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How do digital games utilization levels predict a teacher's digital material development self-efficacy?

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Abstract

This study is a correlation research that aims to reveal whether digital material game usage sub-dimensions, gender, school level, in-service training for education in the digital environment, digital game playing status, devices and remote education variables, are significant predictors of digital material development self-efficacy level sub-dimensions. The study group consisted of 330 teachers. The study group consists of voluntary teachers from all education levels who provide remote education during the pandemic in Malatya city in the 2020–2021 academic year. This study found that there is a negative relationship between teachers' seniority and Web 2.0 development self-efficacy; a positive significant relationship between attitudes to use digital games in the class and Web 2.0 development skills; higher design self-efficacy perception in teachers with in-service training compared to those who did not have in-service training; higher design self-efficacy for teachers with high attitude towards using digital games in class; and negative attitudes towards digital games increased as the negative perspective towards digital material development self-efficacy increased. Experimental and qualitative studies regarding digital game-based digital teaching material efficiency can be recommended.

Keywords: Digital games, digital material, material development, COVID-19 pandemic, self-efficacy.

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1. Introduction

In this era, technology is developing every day, facilitating life and access to information and change in social habits. With this change and development, humans allocate most of their time to Internet use. With the expansion of its use, the Internet has started to change entire entertainment and communication methods, traditional institutions, social life, reality perceptions and the relationships of individuals with each other and with the world due to its nature (Basaran Ozdemir & Babacan, 2011). Today, being a good digital citizen has become mandatory. The digital world exists in all aspects of life due to the practicality it provides and this world is actively used. Individuals need to be equipped with digital literacy to be successful in the digital age and to be equipped alongside the developments in the future (Terkan & Taylan, 2010). Today, technology exists in human lives of all ages and especially children and young people commonly use technology (Yigit & Gunuc, 2020). One of the fields of technology that develops each day and facilitates daily life by adding something new to itself is information technologies. Tools such as smartphones, computers, tablets and the Internet that almost anyone can easily access can be used by adults in work life, children and young people in education life and people of all ages in the social life. With the ease of access to and expansion of these tools, the Internet usage age group is decreasing every day (Orman & Aricak, 2019). The expanded use of the Internet and digital technologies brings new needs as well. According to the Turkish Statistical Institution's (TUIK, 2020) information technologies use research on households, Internet users in the 16–74 age group were 73.3% in 2019, and this ratio has increased to 79.0% in 2020. With the COVID-19 pandemic in 2020, the digital tools and Internet use in communication, education and various business sectors have become mandatory and the number of users has increased naturally. The pandemic has had a negative impact on the social life of people staying at home and has pushed individuals further in the digital environment. In addition to basic physiologic needs, individuals need to be entertained, interact with other people and meet the information gap. In this process, children who stay at home, like the adults, continue their education and intensely use digital environments. Children who are away from the social environments are directed towards digital games to meet their learning, entertainment and socialising needs.

Teachers play an important role in the development of societies. There is a significant relationship between teachers who shape the future of the society and the next generations (Gunduz & Odabasi, 2004). Teachers need to shape the teaching and education process for the characteristics of the new generation, adapt to the new era, stay updated and use various methods, techniques and materials. Especially, children in the elementary school age need interesting and memorable stimulus for permanent and effective learning (Kilic, Tunc Pekkan & Karatoprak, 2013). Learning will be more permanent as the used materials address the senses more. While the teaching materials are used for various purposes, these materials sometimes facilitate teachers' work and in others undertake partial teacher role to directly transfer the learning outcome to the student (Inan, 2006). Learning materials that are the fundamental tools of the teaching and learning process represent tools and resources that teachers offer to the students as knowledge, skill, attitude and value development. These resources could be simple materials such as models and photographs, as well as electronic and technology-supported devices, computers, audio recorders and cameras (Saban, 2016; Sever, 2017).

While it took centuries for traditional teaching tools, such as textbooks and blackboards, to be developed and used in the class settings, new teaching material has entered our life in less than 10 years and has been used since (Short, 2002). Digital technologies have laid the ground for transformation in the teaching education process and have become an environment that gives various opportunities to the education and teaching fields rather than just being a tool. In the education environment, content, method and material are extremely important for educators. What is taught, how it is taught and with what started to transform with the changes in education technologies (Kula & Avci, 2019). The good position of the new generation called Gen Z in terms of digital skills pushes teachers to new approaches to create an educational environment to meet the interests and needs of this generation (Alsancak Sirakaya & Seferoglu, 2019).

Materials in education provide help in various aspects, such as supporting different learning needs, concretising abstract concepts, facilitating recalling, saving time, focusing on purpose and helping with focusing (Avci, 2013). When teaching material is selected, learning outcomes, student and teacher characteristics and properties for the learning environment should be considered (Donmez Usta, 2019). Within this context, material for each class differentiates. Preparing a material and learning environment is material design by deciding on which material will be prepared and suitable for the objectives and learning environment. Then, necessary materials should be collected and the decision as to when and how to use the material should be made. Regardless of where the learning environment is, all opportunities for the students should be organised. The organisations should plan well to enable students to easily see everything and be active. Teaching materials increase the quality of education and give students a rich learning environment. One of the most highlighted skills in curriculum change in recent years is material preparation and use (Yanpar Yelken, 2020).

Teachers need to use technological tools and devices effectively. Using these tools and devices in the teaching environment will ensure permanent learning. Smart boards in the class environment enable both teachers and students the usage opportunity and ensure effective learning as these boards address various sense organs during teaching (Boz & Ozerbas, 2020). To create an effective, efficient and active class environment, concrete teaching materials that are used in teaching–learning process supported by new and different methods and techniques enable permanent and meaningful learning as these methods address students' multiple sense organs. Materials are assistants that facilitate the learning–teaching process, make the learning more permanent and decrease teachers' workload. It is indispensable to use various tools such as images, songs, animations, picture stories, paintings and graphics as education materials. By using these materials, teachers will gamify the class and students will see the class as a game rather than an education class (Susar Kirmizi, 2017).

Games are always preferred in the class environment and keep their popularity due to their applicability to all classes. However, digital games are preferred instead of traditional games in recent years. One of the greatest innovations that technology has brought to today's education environment is digital games (Kusucuran, 2020). Due to the characteristics and dominance of the digital environment of today's generation also called the digital nomads, it is revealed that digital games can be used in teaching environments (Ocak, 2013). With educational digital games, success is achieved as students take an active role in the experience and learning activity; this motivates the student and creates learning awareness (Cetin, 2013). Using digital games in the educational environment for children who already have an interest in computer games can entertain the children and facilitate learning (Kukul, 2013).

One of the greatest technological advances in the education field is the 'Increasing Opportunities and Improving Technology Movement' started by the Ministry of National Education in 2011. For this project, smart board and Internet support were provided to classrooms and tablets were given to the students and teachers. Additionally, an 'Education Information Network' (EBA) where students and teachers can share content was created (Babacan & Sasmaz Oren, 2017). The COVID-19 pandemic that started in 2020 and changed the lifestyle of the entire world also changed the functions of the education process. The frequency of teachers and students' digital environment usage increased. Teachers started to use interactive teaching programmes to assign homework. It is possible to teach live classes from different spaces with the EBA platform presented by the Ministry of Education to teachers and students (Bayburtlu, 2020). Pushing the digital games presented by technology to education in an educational environment with students who have dominant digital skills would be a malevolent approach (Ocak, 2013). Digital games have an important effect on gaining skills such as problem-solving, fast and accurate decisionmaking and strategic thinking (Hazar, Tekkursun Demir & Dalkiran, 2017). Teachers and students have different roles in digital game-supported learning environments. While the student is playing the game, the teacher is the individual controlling this activity. The student is at the centre of the learning process and the teacher guides the student. In this sense, digital game-supported teaching is parallel to the constructivist education approach (Ciftci, 2013).

According to the Digital Games in Education Workshop (2017) reports, digital games are not sufficiently included in the curriculum. Teachers do not choose digital games due to time and benefit and focus on what to teach rather than how to teach. There is no authorised department in the Ministry of Education to coordinate digital games which is one of the largest sectors. There is no sufficient planning to include digital games in the curriculum.

In today's world where virtual reality is becoming an indispensable part of education as it is a part of our lives, various communication tools enable the continuation of education remotely. As we step into the digital education era, it can be seen from the cases that we have experienced in the pandemic that education teaching activities will continue by integrating with technology beyond time and space concepts. Teaching activities carried out in the digital environment require teachers to prepare for the class after a vigorous preparation process. When technological developments around the world are considered, technology visible in education had necessitated teachers to improve themselves in this field and to be prepared for the changing education. Accordingly, research on teachers' digital game usage status in digital teaching material development is important in the technology integration process.

1.1. Research purpose

The purpose of this research is to reveal whether teachers' digital game using levels and certain individual variables are significant predictors of digital material development self-efficacy levels. Accordingly, the answers to the following research questions were evaluated:

Teachers',

- *a. Seniority;*
- *b. School level;*
- *c. In-service training towards education in the digital environment;*
- *d. Digital game playing status;*
- *e. Gender;*
- *f. Used device;*
- *g. Status for pre-pandemic remote education;*
- *h. Attitudes towards using digital games in class;*
- *i. Attitudes towards positive aspects of digital games;*
- *j. Attitudes towards negative aspects of digital games;*
- *k. Attitudes toward the effects of digital games on in-class learning and students.*

1. Are significant predictors of *web 2.0 development sub-dimension of digital material development self-efficacy*?
2. Are significant predictors of *design sub-dimension of digital material development self-efficacy*?
3. Are significant predictors of *negative perspective sub-dimension of digital material development self-efficacy*?

2. Method

2.1. Model of the study

The research applied a correlation pattern that investigates the direction and level of the relationship between multiple variables. The correlation studies aim to give an idea about the relationship and show the level of change between these variables rather than finding a cause-and-effect relationship (Karasar, 2012). The correlation studies are evaluated under non-experimental studies and there is no option for the researcher to intervene with the variables. Therefore, cause-and-effect implications are not possible. However, these studies give certain hints as they express the level of change between the variables (Price, Jhangiani & Chiang, 2015). This study is a correlation research that aims to reveal whether digital game usage sub-dimensions, gender, school level, in-service training for education in digital environment, digital game playing status, used devices and pre-pandemic remote education status, are significant predictors of digital material development self-efficacy level sub-dimensions.

2.2. Study group

The study group consisted of 330 teachers. The study group consisted of volunteer teachers at every class level that provided remote education during the pandemic in the 2020–2021 academic year.

A literature review was conducted to investigate the sufficiency of the number of participants. For multivariate statistics, different sample-size criteria existed. Stevens (2002) recommended that the suitable sample size is 15 times the number of predictor variables for structural equation model in multivariate statistics. Wilson Van Voorhis and Morgan (2007) recommend at least a 10 times larger size. Kline (2005) and Schumacker and Lomax (2004) suggested a sample size of at least 200 for chi-square values and '$N > 50 + 8m$' formula, where 'm' is the dependent variable recommended by Tabachnick and Fidell (2007).

According to the literature recommendations, a power analysis test was also applied for the suitable number of participants. For 15% influence quantity, 5% error and 95% power in the analysis conducted using GPower 3.1 programme, the minimum sample size was calculated as 178 for three predicted variables and 11 predictor variables to provide 95% power analysis results. Since the amount of data in this study was 335, the sample size of this study was considered to be sufficient.

Ethical permission was obtained from the 2021/8-16 Inonu University Social and Humanities Scientific Research Ethical Committee for this research.

Table 1. The category-based distribution of independent variables of the study group

		f	%
Gender	Female	202	60
	Male	133	40
Years of Service	1–5 years	35	10

	6–10 years	64	19
	11–15 years	73	22
	16–20 years	54	16
	More than 20 years	109	33
School Type	Preschool	14	4
	Elementary School	66	20
	Secondary School	93	28
	High School	162	48
Digital Game Playing	Yes	127	38
	No	208	62
In-service training	Yes	194	58
	No	141	42
Used device type	Desktop PC	35	10
	Laptop	176	53
	Smartphones and Tablets	124	37
Remote education before the pandemic	Yes	133	40
	No	202	60

When the category-based distribution of the variables in Table 1 is analysed, it can be seen that 60% of the participants are female, 40% are male and the majority of the group (33%) have 20 years or higher occupational experience. While 38% of the group played digital games, 62% did not play digital games. 53% of the participants used laptop and 37% used smartphones or tablets. 60% of the group did not have any previous training for education in the digital environment.

2.3. Data collection tools

This study applied the Digital Game Using Scale and Digital Material Development Self-Efficacy Scale.

2.3.1. Digital Game Using Scale

After expert views and various analyses, a 17-item attitude scale was developed. Exploratory Factor Analysis (EFA) results for 17 items revealed that the Kaiser-Meyer-Olkin (KMO) value was above 0.50 (KMO = 0.898, $p < 0.00$) and the scale had a 4-factor structure that explains approximately 69.481% of the total variance with eigenvalues greater than 1.00. Confirmatory factor analysis (CFA) and fitness of model index were considered. It was found that the values for important fit indices (χ^2/df [2.467≤ 3], The Root Mean Square Error of Approximation (RMSEA)[0.76 ≤ 0.08], Adjusted Goodness of Fit Index (AGFI)[0.855 ≤ 0.90], Normed Fit Index (NFI) [905 ≤ 0.95], Tucker Lewis Index (TLI) [0.92 ≤ 0.95]) were within acceptable values. To calculate the reliability level of the scale, Cronbach's alpha (α = 0.916) value which is an internal consistency criterion was calculated. As a result, both EFA and CFA results revealed that the scale measuring teachers' attitudes towards digital games is a valid and reliable measurement tool (Gormez, 2020).

2.3.2. Digital Material Development Self-Efficacy Scale

The pilot scale was applied to a total of 308 individuals. At the end of the application, the data were added to the Statistical Package for the Social Sciences programme. For construct validity of the scale according to statistical analysis, KMO and Bartlett tests were applied first for factor analysis. Explanatory and confirmatory factor analyses were conducted on the data obtained from the analysis. Principal component analysis was applied to determine the number of factors and item factor loads of the scale. Factor loads were analysed by using Varimax vertical rotation. Confirmatory factor analysis was conducted on an entirely different group that the data obtained from the first application. Items with a factor load lesser than 40 were excluded from the scale and the analysis was repeated. Confirmatory factor analysis is an analysis method that is commonly used in creating scale models and significantly facilitating the process at the stage. After excluding the necessary items, the item total correlation method was used to test the purposeful use level of the remaining 38 items. The scale validity was identified with Pearson's *r* test. To identify the distinctiveness of the items, 27% top group and 27% bottom group were identified and the differences between the groups were considered. Internal consistency coefficients were calculated for reliability and stability tests were conducted with the test/re-test method. To identify internal consistency, Cronbach's alpha reliability coefficient, Spearman–Brown formula, Guttmann split-half reliability formula and the correlation between two identical halves were used. The stability level of the scale was calculated by identifying the correlation value between two applications applied with a 3-week interval (Korkmaz, Arikaya & Altintas, 2019).

Since measurement tools used in the research were developed for classical test hypothesis and item and test statistic indexes in each application group showed change, it is necessary to identify the reliability for the application group. Therefore, by using the data obtained from 335 teachers, Cronbach's alpha coefficients at scale tool sub-dimensions were calculated.

Table 2. Alpha index results

Digital Game Using Scale	r_x	Digital Material Using Self-Efficacy Scale	r_x
Attitudes towards using digital games in class (ATUDG)	0.94	Web 2.0 Development	0.98
Attitudes towards positive aspects of digital games (ATPDA)	0.77	Design	0.98
Attitudes towards negative aspects of digital games (ATNDA)	0.78	Negative Perspective	0.89

Attitudes toward the effects of digital games on in-class learning and students (ATILS)	0.83

As shown in Table 2, the reliability values for both scales were above 0.70. This reveals that the scales present reliable results for the application group.

2.4. Data analysis

In this study, teachers' digital game using skills sub-dimensions which were ATUDG, ATPDA, ATNDA and ATILS variables were the predictor variables at the equal interval level. In addition to these predictor variables, the predictiveness of some discontinuous variables at a categoric level was tested. The predicted variables were digital material development self-efficacy sub-dimensions which were Web 2.0 development, design and negative perspective variables. Since there were multiple predictors and predicted variables, multivariate regression analysis was applied. The significance of the predictive variables was tested in the multivariate regression analysis. The purpose here was to test the predictive power of the variables rather than testing a theoretical model. Therefore, it is aimed to test the predictive power of variables rather than testing a theoretical model, so β and *t*-values are reported.

No missing values and outliers were observed in the research data. 'Multivariate Normality', 'Multilinearity' and 'Multicollinearity' assumptions required for the analysis method were tested.

Tabachnick and Fidel (2007) define multivariate normality as the normal distribution of all variables and all linear combinations of these variables. To test multivariate normality, univariate and bivariate normalities were tested. For univariate normality, the normal distribution tests of the continuous variables in the study were investigated. Although the normality test result shows that the variables do not show normal distribution, since the skewness coefficient was between +1 and −1 range, a distribution close to normal distribution was observed (Web 2.0 development = −0.322, design = −1.00, negative perspective = 0.036, ATUDG = −0.219, ATPDA = −0.037, ATNDA = 0.073, DOSOT = 0.020). For the bivariate normality test, the scatter diagram matrix was investigated and it was observed that variables had a bivariate normal distribution.

Linearity represents a linear relationship between variables when it is assumed that the variance between predicted variables and predictor variables is equal (Hair, Black, Babin, Anderson & Tatham, 2006). Multilinearity represents the linearity of the relationship between each variable couple. When the dual correlation of each variable was investigated, it was seen that the correlation coefficients changed between .25 and .80. This is the indicator that linearity is achieved in this study.

Multicollinearity is observed when the simple correlation coefficient between the variables is higher than 0.85 (Kline, 2005). The problem, in this case, is an overestimation of the standard errors and increased type-2 ratio (Pedhazur, 1997). VIF and tolerance values of the variables were investigated for multicollinearity. Since the calculated VIF values for the variables (Web 2.0 development = 2.51, design = 1.24, negative perspective = 1.26, ATUDG = 5.49, ATPDA = 3.88, ATNDA = 1.63, DOSOT = 5.65) were lesser than 10 and tolerance values (web 2.0 development = 0.398, design = 0.809, negative perspective = 0.797, ATUDG = 0.182, ATPDA = 0.258, ATNDA = 0.615, DOSOT = 0.177) were greater than 0.10, multicollinearity problem was not observed.

The Durbin–Watson value was investigated for the independence of error terms, i.e., autocorrelation. The calculated value (1.857) being smaller than 2.5 is the indicator of no autocorrelation in the research.

After proving that the research data met the related assumptions, necessary analysis was conducted and the results were reported.

3. Results

In line with the purpose of the research, the significance between predicted and predictive variables was tested. When the results were reported, the results for each predicted variable were given under separate titles.

3.1. What are the significant predictors of the Web 2.0 development sub-dimension of digital material development self-efficacy?

The calculated values of β, standard error, *t* and R^2 of the predictor variables tested for the above research question are given in Table 3.

Table 3. β, *t* and R^2 values for Web 2.0 development

Predicted variable	Predictor variable	β	SD	*t*	R^2
Web 2.0 Development	Seniority	−0.12	0.04	−3.24*	0.21
	School Level	−0.027	0.06	−0.48	
	In-Service Training	−0.38	0.10	−3.72*	
	Digital Game	−0.20	0.11	−1.75	
	Gender	−0.037	0.10	−0.35	
	Device	−0.28	0.08	−2.33*	
	Remote Education	−0.009	0.10	−0.08	
	ATUDG	0.38	0.14	2.70*	
	ATPDA	−0.14	0.12	−1.20	
	ATNDA	−0.12	0.08	−1.53	
	DOSOT	−0.03	0.16	−0.18	

*$p < 0.01$.

As Table 4 shows, the variables that significantly predict Web 2.0 development were seniority ($t = −3.24$, $p < 0.01$), status to have previous in-service training about digital education ($t = −3.72$, $p < 0.01$), device type used in digital education ($t = −2.33$, $p < 0.01$) and attitudes to use digital games in the class ($t = 2.70$, $p < 0.01$). The regression equation based on these variables is as follows:

*Web 2.0 Development = 4.78 − 0.12*Seniority −0.38* In-Service Training − 0.28* Device + 0.38*ATUDG*

When the β values for significant predictors were interpreted, it was seen that there was a negative relationship between teachers' seniority level and Web 2.0 development self-efficacy. One unit of increase in teachers' number of occupational experiences caused a 0.12-unit decrease in Web 2.0 development self-efficacy. Web 2.0 development self-efficacy level of teachers who had in-service training was 0.38 units higher than those who did not have in-service training. The teachers' used devices and Web 2.0

development skills were inversely proportional. Teachers' self-efficacy perception for smartphone and tablet use was 0.28 units higher. Lastly, there was a positive significant relationship between attitudes towards using digital games in class and Web 2.0 development self-efficacy. One unit change in a positive attitude to use digital games caused a 0.38-unit change in Web 2.0 development self-efficacy perceptions. With all these variables, 21% of Web 2.0 development self-efficacy was explained.

3.2. What are the significant predictors of the design sub-dimensions of digital material development self-efficacy?

β, standard error, *t* and R^2 values for the other predicted variable 'Design' are given in Table 4.

Table 4. *β*, *t* and R^2 values for design

Predicted variable	Predictor variable	*β*	SD	*t*	R^2
	Seniority	−0.15	0.033	−4.66*	
	School Level	0.003	0.05	0.06	
	In-Service Training	−0.32	0.089	−3.60*	
	Digital Game	−0.23	0.098	−2.34*	
	Gender	0.027	0.09	0.30	
Design	Device	−0.10	0.07	−1.51	0.22
	Remote Education	−0.038	0.09	−0.43	
	ATUDG	0.38	0.12	3.07*	
	ATPDA	−0.094	0.10	−0.09	
	ATNDA	0.038	0.07	0.57	
	DOSOT	−0.043	0.14	−0.31	

*$p < 0.01$

Table 5 shows the variables that predict or do not predict the design variable at a significant level. The variables that significantly predict design variable were seniority ($t = -4.66$, $p < 0.01$), status to have previous in-service training about digital education ($t = -3.60$, $p < 0.01$) and attitudes to use digital games in the class ($t = 3.07$, $p < 0.01$). The regression equation based on these variables is as follows:

*Design = 4.36 −0.15*Seniority −0.28* In-Service Training + 0.38*ATUDG*

When the given regression equation was analysed, it was seen that the design was inversely proportional with seniority (1–5 years, 6–10 years, 11–15 years, 16–20 years and more than 20 years) and in-service training (yes/no) variables and directly proportional with attitudes towards using digital games in class. In this sense, it is believed that self-efficacy for design decreases as the teachers' seniority increases. One unit change in seniority (teachers in one category compared to the other category) was interpreted as a 0.15 unit change in design self-efficacy perception. This means the design self-efficacy perception of teachers with 5–10 years of seniority was 0.15 higher than teachers with 11–15 years of seniority. Since in-service training had two categories, the reference group was identified as the group that had in-service training and the focus group was identified as the group that did not have in-service training. Accordingly, teachers with in-service training have a 0.28-unit higher design self-efficacy perception than teachers without in-service training. When the attitudes towards using digital games in class were investigated, it was interpreted that 1 unit change in the attitude would change design self-efficacy perception by 0.38 units. Teachers with a high attitude to use digital games in class were the teachers with high design self-efficacy perception. At this significant level, all predictor variables explain 22% of design self-efficacy perception.

3.3. What are the significant predictors of the negative perspective sub-dimension of digital material development self-efficacy?

β, standard error, t and R^2 values for a negative perspective variable are given in Table 5. The regression equation and R^2 value for significant predictor variables were interpreted.

Table 5. β, t and R^2 values for negative perspective

Predicted variable	Predictor variable	β	SD	t	R^2
Negative perspective	Seniority	−0.04	0.03	−1.27	0.16
	School Level	−0.05	0.05	−0.89	
	In-Service Training	−0.12	0.09	−1.25	
	Digital Game	−0.11	0.10	−1.04	
	Gender	−0.05	0.09	−0.57	
	Device	−0.06	0.07	−0.89	
	Remote Education	−0.006	0.09	−0.07	
	ATUDG	0.067	0.13	0.52	
	ATPDA	−0.17	0.11	−1.55	
	ATNDA	−0.44	0.07	−6.28*	
	DOSOT	−0.019	0.14	−0.14	

*$p < 0.01$.

As Table 5 shows, the significant predictor variable for negative perspective was negative attitudes towards digital game ($t = −6.28$, $p < 0.01$) and these variables were inversely proportional. This means that as teachers' attitudes towards negative perspective for digital material development self-efficacy increase, their attitudes towards negative aspects of digital games increase as well.

*Design = 5.71 − 0.44*ATNDA*

It can be seen from the regression equation that when attitudes towards negative perspective for digital material development self-efficacy increased by 1 unit, attitudes towards negative aspects of digital games increased by 0.44 units. 16% of the negative perspective explains the attitudes towards negative aspects of digital games.

4. Discussion, conclusion and recommendations

Web 2.0 development self-efficacy levels and design self-efficacy levels decrease as the years of seniority of teachers increase. In this context, the lesser years of seniority of the teacher is related to the fact that the date of graduation from the education faculty is closer to today. In the teacher training programmes of education faculties, there is increasing technology course integration from the past to the present. In a study conducted on teacher training in the use of technology in education, it was concluded that senior teachers emphasised that the educational technology course should be given by the teachers of the campuses at regular intervals and that they could become more practical in this way (Metin, 2018).

Web 2.0 development self-efficacy levels and design self-efficacy levels of teachers who receive in-service training are higher than those who do not receive in-service training: 'use of technology in education', 'use of the Internet for educational purposes' and 'effective use of teaching materials' (Sarıtepeci, Durak & Seferoglu, 2016). In another study, it was concluded that teachers' in-service training or not receiving in-service training on information and communication technologies was not effective on their technology acceptance and being digitally native (Karaoglan Yilmaz & Binay Eyuboglu, 2018).

Web 2.0 development self-efficacy levels of teachers who use smartphones and tablets in their lessons are higher than teachers who use computers, and there is a positive significant relationship between teachers' use of digital games and Web 2.0 development self-efficacy levels and design self-efficacy levels. As the negative perceptions of teachers about digital material development self-efficacy increase, their attitudes towards the negative aspects of digital games also increase. According to the findings obtained from the research conducted by Ertem (2016), in order to examine the opinions of classroom teachers regarding the use of game-based digital environments and Turkish teaching, it was concluded that classroom teachers regard the use of digital media positively, but they found these environments insufficient and could not use them adequately. In another research, with regard to the appropriate educational levels where digital games can be used, 21.4% of all participants think they are suitable before school and 15.4% think they are not suitable at any level. The dependent variable is the level of education considered appropriate; independent variables are department, class, gender and digital game playing state. While there was a significant but very weak relationship between the dependent variables and the independent variables and the digital game playing variable, no significant relationship was found between the variables of class and gender. The results have shown that the use of digital games in education is possible at all levels of education, but more suitable for younger age groups (Ulker & Bulbul, 2018). Experimental and qualitative studies regarding digital game-based digital teaching material efficiency can be recommended. First of all, it can be suggested to provide in-service training for designing digital games for teachers with more years of seniority, to provide training on how to use applications used on smartphones and tablets in a computer environment and to carry out projects and studies that support mobile learning and mobile teaching.

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