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THE EFFECT OF INTELLIGENCE GAMES ON 5TH GRADE STUDENTS' MATHEMATICS ATTITUDES AND ACADEMIC ACHIEVEMENT

Mehmet ALYANAK*, Ali ÖZKAYA**

Abstract
This study examines the impact of intelligence games on the mathematics attitudes and academic achievement of secondary school students. The study was conducted with fifth-grade students of a public secondary school in the centre of a province in the Mediterranean region. It employed a quasi-experimental design with pre-test and post-test control groups. In the experimental group, mathematics lessons were conducted with an integrated approach to teaching mathematics incorporating intelligence games, while in the control group, mathematics lessons were conducted in accordance with the Ministry of Education's Mathematics Curriculum. The Mathematics Achievement Test and the Mathematics Attitude Scale were employed as data collection instruments. The data were analysed using the SPSS statistical package programme. The results demonstrated that the mathematics attitudes and academic achievement of the students in the experimental group exhibited a positive change.

Key words: Intelligence games, mathematics attitude, academic achievement, secondary school students

ZEKÂ OYUNLARININ 5. SINIF ÖĞRENCİLERİNİN MATEMATİK TUTUMLARI VE AKADEMİK BAŞARILARI ÜZERİNDEKİ ETKİSİ

Özet
Bu çalışma zekâ oyunlarının ortaokul öğrencilerinin matematik tutumlarına ve akademik başarılarına etkisini incelemektedir. Araştırma, Akdeniz bölgesinde yer alan bir ilin merkezinde bulunan bir devlet ortaokulunun 5. sınıf öğrencileriyle gerçekleştirilmiş olup, ön test ve son test kontrol gruplu yarı deneysel desene dayanmaktadır. Deney grubunda matematik dersleri zekâ oyunlarının entegre edildiği matematik öğretimi ile yürütülürken, kontrol grubunda matematik dersleri Millî Eğitim Bakanlığı Matematik Ders Programı çerçevesinde işlenmeye devam etmiştir. Veri toplama araçları olarak Matematik Başarı Testi ve Matematik Tutum Ölçeği kullanılmıştır. Elde edilen veriler SPSS istatistik paket programıyla analiz edildiğinde çıkan

* *Teacher, Ministry of National Education, Antalya, Türkiye, m.alyanak82@gmail.com, 0000-0002-3757-1056*
** *Assoc. Prof. Dr., Akdeniz University, Antalya, Türkiye, aliozkaya@akdeniz.edu.tr, 0000-0002-6401-1839*

sonuçlar deney grubundaki öğrencilerin matematik tutumlarında ve akademik başarılarında olumlu değişiklikler olduğunu göstermiştir.

Anahtar kelimeler: Zekâ oyunları, matematik tutumu, akademik başarı, ortaokul öğrencileri

INTRODUCTION

Mathematics education is a critical area that has a significant impact on students' academic achievement and interests. According to the mathematics teaching programme, the skills that students are expected to develop are the ability to understand mathematics and use it in daily life, to be entrepreneurial, to think independently and make decisions, and to self-regulate (Ministry of National Education [MoNE], 2018). The importance of mathematics education in helping students acquire these and similar skills plays a critical role in developing students' competencies and potential for lifelong learning at the next grade level (Fuson et al., 2005).

Skills such as using mathematical knowledge, determining strategies, and solving problems, which are the skills that traditional learning environments are insufficient to provide students with, can be provided by game-based active learning environments (Pilten, 2008). During play, children tend to express their existing potential in a natural way (Huizinga, 1955). The child takes responsibility and risk in the game, makes decisions on his/her own, evaluates how effective his/her decisions are, and discovers his/her intuitive characteristics in cases where he/she is undecided. In the end, the child will either win and experience the pleasure of a successful struggle on, or he/she will cope with the feeling of losing and become ready not to be discouraged in the face of negative results that he/she will encounter in real life (Sutton-Smith, 1997). In addition, since the atmosphere created during play is suitable for reflecting feelings and thoughts, it is possible to reveal the characteristics of the child (Pellegrini & Smith, 1998). Teachers, families, and friends have more information about the child (Koçyiğit et al., 2007).

Intelligence games are educational tools that develop skills such as problem solving, creative and critical thinking in students. These games facilitate the understanding of abstract concepts and enrich students' interactions with mathematics. Research in the international literature has shown that interest in mathematics learning increases with intelligence games and that these games stimulate positive attitudes towards mathematics (Çağır & Oruç, 2020; White & McCoy, 2019). Sala et al. (2015) found that playing chess, an intelligence game, improved students' mathematical problem solving skills and that there was a strong relationship between chess practice and mathematics scores. Secondary school students achieved higher maths proficiency when using games compared to traditional paper and pencil methods (Chang et al., 2015). In intelligence games, it is aimed to improve the child's ability to work by

competing individually or as a team and to develop a positive attitude towards problem solving (MoNE Intelligence Games Curriculum, 2013).

Attitude towards mathematics is the positive or negative tendency that students develop towards mathematics course and all kinds of activities related to mathematics. Research shows that students' attitudes towards mathematics significantly affect their academic achievement (Öztürk & Korkmaz, 2020). Randel et al. (1992) stated in their study that games develop positive attitudes by providing students with a motivating environment and that these attitudes increase academic performance and enable them to better understand mathematical knowledge. Usta et al. (2018) stated that game-based mathematics teaching has a positive effect on learning. The study by Charles et al. (2009) emphasises how increased engagement in the learning environment can affect achievement. These findings support that positive attitudes can increase student achievement. It was found that the intelligence games course significantly improved maths attitudes; this shows that intelligence games improve problem solving, developing different perspectives and fast, accurate decision-making skills. (Özkaya, 2017). Attitudes, which are psychological structures that cannot be directly observed and measured (Aşkar, 1986) and categorised within affective behaviours, play a major role in whether mathematics is liked or disliked by students (Çoban, 1989). In this context, research in mathematics education plays an important role in understanding and developing students' relationship with mathematics (National Council of Teachers of Mathematics [NCTM], 2000). Effective management of the mathematics learning process, especially at the 5th grade level, which is the beginning of secondary school, can shape students' attitudes towards mathematics and make their relationship with mathematics more positive in the following years (Stipek et al., 2001).

This study stems from the fact that improving students' attitudes towards mathematics and increasing their mathematics achievement is a constant quest. A limited number of studies focusing on the use of intelligence games, which stand out as an effective and innovative method in overcoming the difficulties encountered by students in mathematics learning, have entered the literature. This study differs from the studies in this field and aims to fill the gap in the literature by focusing on fifth grade students.

Purpose of the Research

The aim of this study is to examine how intelligence games influence the attitudes of fifth-grade students towards mathematics and their academic

achievement in mathematics classes. To address this aim, the research questions were developed as follows:

1. What are the consequences of engaging in mathematical intelligence games on the attitudes of fifth-grade students towards mathematics?
2. What is the impact of engaging in intelligence games on the mathematics achievement of fifth-grade students?

In order to address the primary issues previously outlined, the following sub-problems were identified and subsequently addressed.

1.1. Does the difference in pretest positive and negative attitude scores between the experimental and control groups towards mathematics courses reach a statistically significant level?

1.2. Is there a significant difference between the post-test and pre-test scores of the experimental and control groups in terms of their positive and negative attitudes towards the mathematics course?

2.1. Does the pretest academic achievement score of the experimental group differ significantly from that of the control group?

2.2. Does the difference in academic achievement scores the experimental and control groups in the post-test and pre-test periods, significantly?

METHOD

The present study will assess the attitudes towards mathematics and academic achievement of two groups. Following the implementation of the game-playing experiment within the experimental group, the study will ascertain whether there is a discernible disparity between the two groups in terms of both attitude scores and academic achievement mean scores. For this reason, the study was designed with a quasi-experimental design, with an experimental-control group. Such designs permit a comparative analysis of the interactions and results observed between the experimental group and the control group (Shadish et al., 2002).

Population and Sample

The research population comprised all fifth-grade students studying in the city centre of Antalya. The sample for the research was selected from a group of fifth-grade students studying in a public secondary school in Antalya city centre. The school was selected as it met the requisite number of students and socioeconomic diversity for the research, with the sample drawn from a convenience sample. Two distinct branches were designated as the experimental group and the control group, respectively. The experimental

group participated in a mathematics learning programme that incorporated intelligence games, whereas the control group followed the standard curriculum prescribed by the Ministry of National Education (MoNE), conducted in public secondary schools, which did not include the use of brain teasers. The objective was to provide a clear basis for comparison with the experimental group that participated in brain teaser-based activities. Prior to the administration of the pre-tests, two classes were randomly selected from the four classes in the fifth grade of the school where the sample was selected. One class was designated as the experimental group, while the other was designated as the control group. This was done to ensure that the initial conditions between the two groups were comparable. Group equivalence was determined through the administration of pretests and the collection of demographic information from the selected participants, which is presented in Table 1.

Table 1. Demographic Information of Participants

Groups	Gender	N	Total
experiment	m	15	25
	f	10	
control	m	12	25
	f	13	

Table 1 indicates that a total of 50 participants were involved in the study, comprising 25 individuals in the experimental group and 25 in the control group. Of the participants in the experimental group, 15 were female and 10 were male, while in the control group, 12 were female and 13 were male.

Data Collection Tools

The Mathematics Attitude Scale, developed by Önal (2013), was employed to assess students' attitudes towards mathematics. The scale was designed to comprise 22 items, including factors of interest (10 items), anxiety (5 items), study (4 items) and necessity (5 items). The items are presented on a five-point Likert scale, ranging from "Strongly Agree" to "Strongly Disagree." Furthermore, the four-factor structure of the scale was corroborated by confirmatory factor analysis. The internal consistency coefficient of the scale was found to be .90, indicating that it is a reliable instrument.

In order to ascertain the academic level in mathematics, a mathematics achievement test was devised by the researchers in accordance with the test development principles proposed by Cohen et al. (2007). The test comprises 12 items selected from a pool of 30 questions taken from MoNE textbooks based on the fourth and fifth grade mathematics curriculum. The test content was designed to assess a wide range of mathematical skills, including natural

numbers, fractions and decimal notation from the fifth grade curriculum, and measurement and geometry from the fourth grade curriculum. The selection of these topics was intended to ensure that the test reflects both current and prior year learning, thereby increasing its content validity. This approach is supported by the educational assessment literature, which emphasises the importance of aligning tests with educational standards and students' current levels of understanding in order to accurately measure educational outcomes (Cohen et al., 2007; Popham, 2010). The selection process was undertaken with the intention of encompassing students' mathematical thinking, problem-solving, and logical reasoning abilities. The test was administered to a sample of 50 students. The difficulty indices of the test items were employed to ascertain the optimal difficulty level of the test for the students. The reliability of the test was evaluated using the Cronbach's Alpha coefficient, which yielded a value of 0.82. The content validity of the test was ensured by consulting with experts in the field of mathematics education and analysing the curriculum.

Data Collection Process

The data collection process included both pre-test and post-test procedures for the students. The academic achievement test and attitude scale pre-tests for the mathematics course were administered to both the experimental and control groups. Subsequently, one class hour per week was allotted for the implementation of intelligence games activities in the experimental group. The eight-week experiment involved the implementation of the following games: The games included were Mangala, Checkers, Pentago and Chess. A two-week period was allotted for each game. Furthermore, digital versions of these games were introduced, and students were encouraged to engage in intelligence games rather than non-pedagogical games on their mobile devices. As a non-compulsory activity, students in the experimental group participated in the construction of mangala pits in the school garden and the delineation of checkers squares, which were then played with pebbles. During this period, the control group students continued their lessons within the scope of the Ministry of National Education (MoNE) secondary school mathematics curriculum. The post-test was administered at the conclusion of the experimental period. The experiment was conducted during mathematics lessons that were supported by the use of intelligence games. The changes in the students' mathematical knowledge levels and attitudes were quantified. During the research process, informed consent was obtained from the students and their parents. The participants were provided with comprehensive information regarding the objectives, methodology, and voluntary nature of the study. Furthermore, participants were encouraged to raise any queries or concerns with the researchers (American Psychological Association [APA], 2010). The

confidentiality of the participants was rigorously safeguarded throughout the data collection and analysis phase. The data collection process was designed and conducted in such a way that the identities of the participants were not disclosed. In the reporting of the findings, no information that could identify the participants was disclosed. At each stage of the research, the researchers took the necessary precautions to mitigate any potential risks to the participants.

Data Analysis

The data were analysed using the SPSS statistical program, a statistical analysis tool frequently used in social sciences research (Field, 2013). The data collected in the study were subjected to basic statistical analysis and hypothesis testing. In order to ascertain the significance of the differences between the mean scores of the experimental and control groups, an independent two-sample t-test was employed to analyse the achievement test results. This test is a standard method used to determine whether the differences between the mean scores of two independent groups are statistically significant (Leech et al., 2014). For the data collected from the Mathematics Attitude Scale, the scores of the items belonging to positive and negative attitudes in the scale were analysed separately. The obtained scores were employed in order to analyse the differences in attitudes between the experimental and control groups. The objective of this analysis was to evaluate the extent to which intelligence games were effective in influencing students' attitudes towards mathematics courses. Furthermore, during the data analysis, the assumption of normal distribution for achievement and attitude scale scores was tested, and the necessary statistical tests were applied until the appropriateness of the analysis was ensured (Pallant, 2020).

Limitations

It should be noted that the findings of this study may not be generalizable or interpreted in the same way in other contexts due to a number of factors that may influence the results. The study was conducted on a sample of fifth-grade students from a public secondary school situated in the city centre of a Mediterranean region. It should be noted that students residing in different provinces may not possess the same characteristics as those in this sample. Consequently, the generalisation of the results to different student groups or to different geographical regions may be limited (Creswell, 2014).

In accordance with the research plan, the implementation period of the intelligence games was limited to eight weeks. This period may not be sufficient to examine the long-term effects of the games on students (Slavin, 2018).

It is important to note that the study did not consider certain environmental factors that may influence students' mathematics achievement and attitudes towards mathematics. These include the family and social environment. These factors may influence students' learning processes and attitudes, and thus these and similar shortcomings should be considered in the interpretation and generalisation of the findings (Gay et al., 2012).
It is crucial to take these limitations into account when interpreting the research findings and when planning and conducting future studies.

Ethics Committee Approval

This research was conducted in accordance with the ethical standards set forth by the Akdeniz University Social and Human Sciences Scientific Research and Publication Ethics Committee (decision dated 13 April 2023 and numbered 194). At each stage of the research, the ethical standards set out by the board were adhered to, and the principles of research ethics were not breached.

FINDINGS

Findings Related to the Effect of Intelligence Games on 5th Grade Students' Attitude towards Mathematics

A Mathematics Attitude Scale was employed to ascertain the baseline levels of the experimental and control groups.

Table 2. Independent two sample t-test for the positive and negative attitude scores of the experimental and control groups towards mathematics before the experiment

Attitude Type	Groups	N	$\bar{x}$	Ss	t	p
positive	experiment	25	2,22	0,59	-0,74	0,46
	control	25	3,11	0,62		
negative	experiment	25	3,11	0,73	-0,78	0,44
	control	25	3,27	0,73		

The results of the independent two-sample t-test, as presented in Table 2, indicate that there was no statistically significant difference between the two groups with respect to both positive and negative attitudes. The t-value for positive attitudes was -0.743 ($p = 0.461$), while the t-value for negative attitudes was -0.777 ($p = 0.441$). The results indicate that at the outset of the study, the experimental and control groups exhibited comparable levels of positive and

negative attitudes towards the mathematics course. In other words, the two groups exhibited comparable levels of attitudes prior to the commencement of the mathematics lessons supported by intelligence games. This is an appropriate starting point for evaluating the effect of intelligence games on mathematics achievement. This allows us to conclude that the attitudinal change observed in the study is differentiated based on initial attitudes. Both groups exhibited lower initial positive attitudes and higher initial negative attitudes. This provides a basis for analysing whether positive attitudes increase or negative attitudes decrease at the conclusion of the experiment.

Table 3 presents the changes in attitudes towards mathematics courses between the pretest and post-test scores of the experimental and control groups. The aforementioned scores and other findings were obtained as a result of the analysis conducted using a dependent samples t-test.

Table 3. Dependent samples t-test for the post-test- pre-test score difference of the positive and negative attitudes of the groups

Attitude Type	Groups	N	$\overline{x}$	Ss	r	t	p
positive	experiment pre-test	25	2,22	0,59	-0,12	8,25	0,00
	experiment post-test	25	3,74	0,65			
negative	experiment pre-test	25	3,11	0,73	-0,05	-3,76	0,00
	experiment post-test	25	2,36	0,64			
positive	control pre-test	25	2,35	0,62	0,14	-2,00	0,06
	control post-test	25	2,01	0,68			
negative	control pre-test	25	3,27	0,73	-0,45	0,75	0,46
	control post-test	25	3,53	1,28			

The mean score of positive attitudes in the experimental group increased from 2.22 to 3.74 in the post-test, indicating a statistically significant increase ($t = 8.246$, $p = 0.001$). The mean score of negative attitudes decreased from 3.11 to 2.36 in the post-test compared to the pre-test, representing a significant decrease ($t = -3.756$, $p = 0.001$).

The results of the study indicate that students in the experimental group exhibited an increase in positive attitudes and a decrease in negative attitudes

following participation in mathematics lessons supported by brain teasers. This evidence is significant in demonstrating that the incorporation of intelligence games can positively influence students' attitudes towards mathematics lessons. In particular, the increase of 1.52 points out of 5 in positive attitudes may be indicative of an increase in students' interest and excitement towards mathematics lessons. Concurrently, the decline in the mean scores of negative attitudes indicates that previous reservations or concerns about the mathematics course may have diminished.

The mean score of positive attitudes for the control group, which was 3.35 in the pre-test analysis, decreased to 2.01 in the post-test. This change was not statistically significant, with a borderline value of $p = 0.057$. In other words, the mathematics attitudes of the control group students did not undergo any discernible change as a result of the experiment. The mean negative attitude score increased from 3.27 in the pre-test to 3.53 in the post-test. This change was also not statistically significant ($p = 0.461$). When the score changes in the control group are compared with those in the experimental group, a different picture emerges. The scores are presented in Figure 1 in the form of bar graphs. There was a slight decrease in positive attitude scores and a slight increase in negative attitude scores, although this change was not statistically significant. The findings indicate that the implementation of intelligence games has a significant impact on the mathematics attitudes of students in the experimental group. The impact of the intervention is observed to be positive and statistically significant, whereas no statistically significant change is observed in the control group.

These findings suggest that intelligence games may be a valuable educational tool for mathematics educators.

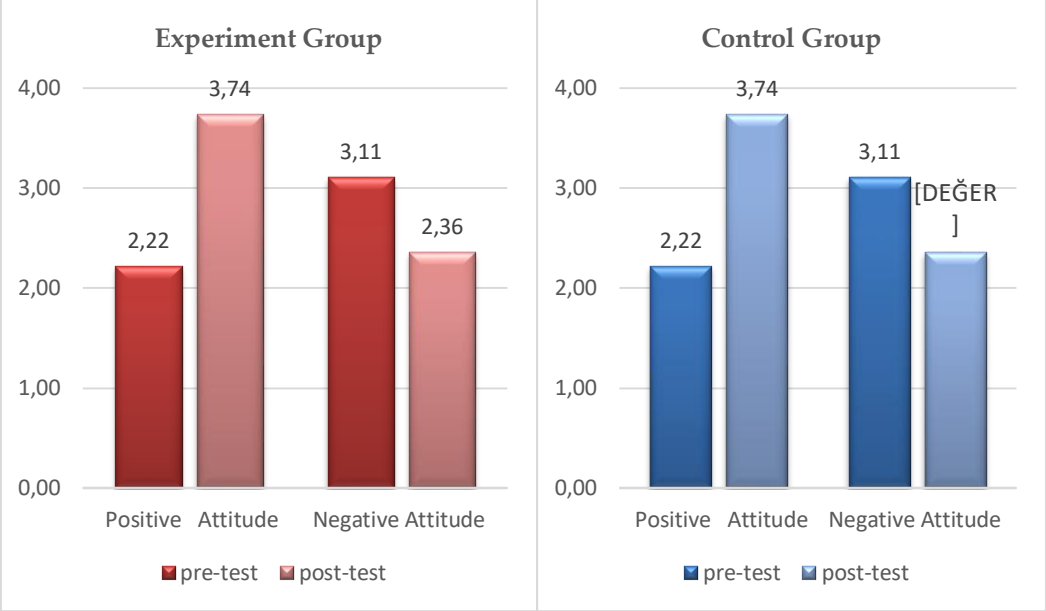

Figure 1. Graphs of Attitude Changes Among the Groups

Findings Related to the Effect of Intelligence Games on Academic Achievement in Mathematics Course

A mathematical achievement test was administered to the experimental and control groups in order to ascertain their initial levels of mathematical ability. The results of the test are presented in Table 4.

Table 4. Independent two sample t-test of math achievement scores of the pre-experimental groups

Groups	N	$\overline{x}$	Ss	t	p
experiment	25	36,68	11,54	0,74	0,94
control	25	36,34	19,38		

The results of the independent two-sample t-test indicated that there was no statistically significant difference between the two groups in terms of their maths achievement scores. The significance level t-value was 0.74, while the p-value was 0.94. The results indicate that the experimental and control groups exhibit comparable levels of mathematical achievement. At this juncture, the comparable achievement scores between the groups provide a foundation for evaluating the impact of intelligence games on mathematical achievement. The comparable level of preparedness is of great importance for the more accurate delineation of the impact of the intelligence games implemented in the experimental group on academic performance in mathematics.

Table 5. Dependent samples t-test for the difference between the math achievement scores of the experimental and control groups before and after the experiment

Groups	Test Type	N	$\overline{x}$	Ss	r	t	p
experiment	pre-test	25	36,68	11,54	0,29	2,69	0,01
	post-test	25	48,02	21,29			
control	pre-test	25	36,34	19,38	0,38	0,72	0,48
	post-test	25	39,01	12,44			

The arithmetic mean of the pre-test achievement score for the 25 experimental group students was 36.68, with a standard deviation of 11.54. Conversely, the arithmetic mean of the post-test was 48.02, with a standard deviation of 21.29. The arithmetic mean of the pretest score applied to the control group, which included the same number of students as the experimental group, was 36.34 with a standard deviation of 19.38. The mean of the post-test was 39.01, with a standard deviation of 12.44.

As demonstrated in Table 4, the dependent samples t-test revealed a statistically significant increase in the post-test mathematics achievement scores of the experimental group in comparison to the pretest (t=2.69, p=0.01). This increase in achievement is indicative of the positive impact of intelligence games on the mathematics performance of students in the experimental group. Conversely, the t-test results of the control group demonstrated that there was no statistically significant change between the pre-test and post-test scores (t=0.72, p=0.48).

These findings indicate that intelligence games can be an effective method for improving the mathematics achievement of fifth grade students. The significant increase in the post-test achievement scores of the experimental group in comparison to the pre-test, coupled with the fact that the change in the scores of the control group was not statistically significant, provides compelling evidence that the increase in the scores of the experimental group is a direct result of the use of intelligence games in mathematics lessons.

The results of this study provide educators with evidence that intelligence games can be an invaluable addition to mathematics education and highlight the potential of such participatory activities to enhance student achievement.

DISCUSSION AND CONCLUSION

The results of the analysis indicated an increase in the mean score of positive attitudes towards mathematics among students in the experimental group, while there was a significant decrease in the mean score of negative attitudes. Concomitantly, there was an enhancement in the mathematical achievement scores of the students in this group. In the control group, there was no statistically significant difference between the pre-test and post-test mean scores in attitudes towards mathematics and mathematics academic achievement scores. These findings suggest that intelligence games may have a positive effect on student attitudes and academic achievement in the fifth grade mathematics course.

Upon examination of the existing literature, these results are supported, and there is evidence that intelligence games can increase student achievement. In Demirel's (2015) study, it was demonstrated that the integration of intelligence games into course activities was associated with an increase in students' academic achievement. In their 2023 study, Çağan and Usta demonstrated that students in secondary school demonstrated enhanced academic achievement when intelligence games were integrated into the teaching method. Orak et al. (2016) reported that the integration of intelligence games in elementary school mathematics lessons was associated with an increase in academic achievement. In a study by Çevik et al. (2016), it was demonstrated that the Tower of Hanoi intelligence game positively affected academic achievement and attitudes in mathematics courses among students with mild intellectual disabilities. Mavridis et al. (2017) demonstrated that online flexible games had a positive effect on mathematics attitude and improved learning outcomes compared to traditional methods. Akinsola et al. (2007) demonstrated that a simulation-game environment was conducive to improving mathematics attitude and mathematics academic achievement. Bottino et al. (2013) and Mubaslat (2012) demonstrated that intelligence games have a positive effect on academic achievement. In addition to the aforementioned studies, there are other studies that emphasise the positive effects of intelligence games in various educational settings. For example, a study by Caponetto et al. (2014) demonstrated that intelligence games were efficacious in enhancing problem-solving abilities in students. Furthermore, Francisco and Maher (2011) reported that lessons taught through activities supported by intelligence games and puzzles improved students' mathematical thinking skills.

Such studies indicate that brain teasers, in addition to serving as a means of reinforcing knowledge, can also enhance students' creative problem-solving

and critical thinking abilities. The findings of this study are consistent with those of previous research, indicating that educators and policymakers should consider the potential benefits of integrating intelligence games into the Grade 5 mathematics learning process. Such integration can facilitate the development of a positive relationship with mathematics and enhance academic achievement.

The results of the study showed that the use of intelligence games in mathematics lessons improved students' mathematics attitudes and academic achievement. Therefore, the use of intelligence games in mathematics lessons should be encouraged more frequently. The scope of the research should be expanded and the effects of intelligence games on students of different age groups should be examined. This would provide a better understanding of the impact of intelligence games on students' learning and offer insights into how these games can be applied to students at different levels of education.

The study's overall evaluation indicates that the use of intelligence games has a significant impact on enhancing fifth grade students' attitudes towards mathematics and their academic performance. The findings of the study may prompt educators and researchers in the field of mathematics education to explore methods that enhance the interactivity and student-centredness of learning processes. One such method is the integration of intelligence games into mathematics courses, which has the potential to enhance students' interest and achievement. This study paves the way for further research to elucidate the role and value of intelligence games in mathematics education.

RECOMMENDATIONS

The findings of this study indicate that the integration of intelligence games into the fifth grade mathematics curriculum has a positive impact on student performance. Consequently;

1. It is of the utmost importance to enhance the functionality of these games within the school environment.
2. It is recommended that training programmes be developed to instruct educators on the appropriate integration of intelligence games into lesson plans.
3. The provision of guidelines for teachers and student activity resources should facilitate the adaptation of these games to the curriculum.
4. It is recommended that digital applications and online platforms be created to assist students in developing their mathematical skills through the use of intelligence games, and that the accessibility of these games be enhanced.

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Genişletilmiş Özet

Giriş

Matematik eğitimi, öğrencilerin akademik başarıları ve ilgileri üzerinde önemli bir etkiye sahip olan kritik bir alandır. Matematik öğretimi programına göre öğrencilerde geliştirilmek istenen, matematiği anlayıp günlük hayatta kullanabilme, girişimci olma, bağımsız düşünüp karar verebilme ve öz düzenleme gibi becerilerdir (Millî Eğitim Bakanlığı [MEB], 2018). Geleneksel öğrenme ortamlarının öğrencilere kazandırmakta yetersiz olduğu yetiler olan, matematiksel bilgileri kullanabilme, strateji belirleme ve karşılaşılan problemleri çözme gibi beceriler; oyun temelli aktif öğrenme ortamları ile sağlanabilmektedir (Pilten, 2008). Oyun oynama sırasında çocuklar mevcut potansiyellerini tabii bir şekilde dışa vurmaya meyilli olurlar (Huizinga, 1955). Bunun yanı sıra, oyun esnasında oluşan atmosfer, duygu ve düşünceleri yansıtmaya müsait olduğundan çocuğun sahip olduğu özelliklerin ortaya çıkması olasıdır (Pellegrini & Smith, 1998). Öğretmenler, aileler ve arkadaşları çocuk ile ilgili daha fazla bilgiye sahip olurlar (Koçyiğit vd., 2007). Matematik tutumu, matematik dersine ve matematikle ilgili her türlü aktiviteye karşı öğrencinin geliştirdiği olumlu veya olumsuz eğilimdir. Araştırmalar, öğrencilerin matematiğe yönelik tutumlarının, akademik başarılarını önemli ölçüde etkilediğini ortaya koymaktadır (Öztürk & Korkmaz, 2020). Duyuşsal nitelikte olan davranışlar içerisinde kategorize edilen, doğrudan gözlenip ölçülemeyen psikolojik yapılar olan tutumların (Aşkar, 1986), matematik dersinin öğrenciler tarafından sevilip sevilmemesinde rolü büyüktür (Çoban, 1989). Bu bağlamda, matematik eğitimi alanında yapılan araştırmalar, öğrencilerin matematikle olan ilişkisini anlamak ve geliştirmek için önemli bir rol oynamaktadır (National Council of Teachers of Mathematics [NCTM], 2000). Özellikle ortaokulun başlangıç sınıfı olan 5. sınıf seviyesinde, matematik öğrenme sürecinin etkili bir şekilde yönetilmesi, öğrencilerin matematik tutumlarını şekillendirebilir ve ilerleyen yıllarda matematikle olan ilişkilerini daha olumlu ya da daha olumsuz duruma getirebilir. (Stipek vd., 2001). Öğrencilerin matematik öğreniminde karşılaştıkları güçlüklerin aşılmasında etkili ve yenilikçi bir yöntem olarak öne çıkan zeka oyunlarının matematik dersinde kullanımına odaklanan sınırlı sayıda çalışma literatüre girmiştir. Bu çalışma, özellikle beşinci sınıf öğrencileri üzerinde gerçekleştirilerek bu alandaki çalışmalardan farklılaşmakta ve literatürdeki boşluğu doldurmayı hedeflemektedir.

Araştırmanın amacı, zekâ oyunlarının 5. sınıf öğrencilerinin matematik tutumlarına ve matematik dersindeki akademik başarılarına etkisini incelemektir. Araştırmanın problem cümlesi; zekâ oyunları oynamanın 5. sınıf

öğrencilerinin matematik tutumuma ve akademik başarısına etkisi nedir? olarak belirlenmiştir.

Yöntem

Bu çalışmada deney-kontrol gruplu yarı deneysel desende tasarlanmıştır. Araştırma evreni Antalya il merkezinde öğrenim gören tüm 5. Sınıf öğrencilerinden oluşmakta olup araştırmanın örneklemi Antalya ilindeki bir ortaokulun 5. Sınıf öğrencilerinden seçilmiştir. Deney grubu, zekâ oyunlarıyla desteklenen bir matematik öğrenme programına dahil edilirken, kontrol grubunda dersler MEB İlköğretim Matematik Öğretim Programı çerçevesinde derslere devam edilmiştir. Her grup 25'er öğrenci içerecek olup araştırma 50 öğrenci ile yürütülmüştür.

Öğrencilerin matematik dersine karşı tutumlarını ölçmek için Önal (2013) tarafından geliştirilen ve eğitim araştırmalarında sıkça kullanılan Matematik Tutum Ölçeği kullanılmıştır. Matematikteki akademik düzeyin belirlenmesi için ise araştırmacılar tarafından hazırlanan Matematik Başarı Testi kullanılmıştır. Başarı testi ile tutum ölçeğinin ön testleri, deney grubu ve kontrol grubuna uygulandıktan sonra deney grubunda ders sonlarında haftada 1 ders saati zekâ oyunları etkinlikleri düzenlenmiştir. Sekiz haftalık deney sürecinde "Mangala", "Dama", "Pentago" ve "Satranç" oyunları oynanmıştır. Her oyun için iki haftalık bir zaman dilimi ayrılmıştır. Ayrıca öğrenciler bu oyunların dijital versiyonlarını telefon ve tabletlerine yükleyip evde aileleriyle oynamışlardır. Yine serbest aktivite olarak da okul bahçesinin topraklı zemininde mangala çukurları açılarak ve dama kareleri çizilerek çakıl taşlarıyla bu oyunlar deney grubu öğrencilerine oynatılmıştır. Deney sürecinin sonunda uygulanan son test ise, zekâ oyunlarıyla desteklenmiş matematik derslerinin sonunda uygulanmış ve öğrencilerin matematik bilgi düzeyleri ile tutumlarındaki değişimler ölçmüştür. Veriler SPSS istatistik programı kullanılarak analiz edilmiştir.

Bulgular

Yapılan analizde deney grubunun matematik dersine yönelik olumlu tutumlarında anlamlı bir artışı görülürken olumsuz tutumlarındaki düşüş de anlamlı olmuştur. Kontrol grubunda ise olumlu ve olumsuz tutumlardaki değişimler istatistiksel olarak anlamlı olmamıştır. Başarı testinin son test – ön test puan farkı analizinde de deney grubunun puan farkı istatistiksel olarak anlamlı iken kontrol grubunun puan değişimi anlamlı olmamıştır.

Tartışma, Sonuç ve Öneriler

Araştırmada elde edilen bulgular, zekâ oyunlarının 5. Sınıf matematik dersinde öğrenci tutumları ve akademik başarı üzerinde olumlu yönde bir etkisi

olduğunu göstermektedir. Literatür incelendiğinde de bu sonuçlar desteklenmekte ve zekâ oyunlarının öğrenci başarısını artırabileceğine dair başka kanıtlara da rastlanmaktadır. Demirel (2015) çalışmasında, zekâ oyunlarının entegre edildiği ders etkinliklerinin öğrencilerin akademik başarılarını artırdığını belirtilmiştir. Orak ve diğerleri (2016), ilkokul matematik derslerinde zekâ oyunları kullanmanın akademik başarıyı artırdığını raporlamışlardır. White and McCoy (2019) found that game-based learning improved primary school students' academic achievement in mathematics and their attitudes towards mathematics. In their research, they stated that these games improved problem solving skills and changed their attitudes towards mathematics positively.

Bottino ve ark., (2013) ile Mubaslat (2012), zekâ oyunlarının akademik başarı üzerinde olumlu bir etkiye sahip olduğunu göstermişlerdir. Araştırma sonuçları, zekâ oyunlarının matematik derslerinde kullanımının öğrencilerin matematik tutumlarını ve akademik başarılarını iyileştirdiğini göstermiştir. Bu nedenle, zekâ oyunlarının matematik derslerinde kullanılması daha sık teşvik edilmelidir. Yapılan araştırmaların kapsamı genişletilmeli ve zekâ oyunlarının farklı yaş gruplarındaki öğrenciler üzerinde de etkileri incelenmelidir.