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The Relationship between Students' Academic Achievements in Mathematics and Their Free Time Play Preferences

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Abstract

The purpose of this study is to investigate relationship between middle school students' free time play preferences and their academic achievement in mathematics. The research sample was composed of 675 middle school students determined by their socioeconomic status in Marmara and Central Anatolia Region. The research was designed with relational survey model and the data of the research was collected by personal information form. The form examined the middle school students' play preferences including 11 different games and students' daily playing frequency including 5 time interval as "never", "less than 1 hour", "1-2 hours", "2-3hours", "4 hours and above". For analyzing the data, with the help of Windows SPSS version 21, one way ANOVA, was used. Based on the outcomes, it was found that, middle school students' academic achievement in mathematics significantly differ in their online computer games, offline computer games, smart phone/tablet games, social media games, word games, cartoon and sports cards games and mind games playing time. At the other hand, there is no significant difference between middle school students' achievement in mathematics and their sports games, rhythm-dance games, outdoor games and puzzle, model building games playing time. The results of the research make suggestions both for teachers and new researches on the topic.

Keywords: Play, play types, play preferences, academic achievement in mathematics, middle school students

Öğrencilerin Serbest Zaman Oyun Tercihleri ile Matematik Akademik Başarıları Arasındaki İlişki

Öz

Bu araştırmada ortaokul öğrencilerinin serbest zaman oyun tercihleri ile matematik dersi akademik başarıları arasındaki ilişkinin incelenmesi amaçlanmıştır. Araştırmanın çalışma grubunu Marmara bölgesi ve İç Anadolu bölgesinde öğrenim görmekte olan 675 ortaokul öğrencisi oluşturmuştur. Genel tarama modelinde yürütülen araştırmada; veri toplama aracı olarak kişisel bilgi formu kullanılmıştır. Öğrencilerin oyun tercihleri ve oyun oynama süreleriyle ilgili bilgiler, kişisel bilgi formunda yer alan 11 farklı oyun ve bu oyunların süresinin olduğu tablodan yararlanılarak elde edilmiştir. Oyun süreleri hiç, 1 saatten az, 1-2 saat, 2-3 saat ve 4 saat ve üzeri şeklinde kategorize edilmiştir. Öğrencilerin matematik akademik başarıları bir önceki yıldaki matematik karne ortalamaları temel alınarak hesaplanmıştır. Verilerin istatistiksel analizi SPSS 21.0 programı ile yapılmıştır. Toplanan verilerin analizinde tek yönlü varyans analizinden (one-way ANOVA) yararlanılmıştır. Araştırmadan elde edilen sonuçlara göre; ortaokul öğrencilerinin, bilgisayar oyunları (internet üzerinden), bilgisayar oyunları (internet olmadan), akıllı telefon/tablet oyunları, sosyal medya oyunları, kelime-bulmaca oyunları, kart oyunları ve zekâ oyunları oynayan öğrencilerin matematik dersi akademik başarı ortalamaları arasında anlamlı bir farklılık gözlenmiştir. Diğer taraftan sportif oyunlar, müziksel ve ritmik oyunlar, geleneksel sokak oyunları ve "yapboz, kes-yapıştır, maket" oyunları oynayan öğrencilerin matematik dersi akademik başarıları

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arasında anlamlı bir farklılık olmadığı yani bahsedilen oyunları oynayan öğrencilerin matematik başarı düzeylerinin benzerlik gösterdiği söylenebilir. Elde edilen veriler literatür ışığında yorumlanarak alan ve araştırmalara katkı sağlayacak önerilerde bulunulmuştur.

Anahtar Kavramlar: Oyun, oyun türleri, oyun tercihleri, matematik başarısı, ortaokul

Introduction

Today's era of information requires the hardware and manpower needed to retrieve, assess, and visualize information by symbols and models, and transform it into a new product following procedures of analysis and synthesis. Such need gradually escalates the competition in information and technology among countries, thus making education, which will enable growing next generations to quickly access information and make it useful, a number one priority for the countries. A definition of education is the process of formation of deliberate terminal behavior change in individuals via their own experiences; another is the process of formation of terminal bio-chemical changes in one's brain due to physical stimulation (Sönmez, 2007). In improving this process, education program development and evaluation activities are conducted; hence the need for education to assess inputs, processes and outputs by basing on a rather rational foundation arises. In international arena, examinations such as TIMMS, PISA, PIRLS offer leading data for program development activities, while in case of Turkey, students are observed to face challenges in mathematics at national and the abovementioned international tests, which urges better evaluation of mathematics program and mathematics education in Turkey respectively.

Mathematics training may help improve thinking and horizon of individuals in a society (Aydın, 2003). In general, the objective of mathematics training can be defined as: brining an individual in mathematical knowledge and skills required during daily life, teaching them problem solving and a concept of thought which involves problem solving approach towards different cases (Altun, 2002; 7). According to Baykul (2003), training suitable for mathematics should be able to achieve three objectives, as follows: to help students understand mathematical concepts, mathematical operations and to identify the connection between concepts and operations. In order to make use of mathematics during training, mathematical literacy is important. Making use of mathematics means fully understanding the mathematical concepts and thoughts presented within transactions, expressing the ideas to others by means of these concepts and thoughts, and employing these methods of thought (Ersoy, 1997). PISA studies define mathematical literacy as an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen (OECD, 2009). In raising mathematic literate individuals, understanding mathematics and being furnished with mathematical skills and success in mathematics grows significance, thus the concept of "achievement in mathematics" emerges.

Just as in ordinary success, there are various factors affecting achievement in mathematics, such as self-regulated strategies; spatial, problem-solving and reasoning skills; learning styles; motivation; self-competence; school type; family financial status; study duration; attitude and interest; anxiety and attendance to cram courses (Yurt & Sünbül, 2013; Epstein, 2018). In this regard, it is crucial to assess achievement of students' knowledge, skills and abilities; to research achievement factors; to make practical suggestions to both students and teachers.

Even though various strategies, methods and techniques are employed to increase mathematics achievement; experimental studies tend to assess teaching with games, game-based teaching, pedagogic games and mathematics achievement variables.

Therefore, it is emphasized that teaching mathematics through games is practiced as a teaching method to increase achievement in mathematics (Altunay, 2004; Tural, 2005; Kılıç, 2007; Gelen & Özer, 2010). Although games are somewhat significant in all phases of child development; a learning environment of games is especially essential during childhood and adolescence when physical, social, cognitive, psycho-motor and psychological developments are paramount. Games, with the advancing technology and urbanization, are positioned in a wide variety of environments, tools and processes. While the definition of the concept of play differs among various philosophies and approaches, studies on play motives suggest several theories, which are (1) Biological Theories of Play (Schiller

and Spencer; Lazarus (1883) Emler and Mitehel; Gross); (2) Psycho-analytic Theories of Play (S. Freud, A. Freud, Klein, Erikson and Winnicott.), (3) Cognitive Theories of Play (Piaget, Vygotsky), (4) Inter-cultural Psychological Approaches of Play (Göncü and Gaskins), (5) Anthropological Theories of Play Hall (1906); Huizinga (1970), Turner (1969,1982), Bateson (1972), Geertz (1973) and Schwartzman (1978) (Biddle et al., 2013).

Lazarus (1883) defines play as a spontaneous, aimless and a pleasing leisure activity; according to Gross (1899) play is a set of pre-tests for maturity reached at the end of childhood (Songur, 2006: 32); to Bilen (1998) "activities that improve the physical and cognitive skills, the abilities and the artistic and aesthetic qualities of an individual, and that render life pleasant". According to Piaget, play is rapport, it is a method of self-learning experience of concepts that none other can teach a child. Piaget gave an outline of the evolution of play during first seven years of a child's life by defining three successive systems – practice play, symbolic play and games with rules. According to Vygotsky, real play commences around 3 years old as the child is engaged in pretend play, same as socio-dramatic play. Play is indeed a social symbolic activity, but it also helps children present their conceptualization and use of socio-cultural material of their own culture for playing purposes (Nicolopouplou, 1993). Besides various definitions of play, researchers describe various sorts of play, as well. Smilansky and Shefatya (1990) categorized games in 5 different types as functional play (sand play), constructive play (cubes and block games), dramatic play (firefighting, cops & robbers), socio-dramatic play (doctor games, playing happy families), and games with rules (sports games). Parten (1932) grouped play as unoccupied play, solitary play, onlooker play, parallel play, associative play and cooperative play. Meanwhile, Hughes (2002) mentions 16 different types of play:

1. Symbolic play (riding a horse on a broom stick, pretend to fly with extended arms)

2. Rough and Tumble Play (rolling, tussling, rough-and-tumble)

3. Socio-dramatic Play (imitating parents, preparing food)

4. Social Play (games faking social rules, dialogues)

5. Creative Play (transformation of objects and events, making new connections)

6. Communication Play (jokes, mimes, making impressions, charades)

7. Dramatic Play (presentation of a TV show or an event on the street)

8. Locomotor Play (jumping rope, sports games)

9. Deep Play (tree climbing, high jump, playing with matches)

10. Exploratory Play (holding, throwing, mouthing objects to explore their properties)

11. Fantasy Play (no rules, flying, imitating pilots, captains or drivers)

12. Imaginative Play (with rules, realistic, imagining non-existent object as if they were)

13. Master Play (digging holes, making water passes, sand play)

14. Object Play (playing with objects such as clothes, glass, cutlery out of their intended use)

15. Role Play

16. Recapitulative Play (games to explore and reanimate ancient times, history, ancestry and historic events)

There are also other types of games such as musical-rhythmic games, physical games, traditional children's games, sports games, card games, lottery-bingo games, blocks, cubes, lego, tangrams, mind games, word games, competition games, imitation games, cooperative games and math games (Tural, 2005; Demir, 2016). According to Orlich (1985), including these types of games in classroom has functions such as changing attitude, developing particular behavior, assist individuals to take new roles in future and understand changing roles, improve students' skills through principles, simplify complex situations or problems, remind them of roles they often ignore but affect life, develop motivation and analytical processes, making them rather sensitive towards other people's roles in life. Concordantly, although games are somewhat significant in all phases of child development; a learning environment of games is especially essential during childhood and adolescence when physical, social, cognitive, psycho-motor and psychological developments are

paramount. As a part of play, by using their imagination, children organize their living space and improve their abstract thinking skills. Making conclusions through fiction and story layouts in games, children reflect a good deal of these into real life situations (Ugurel, 2003). Research on various types of play shows that plays such as legos, blocks, cubes (Tracy, 1987; Wolfgang et. al., 2001; Moyer, 2001; Oostermeijer et. al., 2014), puzzle games (Caldera et al., 1999, Levine et. al., 2012), Sudoku games (Baek et. al., 2008), sports games and physical activities ((Hanson and Kraus, 1998; Broh, 2002; Castelli et. al., 2007; Thomas, 2009; Eveland-Sayers et. al., 2009), music, rhythm and dance (Catterall et al, 1999; Minton, 2003) positively affect students' academic success in general and achievement in mathematics in particular. Besides, use of technology, computers, internet and mobile platforms as a medium of play and entertainment adversely affects academic success of students (OECD, 2009; Duman, 2008; Bayraktar and Gün, 2007; Gencer and Koç, 2012; Demir, Kılıç and Ünal, 2010; Gürsakal, 2012; Akyüz, 2013; Usta, 2014). In this context, research on the correlation between play preferences of middle schools students, their duration of play and achievement in mathematics may help make sense of children's realm of play. Moreover, the research would make suggestions to both teachers and researchers in terms of pedagogic play activities and boosting academic success in mathematics. For this purpose, the answers to the following questions will be sought.

1- Does middle school students' achievement in mathematics vary according to duration of play they are engaged?

Sub-problems

1. Does middle school students' achievement in mathematics vary according to duration of sports games (football, basketball, swimming, running) they play?
2. Does middle school students' achievement in mathematics vary according to duration of online computer games they play?
3. Does middle school students' achievement in mathematics vary according to duration of offline computer games they play?
4. Does middle school students' achievement in mathematics vary according to duration of smart phone/tablet games they play?
5. Does middle school students' achievement in mathematics vary according to duration of social media games they play?
6. Does middle school students' achievement in mathematics vary according to duration of musical and rhythmic games, dances and folk dances they play?
7. Does middle school students' achievement in mathematics vary according to duration of word games (tongue twisters, riddles, taboo) they play?
8. Does middle school students' achievement in mathematics vary according to duration of traditional outdoor games (hide and seek, chasing, tag) they play?
9. Does middle school students' achievement in mathematics vary according to duration of puzzles / lego / cut and paste / model games they play?
10. Does middle school students' achievement in mathematics vary according to duration of mind games (Chess, Sudoku, Jenga) they play?
11. Does middle school students' achievement in mathematics vary according to duration of card games (sports, animals and cartoon characters cards) they play?

Method

Research Model

This research, aiming at studying the correlation between middle school students' play preferences and academic achievement in mathematics, was designed according to relational survey model. Relational survey models are used in order to detect existence and/or degree of co-variance among two or more variables (Karasar, 2009).

Research Sample

The research sample is comprised of randomly selected students from middle schools under the Ministry of National Education of Turkey located in Marmara and Central Anatolia Region during academic year 2015-2016. Out of 675 students, 340 (%50,4) are male and 335 (%49,6) are female. 152 (%22,5) of middle school students are at 5th grade, 169 (%25) 6th grade, 243 (%36) 7th grade and 111 (%16,4) 8th grade, respectively.

Data Collection Tools

Research data was collected by Personal Information Form. Information on students' play preferences and duration of time they engage in 11 different games was retrieved through a chart considering playing frequency including 5 time intervals of "never", "less than 1 hour", "1-2 hours", "2-3 hours", "3-4 hours" "4 hours and above". Level of academic achievement in mathematics was determined by taking students' average success rate in previous year into consideration.

Data Analysis

One-way ANOVA was used for unrelated samples in the analysis of research data on the correlation between duration of students' play and their academic achievement in mathematics. Significance level was assumed to be .05.

Findings

Findings retrieved as a result of statistical analysis of data collected to resolve research problems are as follows:

1. Findings on Sub-Problem

According to the first sub-problem of the study "Does middle school students' achievement in mathematics vary according to duration of sports games (football, basketball, swimming, running) they play?" findings are as stated below.

Table 1. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of sport games

Sport games	N	$\bar{x}$	ss
never	202	71,77	17,051
less than 1 hour	167	76,05	16,714
1-2 hours	182	73,50	16,663
2-3 hours	68	73,63	17,234
3-4 hours	34	77,22	15,017
4 hours and above	22	69,18	17,223
Total	675	73,67	16,842

Table 1 shows that average rate of academic achievement in mathematics is $\bar{x}$ = 71,77 for those who never play sports games; $\bar{x}$ =76,05 for those who play less than 1 hour; $\bar{x}$ =73,50 for those who play 1-2 hours; $\bar{x}$ =73,63 for those who play 2-3 hours; $\bar{x}$ =77,22 for those who play 3-4 hours; and $\bar{x}$ =69,18 for those who play 4 hours and above.

Table 1.a. ANOVA results on students' academic achievement in mathematics according to duration of sports games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	2547,130	5	509,426	1,807	,109
Within Groups	188646,94	669	281,984		
Total	191194,04	674			

p<0,05

According to ANOVA test conducted in order to detect whether students' academic achievement in mathematics vary according to duration of sports games they play, it was concluded that students'

academic achievement in mathematics does not indicate a meaningful variance according to duration of sports games they play.

2. Findings on Sub-Problem

According to the 2nd sub-problem of the study "Does middle school students' achievements in mathematics vary according to duration of online computer games (via internet) they play?" findings are as stated below.

Table 2. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of online computer games (via internet)

Online Computer Games	N	x̄	ss
never	184	74,39	16,608
less than 1 hour	214	75,96	15,952
1-2 hours	178	73,79	16,476
2-3 hours	49	69,69	17,673
3-4 hours	30	66,03	17,931
4 hours and above	20	62,70	20,494
Total	675	73,67	16,842

Table 2 shows that average rate of academic achievement in mathematics is $\overline{x}$ = 74,39 for those who never play online computer games; $\overline{x}$ =75,96 for those who play less than 1 hour; $\overline{x}$ =73,79 for those who play 1-2 hours; $\overline{x}$ =69,69 for those who play 2-3 hours; $\overline{x}$ =66,03 for those who play 3-4 hours; and $\overline{x}$ =62,70 for those who play 4 hours and above.

Table 2.a. ANOVA results on students' academic achievement in mathematics according to duration of online computer games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	6160,491	5	1232,098	4,455	,001*
Within Groups	185033,603	669	276,582		
Total	191194,094	674			

*p<0,05

According to ANOVA test conducted in order to detect whether students' academic achievement in mathematics vary according to duration of online computer games they play, it was found that academic achievement of students who never play those games are higher than those who play 3-4 and 4 hours and above, which is meaningful; achievement of those who play less than 1 hour is higher than those who play 2-3, 3-4 and 4 hours and above, which is meaningful; and that achievement of those who play 1-2 hours is higher than those who play 3-4 and 4 hours and above, which is meaningful. It is observed that the longer the duration of play of online games by the students is, the lower their achievement in mathematics is going to be.

3. Findings on Sub-Problem

According to the 3rd sub-problem of the study "Does middle school students' achievements in mathematics, vary according to duration of offline computer games they play?" findings are as stated below.

Table 3. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of offline computer games

Offline Computer Games	N	x̄	ss
never	346	74,32	16,43
less than 1 hour	190	74,98	15,91
1-2 hours	92	71,72	17,65
2-3 hours	19	75,89	17,07
3-4 hours	14	58,35	22,41
4 hours and above	14	65,00	19,21
Total	675	73,67	16,84

Table 3 shows that average rate of academic achievement in mathematics is $\bar{x}$ = 74,32 for those who never play offline computer games; $\bar{x}$ =75,98 for those who play less than 1 hour; $\bar{x}$ =71,72 for those who play 1-2 hours; $\bar{x}$ =75,89 for those who play 2-3 hours; $\bar{x}$ =58,35 for those who play 3-4 hours; and $\bar{x}$ =65,00 for those who play 4 hours and above.

Table 3.a. ANOVA results on students' academic achievement in mathematics according to duration of offline computer games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	5253,995	5	1050,799	3,781	,002*
Within Groups	185940,099	669	277,937		
Total	191194,094	674			

*p<0,05

According to ANOVA test conducted in order to detect whether students' academic achievement in mathematics vary according to duration of offline computer games they play, it was found that academic achievement of students who never play those games are higher than those who play 3-4 and 4 hours and above, which is meaningful; achievement of those who play less than 1 hour is higher than those who play 3-4 and 4 hours and above, which is meaningful; and that achievement of those who play 1-2 hours and 2-3 hours is higher than those who play 3-4 and 4 hours and above, which is meaningful.

4. Findings on Sub-Problem

According to the 4th sub-problem of the study "does middle school students' achievement in mathematics vary according to duration of smart phone/tablet games they play?" findings are as stated below.

Table 4. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of smart phone/tablet games

Smart Phone/Tablet Games	N	x̄	ss
never	214	73,57	16,814
less than 1 hour	242	75,36	16,387
1-2 hours	142	74,55	16,842
2-3 hours	34	71,29	19,358
3-4 hours	20	65,55	14,210
4 hours and above	23	62,08	14,538
Total	675	73,67	16,842

Table 4 shows that average rate of academic achievement in mathematics is $\bar{x}$ = 73,57 for those who never play smart phone/tablet games; $\bar{x}$ =75,36 for those who play less than 1 hour; $\bar{x}$ =74,55 for those who play 1-2 hours; $\bar{x}$ =71,29 for those who play 2-3 hours; $\bar{x}$ =65,55 for those who play 3-4 hours; and $\bar{x}$ =62,08 for those who play 4 hours and above.

Table 4.a. ANOVA results on students' academic achievement in mathematics according to duration of smart phone/tablet games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	5402,470	5	1080,494	3,891	,002*
Within Groups	185791,624	669	277,715		
Total	191194,094	674			

*p<0,05

According to ANOVA test conducted in order to detect whether students' academic achievement in mathematics vary according to duration of smart phone/tablet games they play, it was found that academic achievement of students who never play those games are higher than those who play 3-4 and 4 hours and above, which is meaningful; achievement of those who play less than 1 hour is higher than those who play 3-4 and 4 hours and above, which is meaningful; that achievement of those who play 1-2 hours and 3-4 hours is higher than those who play 4 hours and above, which is meaningful; and that achievement of those who play 2-3 hours is higher than those who play 4 hours and above,

which is meaningful. It is observed that the longer the duration of play of smart phone/tablet games by the students is, the lower their achievement in mathematics is going to be.

5. Findings on Sub-Problem

According to the 5th sub-problem of the study "Does middle school students' achievement in mathematics vary according to duration of social media games (Facebook) they play?" findings are as stated below.

Table 5. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of social media games

Social media games	N	x̄	ss
never	266	75,02	16,352
less than 1 hour	221	74,76	17,091
1-2 hours	89	74,69	15,831
2-3 hours	55	67,60	16,426
3-4 hours	21	71,47	18,632
4 hours and above	23	60,26	15,647
Total	675	73,67	16,842

Table 5 shows that average rate of academic achievement in mathematics is $\overline{x}$ = 75,02 for those who never play social media games; $\overline{x}$ =74,76 for those who play less than 1 hour; $\overline{x}$ =74,09 for those who play 1-2 hours; $\overline{x}$ =67,60 for those who play 2-3 hours; $\overline{x}$ =71,47 for those who play 3-4 hours; and $\overline{x}$ =60,26 for those who play 4 hours and above.

Table 5.a – ANOVA results on students' academic achievement in mathematics according to duration of social media games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	7108,543	5	1421,709	5,167	,000*
Within Groups	184085,551	669	275,165		
Total	191194,094	674			

*p<0,05

According to ANOVA test conducted in order to detect whether students' academic achievement in mathematics vary according to duration of social media games they play, it was found that academic achievement of students who never play those games are higher than those who play 2-3 and 4 hours and above, which is meaningful; achievement of those who play less than 1 hour is higher than those who play 3-4 and 4 hours and above, which is meaningful; that achievement of those who play 1-2 hours, and 2-3 hours is higher than those who play 4 hours and above, which is meaningful; that achievement of those who play 2-3 hours is higher than those who play 3-4 and 4 hours and above, which is meaningful; and that achievement of those who play 3-4 hours is higher than those who play 4 hours and above, which is meaningful.

6. Findings on Sub-Problem

According to the 6th sub-problem of the study "Does middle school students' achievement in mathematics vary according to duration of musical and rhythmic games, dances and folk dances they play?" findings are as stated below.

Table 6. Descriptive statistics on middle school students' academic achievementin mathematics according to duration of musical and rhythmic games

Musical and rhythmic games	N	x̄	ss
never	415	73,74	17,123
less than 1 hour	135	74,08	16,204
1-2 hours	82	72,93	15,540
2-3 hours	28	74,75	17,487
3-4 hours	9	72,77	19,279
4 hours and above	6	66,00	25,922
Total	675	73,67	16,842

Table 6 shows that average rate of academic achievement in mathematics is $\bar{x}$ = 73,74 for those who never play musical and rhythmic games; $\bar{x}$ =74,08 for those who play less than 1 hour; $\bar{x}$ =72,93 for those who play 1-2 hours; $\bar{x}$ =74,75 for those who play 2-3 hours; $\bar{x}$ =72,77 for those who play 3-4 hours; and $\bar{x}$ =66,00 for those who play 4 hours and above.

Table 6.a. ANOVA results on students' academic achievement in mathematics according to duration of musical and rhythmic games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	462,387	5	92,477	,324	,898
Within Groups	190731,707	669	285,100		
Total	191194,094	674			

p<0,05

According to ANOVA test conducted in order to detect whether students' academic achievement in mathematics vary according to duration of musical and rhythmic games they play, it was concluded that students' academic achievement in mathematics does not indicate a meaningful variance according to duration of musical and rhythmic games they play.

7. Findings on Sub-Problem

According to the 7th sub-problem of the study "Does middle school students' achievement in mathematics vary according to duration of word games (tongue twisters, riddles, taboo) they play?" findings are as stated below.

Table 7. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of word games (tongue twisters, riddles, taboo)

Word games (tongue twisters, riddles, taboo)	N	x̄	ss
never	250	70,86	17,149
less than 1 hour	297	75,06	16,634
1-2 hours	102	77,09	14,884
2-3 hours	17	75,58	15,447
3-4 hours	9	63,55	25,348
Total	675	73,67	16,842

Table 7 shows that average rate of academic achievement in mathematics is $\bar{x}$ = 70,86 for those who never play word games (tongue twisters, riddles, taboo); $\bar{x}$ =75,06 for those who play less than 1 hour; $\bar{x}$ =77,09 for those who play 1-2 hours; $\bar{x}$ =75,58 for those who play 2-3 hours; $\bar{x}$ =63,55 for those who play 3-4 hours.

Table 7.a. ANOVA results on students' academic achievement in mathematics according to duration of word games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	4721,806	4	1180,452	4,241	,002*
Within Groups	186472,288	670	278,317		
Total	191194,094	674			

*p<0,05

According to ANOVA test, it was found that academic achievement of students who never play those games are lower than those who play less than 1 and 1-2 hours, which is meaningful; achievement of those who play less than 1 hour is higher than those who play 3-4 and 4 hours and above, which is meaningful; that achievement of those who play 1-2 hours, and 3-4 hours is high, which is meaningful; and that playing word games for 1-2 hours or 2-3 hours has an impact on academic achievement as in the longer the duration of play is, the lower their achievement in mathematics is going to be.

8. Findings on Sub-Problem

According to the 8th sub-problem of the study "Does middle school students' achievement in mathematics vary according to duration of traditional outdoor games they play?" findings are as stated below.

Table 8. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of traditional outdoor games

Outdoor games	N	x̄	ss
never	267	72,50	16,919
less than 1 hour	184	75,09	16,001
1-2 hours	137	75,26	17,244
2-3 hours	47	73,40	16,940
3-4 hours	18	71,83	19,385
4 hours and above	22	68,27	17,411
Total	675	73,67	16,842

Table 8 shows that average rate of academic achievement in mathematics is $\bar{x}$= 72,50 for those who never play traditional outdoor games; $\bar{x}$=75,09 for those who play less than 1 hour; $\bar{x}$=75,26 for those who play 1-2 hours; $\bar{x}$=73,40 for those who play 2-3 hours; $\bar{x}$=71,83 for those who play 3-4 hours; and $\bar{x}$=68,27 for those who play 4 hours and above.

Table 8.a. ANOVA results on students' academic achievement in mathematics according to duration of traditional outdoor games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	1791,883	5	358,377	1,266	,277
Within Groups	189402,211	669	283,112		
Total	191194,094	674			

p<0,05

According to ANOVA test conducted in order to detect whether students' academic achievement in mathematics vary according to duration of traditional outdoor games they play, it was concluded that students' academic achievement in mathematics does not indicate a meaningful variance according to duration of traditional outdoor games they play.

9. Findings on Sub-Problem

According to the 9th sub-problem of the study "Does middle school students' achievement in mathematics vary according to duration of puzzles / Lego / cut and paste / model games they play?" findings are as stated below.

Table 9. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of puzzle/model games

Puzzle / model games	N	x̄	ss
never	384	72,33	16,661
less than 1 hour	194	75,45	17,360
1-2 hours	71	74,67	17,233
2-3 hours	14	78,21	13,221
3-4 hours	12	76,83	13,002
Total	675	73,67	16,842

Table 9 shows that average rate of academic achievement in mathematics is $\bar{x}$= 72,33 for those who never play puzzle/model games; $\bar{x}$=75,45 for those who play less than 1 hour; $\bar{x}$=74,67 for those who play 1-2 hours; $\bar{x}$=78,21 for those who play 2-3 hours; $\bar{x}$=76,83 for those who play 3-4 hours; and $\bar{x}$ =68,27 for those who play 4 hours and above.

Table 9.a. ANOVA results on students' academic achievement in mathematics according to duration of puzzle/model games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	1786,941	4	446,735	1,580	,178
Within Groups	189407,153	670	282,697		
Total	191194,094	674			

p<0,05

According to ANOVA test conducted in order to detect whether students' academic achievement in mathematics vary according to duration of puzzle/model games they play, it was concluded that students' academic achievement in mathematics does not indicate a meaningful variance according to duration of puzzle/model games they play.

10. Findings on Sub-Problem

According to the 10th sub-problem of the study "Does middle school students' achievement in mathematics vary according to duration of mind games (chess, Sudoku, Jenga) they play?" findings are as stated below.

Table 10. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of mind games

Mind games	N	x̄	ss
never	279	71,38	16,778
less than 1 hour	258	75,29	16,594
1-2 hours	110	76,02	16,248
2-3 hours	16	75,56	15,743
3-4 hours	12	68,16	24,296
Total	675	73,67	16,842

Table 10 shows that average rate of academic achievement in mathematics is $\overline{x}$ = 71,38 for those who never play mind games; $\overline{x}$ =75,29 for those who play less than 1 hour; $\overline{x}$ =76,02 for those who play 1-2 hours; $\overline{x}$ =75,76 for those who play 2-3 hours; $\overline{x}$ =68,16 for those who play 3-4 hours.

Table 10.a. ANOVA results on students' academic achievement in mathematics according to duration of mind games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	3171,495	4	792,874	2,825	,024*
Within Groups	188022,599	670	280,631		
Total	191194,094	674			

*p<0,05

According to ANOVA test, it was found that academic achievement of students who never play mind games are lower than those who play less than 1 hour and 1-2 hours, which is meaningful. One may suggest that duration of 1-2 hours of play of mind games is ideal.

11. Findings on Sub-Problem

According to the 11th sub-problem of the study "Does middle school students' achievement in mathematics vary according to duration of card games (sports, animals and cartoon characters cards) they play?" findings are as stated below.

Table 11. Descriptive statistics on middle school students' academic achievement in mathematics according to duration of card games

Card games	N	x̄	ss
never	401	72,67	16,759
less than 1 hour	169	76,43	16,302
1-2 hours	62	77,09	15,043
2-3 hours	31	67,58	17,860
3-4 hours	12	66,41	24,537
Total	675	73,67	16,842

Table 11 shows that average rate of academic achievement in mathematics is $\overline{x}$ = 72,67 for those who never play card games; $\overline{x}$ =76,43 for those who play less than 1 hour; $\overline{x}$ =77,09 for those who play 1-2 hours; $\overline{x}$ =67,58 for those who play 2-3 hours; $\overline{x}$ =66,41 for those who play 3-4 hours.

Table 11.a. ANOVA results on students' academic achievement in mathematics according to duration of card games

	Sum of Squares	df	Mean Square	F	p.
Between Groups	4198,145	4	1049,536	3,760	,005*
Within Groups	186995,949	670	279,098		
Total	191194,094	674			

*p<0,05

According to ANOVA test, it was found that academic achievement of students who never play card games are lower than those who play less than 1 hour and 2-3 hours, which is meaningful; that achievement of those who play less than 1 hour is higher than those who play 3-4 hours, which is meaningful; that achievement of those who play 1-2 hour is higher than those who play 2-3 and 3-4 hours, which is meaningful. One may suggest that duration of 1-2 hours of play of card games is ideal

Discussion

In scope of present study on middle school students' play preferences correlation with their academic achievement in mathematics; It was found that middle school students' academic achievement in mathematics does not vary according to duration of sports games (football, basketball, swimming, running) they play. However, average rate of academic achievement in mathematics is higher in case of those who play less than 1 hour or 3-4 hours daily when compared to other students. A good number of studies point to the correlation between participation in sports activities and academic achievement and claim that sports activities positively affect individuals (Broh, 2002; Hanson and Kraus, 1998; Castelli et. al., 2007; Thomas, 2009; Eveland-Sayers et. al. 2009, Meadows, 2019). Despite the fact that literature review suggests otherwise, present study does not indicate meaningful variance among research sample groups. Having reached similar conclusions, Akyüz (2013) emphasizes that sports activities have negative correlation with achievement in mathematics in Turkey and that research should be carried out in order to investigate its causes and to examine the quality of the concerned activities.

It was found that middle school students' academic achievement in mathematics show meaningful variance according to duration of online computer games they play. While no meaningful variance in terms of academic achievement in mathematics is observed among those who play online computer games less than 1 hour and 1-2 hours; meaningful variance exists amid duration of game play of 1-2 hours or above. Consequently, one may claim that academic achievement in mathematics drops in proportion to the increase in duration of game play in case of those who play online computer games for 1-2 hours or above. As literature review suggests, spending excess time over the internet negatively affect achievement (Bayraktar and Gün, 2007; Gencer and Koç, 2012; Akyüz, 2013).

It was found that middle school students' academic achievement in mathematics varies according to duration of offline computer games they play. While no meaningful variance in terms of academic achievement in mathematics is observed among those who never play computer games and those who play less than 1 hour and 1-2 hours; meaningful variance exists amid duration of game play of 2 hours or above. Consequently, one may claim that academic achievement in mathematics is lower in case of students who play 2 hours and above when compared to those who play less than 2 hours or never. Resources endorse these findings and suggest that owning a computer, technological facilities and internet use are considered to be variables in relation to achievement in mathematics, however the direction of such relation is determined by what purpose the technological facilities and mediums are being used. Accordingly, use of technological facilities for entertainment purposes (chatting, downloading music, playing and downloading games) adversely affects achievement in mathematics (OECD, 2004; Duman, 2008; Demir, Kılıç and Ünal, 2010; Gürsakal, 2012; Akyüz, 2013). In other words, the more frequent students use technology as a medium of entertainment, the lower mathematics performance is going to be (Kim & Chang, 2010; Usta, 2014).

It was found that middle school students' academic achievement in mathematics varies according to duration of smart phones/tablet games they play. While no meaningful variance in terms of academic achievement in mathematics is observed among those who never play smart phone/tablet games and those who play less than 1 hour and 1-2 hours; meaningful variance exists amid duration of game

play of 2 hours or above. Consequently, one may claim that academic achievement in mathematics is lower in case of students who play 2 hours and above when compared to those who play less than 2 hours or never. In other words, just as in computer games, the more frequent students use technology as a medium of entertainment, the lower mathematics performance is going to be (Usta, 2014).

It was found that middle school students' academic achievement in mathematics varies according to duration of social media (Facebook) games they play. While no meaningful variance in terms of academic achievement in mathematics is observed among those who never play social media games and those who play less than 1 hour and 1-2 hours; meaningful variance exists amid duration of game play of 2 hours or above. Consequently, one may claim that academic achievement in mathematics is lower in case of students who play 2 hours and above when compared to those who play less than 2 hours or never. Moreover, meaningful variance is observed among those who play 4 hours and above and those who play up to 2 hours.

It was found that middle school students' academic achievement in mathematics does not vary according to duration of musical and rhythmic games they play. Consequently, one may suggest that achievement rate among students who play musical and rhythmic game is similar. On the contrary, literature review shows that participation in activities such as music, rhythm and dance positively affects achievement in mathematics (Catterall et. al., 1999; Minton, 2003). As in case of sports games, one may claim that the qualities of music and dance activities in Turkey need to be examined.

It was found that middle school students' academic achievement in mathematics varies according to duration of word games (tongue twisters, riddles, taboo) they play. Highest achievement rate in mathematics is observed in case of students who play word games for 1-2 hours followed by 2-3 hours and less than 1 hour, respectively. One may therefore deduce that if students spare 2-3 hours for playing word games, their achievement in mathematics is going to be affected positively.

It was found that middle school students' academic achievement in mathematics does not vary according to duration of traditional street games they play. Consequently, one may suggest that students' achievement in mathematics can be likened to their duration of play of traditional street games.

It was found that middle school students' academic achievement in mathematics does not vary according to duration of puzzles / Lego / cut and paste / model games they play. Highest average rate of achievement in mathematics is observed in case of students who play for these games for 2-3 hours. However, longer duration of play does not seem to yield greater success rate. Although literature review suggests that structure games such as Lego, blocks, cubes (Tracy, 1987; Wolfgang et. al., 2001; Moyer, 2001; Oostermeijer et. al., 2014) and puzzle games (Caldera et al., 1999, Levine et. al., 2012) help increase academic achievement in mathematics; present study does not correspond with those findings.

It was found that middle school students' academic achievement in mathematics varies according to duration of mind games (chess, Sudoku, Jenga) they play. While meaningful variance in terms of academic achievement in mathematics is observed among those who never play mind games and those who play less than 1 hour and 1-2 hours; no meaningful variance exists amid duration of game play of 2 hours or above, thus pointing to correlation between mind games and academic achievement in mathematics. Former studies suggest that Sudoku games (Baek et. al., 2008) and chess (Cage and Smith, 2000; Sadık, 2006) positively affect problem solving skills in mathematics.

It was found that middle school students' academic achievement in mathematics varies according to duration of card games, board games (sports, animals and cartoon characters cards) they play. Students who play card games for 1-2 hours have the highest success rate followed by those who play less than 1 hour and that never play those games, meanwhile playing more than 2 hours reduces average achievement rate. In literature review, it was reported that learning through card games and board games had benefits of less frustration, deeper understanding, and greater student clarity of concepts (Cody et al., 2015).

Future research may be conducted in order to assess correlation between achievement in mathematics and other variables such as various age groups, gender, grade, different game types as well as achievement in different subjects and play preferences. In addition to assessment of teachers' play preferences according to several variables; it is considered that presentation of further details

on the element of family – which greatly influences planning of extracurricular activities – in future research would enrich the studies in methodological aspect.

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Geniş Özet

Giriş

Günümüz bilgi çağı, bilgiyi elde edecek, yorumlayacak, semboller ve modellerle görselleştirecek, analiz ve sentez süreçlerinden geçirerek yeni bilgiyi ürün haline getirecek insan gücüne ve donanımlara ihtiyaç duymaktadır. Bu sürecin nitelikli hale gelmesinde eğitim programı geliştirme ve değerlendirme çalışmaları önem kazanırken bu süreçlerin rasyonel bir temele dayanarak gerçekleştirilmesi gerekmektedir. Ülkemizdeki öğrencilerin TIMMS, PISA, PIRLS gibi uluslararası ve ulusal sınavlarda matematik dersinde sorun yaşadığı görülmektedir. Bu bağlanmada matematik programı ve matematik öğretim sürecinin daha fazla sorgulanması gerektiği söylenebilir. Matematik okuryazarı bireylerin yetiştirilmesinde matematiği anlamak, matematiksel becerilere sahip olmak ve matematikte başarılı olmak önem kazanmaktadır. Akademik başarıda olduğu gibi matematik başarısını da etkileyen birçok faktörün bulunduğu görülmektedir. Öğrencilerin bilgi, beceri ve yetenekleriyle ilgili başarı gösterip göstermediklerini değerlendirmek, başarıyı etkileyen faktörleri araştırmak, öğretmenlere ve öğrencilere uygulamaya yönelik önerilerde bulunmanın önemi bilinmektedir. Matematik başarısını artırmada farklı strateji, yöntem ve teknikler kullanılmakla birlikte oyunla öğretim, oyun tabanlı öğrenme, eğitsel oyun ve matematik başarısı değişkenlerinin deneysel çalışmalar kapsamında incelendiği görülmektedir. Oyunla matematik öğretimi öğrencilerin matematik başarısını artırmada bir öğretim yöntemi olarak kullanıldığı bilinmektedir. Oyun kavramı her felsefeye ve yaklaşıma göre farklı tanımlanmıştır. Oyunların neden oynandığıyla ilgili farklı teoriler ortaya atılmış ve farklı oyun yaklaşımlarının yanında araştırmacılar tarafından farklı oyun türleri tanımlanmıştır. Müziksel-ritmik (rontlar), fiziksel, sportif, kart, şans-çekiliş, blok, küp, lego, tangram, zekâ-mantık, sözcük, yarışma ve mücadele, taklit, geleneksel çocuk oyunları, işbirlikli ve matematik oyunları gibi farklı oyun türleri farklı iş görü ve farklı amaçlar kapsamında kullanılabilmektedir. Sınıfta, serbest zamanlarda bu ve farklı oyunlara yer vermenin tutum değiştirme, özel davranışları değiştirme, gelecekteki yeni roller almaları için bireylere yardım etme, rol değişimlerini anlamada bireylere yardım etme, uygulanan ilkelerle öğrencilerin yeteneğini geliştirme, karmaşık durum veya problemleri basite indirgeme, yaşamlarını etkileyen fakat göz önünde bulundurmadıkları rolleri gösterme, motivasyon geliştirme, analitik süreçler geliştirme, diğer insanların yaşam rolleri için bireyleri duyarlı hale getirme gibi işlevleri vardır. Bu kapsamda ortaokul çocuklarının serbest zaman oyun tercihleri, oyun süreleri ve matematik dersi başarıları arasındaki ilişkinin incelenmesi çocukların oyun dünyasını anlamlandırmada yol gösterici olabilir. Ayrıca öğretmenlere ve araştırmacılara eğitsel oyun yöntemi etkinliklerine yönelik önerilerde bulunmada ve matematik başarısını artırmada rehberlik edeceği söylenebilir.

Yöntem

Araştırmada ortaokul öğrencilerinin serbest zaman oyun tercihleri ile matematik dersi akademik başarıları arasındaki ilişkinin incelenmesi amaçlanmıştır. Araştırma problemi "Ortaokul öğrencilerinin matematik dersi akademik başarı düzeyleri serbest zaman oyun oynama sürelerine göre farklılık göstermekte midir?" şeklinde tasarlanmıştır. Araştırmanın çalışma grubunu Marmara bölgesi ve İç Anadolu bölgesinde öğrenim görmekte olan 675 ortaokul öğrencisi oluşturmuştur. Genel tarama modelinde yürütülen araştırmada; veri toplama aracı olarak kişisel bilgi formu kullanılmıştır. Öğrencilerin oyun tercihleri ve oyun oynama süreleriyle ilgili bilgiler, kişisel bilgi formunda yer alan 11 farklı oyun ve bu oyunların oynama süresinin olduğu tablodan yararlanılarak

elde edilmiştir. Oyun süreleri hiç, 1 saatten az, 1-2 saat, 2-3 saat ve 4 saat ve üzeri şeklinde kategorize edilmiştir. Öğrencilerin matematik akademik başarıları bir önceki yıldaki matematik karne ortalamaları temel alınarak hesaplanmıştır. Verilerin istatistiksel analizi SPSS 21.0 programı ile yapılmıştır. Toplanan verilerin analizinde tek yönlü varyans analizinden (one-way ANOVA) yararlanılmıştır.

Sonuç ve Tartışma

Araştırmadan elde edilen sonuçlara göre; ortaokul öğrencilerinin, bilgisayar (internet üzerinden), bilgisayar (internet olmadan), akıllı telefon/tablet oyunları ve sosyal medya oyunları oynayan öğrencilerin matematik dersi akademik başarı ortalamaları arasında anlamlı bir farklılık gözlenmiştir. Bu oyunları oynamayan ve 2 saatten az oynayan öğrencilerin matematik başarı düzeyleri arasında anlamlı farklılık olmadığı yani başarı düzeylerinin benzer olduğu görülmüştür. Ancak 2 saat ve üzerinde oyun oynayan öğrencilerin matematik başarılarının anlamlı düzeyde düşük olduğu gözlenmiştir. Bu bulguyu destekler nitelikte teknolojik imkânların eğlenme aracı olarak kullanılması (sohbet etme, müzik indirme, oyun oynama, oyun yükleme gibi) matematik başarısını olumsuz yönde etkilediği, teknolojiyi eğlence amacı ile kullanma sıklığı arttıkça matematik performansının da düştüğünü belirten araştırmalar bilinmektedir. Serbest zaman oyun oynama sürelerinin belirtilen süreleri aşmayacak şekilde düzenlenmesi, oyun içerikleri ve oyun tercihinin doğru yapılması matematik başarısını olumlu yönde etkileyebileceği söylenebilir.

Kelime-bulmaca oyunları, kart oyunları ve zekâ oyunları oynayan öğrencilerin matematik dersi akademik başarı ortalamaları arasında anlamlı bir farklılık gözlenmiştir. Bu oyunları oynama süresi arttıkça matematik başarı düzeylerinin de arttığı görülmüştür. Deneysel araştırmalarda bu tür oyunların matematik başarısına olumlu etki ettiğini gösteren birçok araştırmanın varlığı bilinmektedir. Serbest zaman oyunlarını zenginleştirecek içerikler ve oyunlar sunmak öğrencilerin matematik başarısını artırabileceği söylenebilir.

Diğer taraftan sportif oyunlar, müziksel ve ritmik oyunlar, geleneksel sokak oyunları ve "yapboz, kes-yapıştır, maket" oyunları oynayan öğrencilerin matematik dersi akademik başarıları arasında anlamlı bir farklılık olmadığı yani bahsedilen oyunları oynayan öğrencilerin matematik başarı düzeylerinin benzerlik gösterdiği söylenebilir. Bu tür oyunları oynamanın matematik başarısıyla pozitif ilişkisi olduğunu belirten araştırmaların yanında bu oyunların matematik başarısını olumlu etkilediğini belirten deneysel araştırmaların varlığı bilinmektedir. Araştırmalarda ve bu çalışmada sportif oyunlar ve matematik başarı arasında ilişki olmaması veya ilişkinin negatif olması ülkemize özgü bir durum olduğu görülmüştür, bu durum farklı bir araştırma konusu olabilir. Aileler, öğretmenler ve araştırmacılar serbest zaman oyunlarda ve oyunla matematik öğretimini temel alan öğretim yaklaşımlarda oyun türleri hakkında bilgilendirilebilir. Oyun türleriyle ilgili farklı değişkenlerle araştırmalar yürütülebilir.