectively: .86, .81, .75 and 78. By looking at these data, it is recognized that the overall structure of the scale is reliable (George & Mallery, 2016).

Figure 1
GaEMUS Scree Plot Chart



In Figure 1, the eigenvalues of factors that can be used to decide the factor structure of the scale according to the results of factor analysis of the main components that make up the scale show us how many Factors structures the scale has (Green et al., 2000). According to figure 1, the presence of 4 factors with the eigenvalues of the scale above 1.00 can be said to support the factor structure given in Table 4. In this regard, it was determined that the scale has a 4 sub-factor structure.

Table 5
Values obtained from CFA (before and after modification)

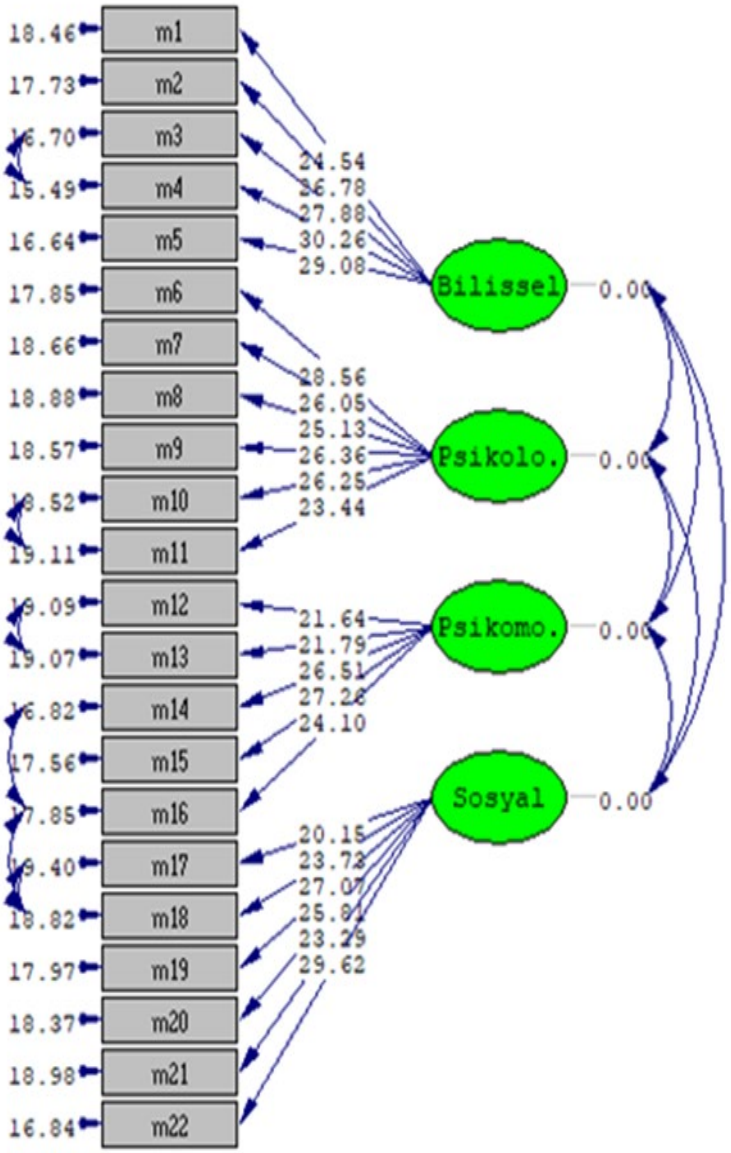
Value	Before	After	Good Compliance	Acceptable Compliance
$\chi 2$	2378.15	1549.17	-	-
df	203	197	-	-
p	0.00	0.00	-	-
$\chi 2$ / df	11.7	7.8	$0 \leq \chi 2/df \leq 2$	$2 < \chi 2/df \leq 5$
RMSEA	0.11	0.09	$0 \leq RMSEA \leq 0.05$	$0.05 < RMSEA \leq 0.08$
SRMR	0.05	0.04	$0 \leq SRMR \leq 0.05$	$0.05 < SRMR \leq 0.10$
CFI	0.96	0.98	$0.97 \leq CFI \leq 1.00$	$0.95 \leq CFI < 0.97$
NFI	0.96	0.97	$0.95 \leq NFI \leq 1.00$	$0.90 \leq NFI < 0.95$
NNFI	0.96	0.97	$0.97 \leq NNFI \leq 1.00$	$0.95 \leq NNFI < 0.97$
PNFI	0.84	0.83	$0.95 \leq PNFI \leq 1.00$	$0.50 \leq PNFI \leq 0.95$
AGFI	0.75	0.82	$0.95 \leq PNFI \leq 1.00$	$0.50 \leq PNFI \leq 0.95$
IFI	0.96	0.98	$0.97 \leq NNFI \leq 1.00$	$0.95 \leq NNFI < 0.97$

GaEMUS Confirmatory Factor Analysis (CFA)

In accordance with Lisrel's recommendations, since the significance of the square/df value at the end of the confirmatory factor analysis (p=0.00) and the RMSEA value are high, and the compliance indices are not at the predicted level 3-4, 10-11, 12-13, 14-16, 18-16, 18-17 modifications were made between the substances. After modification, a decrease in the value of RMSEA was observed with the significance of the square/df value, and compliance indices increased to better levels. The values obtained after modification are presented in Table 5.

Factor load values obtained from the PATH diagram were examined (See Figure 2). The correlation of each substance is at least 0.30 showing the correlations of the relevant factor, different operations are recommended for the substances below this value. As can be seen from Table 5, it was understood that the factor loads of the substances have changed in 0.64 - 0.85 in the range of 0.30. As a result of the CFA, the model has been demonstrated with adaptation indices. When these values are examined, the values of GaEMUS have an acceptable compliance (Harrington, 2014).

Figure 2
GaEMUS Path Diagram



Discussion

In view of the results and factor distributions of the study, it is seen that many different dimensions are hosted in the sole operation for the literature. any studies have been conducted on these factors. There are many studies that conclude that gaming has benefited individuals of all kinds, with or without material, in a serious way. If we look at them; Dündar and Ayan (2009) stated that the use of games and toys improves creativity and should be used in lessons along with other methods. Öztemiz and Önal

(2013) showed that in their work to determine the teacher's views on giving primary school students the habit of reading with games, teachers express their opinion that the game can be used effectively in education as a technique. Studies investigating the effects of game and toy use in terms of academic success, contribution to the mental process and physical development have been examined, and it has been stated that the use of game and game material is beneficial for the individual (Jones, 2001; Casby, 2003; Christakis et al., 2004; Aral, 2004; Driscoll & Nagel, 2008; Coşkun et al., 2012; Poyraz, 2012; Warner, 2012; Tsai et al., 2016; Smith et al., 2021; Yang et al., 2021; Smutny & Saal, 2021; Trimlett et al, 2021; Gaydos, 2021).

Piaget's (1962) and Vygotsky (1978) and a contemporary and classic game to game theorists, according to children's cognitive, physical, psychomotor, affective and social are pointing as the main source for growth, but the older child played a major role in the development of abstract thinking ability believe that. Mothers who see play as an educational tool and believe that it supports their cognitive development participate more in their children's play, support and encourage their children to play games (Farver, 1998; Smith et al., 2021; Yang et al., 2021).

Table 6

Contemporary and classical theories and theorists on the game

Classical Theories	
Excess Energy Theory	Friedrich Schiller Herbert Spencer
Relaxation and Entertainment Theory	Moritz Lazarus
Preparation Theory for Adult Life	Kari Groos
Finding The Essence / Repetition Theory	Stanley Hall
Pleasure Theory	Charlotte Bühler
Contemporary Theories	
Psychoanalytic Theory-Personality Development Theory	Sigmund Freud
Psychosocial Development Theory	Eric Ericson
Cognitive Development Theory	Jean Piaget
Sociocultural Development Theory	Lev.S.Vygotsky
Social Learning Theory	Albert Bandura
Attachment Theory	John Bowlby
Theory of Mind	Premack & Woodruff

The development of many scientists mentions the benefits of using the game and game materials above and the development of this scale that allows multi-factors to be combined with the benefits of this scale can be considered to be important for the literature. The resulting results are considered to be considered with the cognitive, psychological, social and psychomotor size of the scale. These factors are expected to provide for many studies in advanced times (Tsai et al., 2016; Smith et al., 2021; Yang et al., 2021; Smutny & Saal, 2021; Trimlett et al, 2021; Gaydos, 2021).

Conclusion

At the end of this study, the Game and Educational Material Use Scale (GaEMUS) is a valid and reliability of the game and educational materials, has been concluded that there is a data collection tool provided. The substance pool of this scale consisted of 32 items, while the first trial form resulting from expert opinions consisted of 23 items. The Kaiser-Meyer-Olkin (KMO) coefficient, often used in scale development studies, was calculated to test the suitability level of this GaEMUS 23-items structure.

The KMO value of GaEMUS is 0.80. The significance level of the Barlett Sphericity test for the scale was calculated as 0.00. The fact that the KMO value of GaEMUS has a value greater than 0.60 and the significance of the Barlett Sphericity Test ($p<0.05$) indicates that the relationships between the substances of the scale are significant (Kalaycı, 2010). However, data compliance was checked using Barlett's Sphericity Test. Taking into account the data obtained from these two analyses, it was found that the structure of the scale is suitable for factor analysis.

According to the results of the Explanatory Factor Analysis (EFA), the scale was found to have a four-factor structure. It was concluded that it accounted for 60.07% of the total variation on the scale. Considering the scale development studies and the sources written by experts, it is said that the variance explanation power sought in measurement tools should be over 30% (Büyüköztürk, 2017). It can be said that it is well above the ratio of GaEMUS. The scale of use of Game and Educational Material (GaEMUS) has a four-factor structure. GaEMUS's sub-factors are the "Cognitive Process, Psychological, Psychomotor Development, Social" sub-dimensions. These 4-factor sub-dimensions produced a measurement tool consisting of a total of 22 items. Cronbach's Alpha internal stability coefficient of this scale structure was calculated as 0.80. Cronbach's Alpha values for the lower dimensions of GaEMUS were calculated respectively .86, .81, .75 and .78. These values show that the scale has a level of internal stability coefficient that is valid for its overall and individual sub-dimensions. Confirmatory analysis was carried out to test the accuracy of the structural model revealed by CFA results to develop the game and educational material use scale (GaEMUS). It was determined that all the obtained values and structural dimension of the scale were confirmed. It has been concluded that this scale, which will be used for games and educational material, is a valid and reliable measurement tool.

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Annex 1. Game and Educational Material Use Scale (GaEMUS)

A.	**The Cognitive Process Dimension**
1.	Gaming enables my productivity emotions to evolve.
2.	The game allows me to easily understand education topics.
3.	The game improves my imagination.
4.	The game contributes to my cognitive and mental process.
5.	The game contributes to my scientific thinking.
B.	**The Psychological Dimension**
6.	The game offers an opportunity for my leadership skills to develop.
7.	The game improves my ability to empathize.
8.	The game makes me express myself.
9.	The game allows others to notice me.
10.	The game will cheer me up.
11.	It gives you a chance to relieve my gaming stress.
C.	**The Psychomotor Development Dimension**
12.	The game will improve my hand-eye coordination.
13.	The game makes it easy to use different tools.
14.	The game allows for physical development.
15.	The game supports my language development.
16.	Play allows my muscles to work.
D.	**The Social Dimension**
17.	The game enhances my sense of belonging.
18.	The game makes it easy for me to adapt to social environments.
19.	The game supports my social development.
20.	The game improves my communication skills.
21.	Game sharing enhances my feelings.
22.	The game allows me to learn social rules.