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| Research Article / Araştırma Makalesi |

Analysis of Mind and Intelligence Games for Primary School Mathematics Curriculum Learning Outcomes

Akıl ve Zekâ Oyunlarının İlköğretim Matematik Öğretim Programı Kazanımlarına Göre Analizi

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Keywords

1. Primary school
2. Mind games
3. Intelligence games
4. Mathematics curriculum
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Anahtar Kelimeler

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Abstract

Purpose: In this study, the Turkish Federation of Mind and Intelligence Games used in Intelligence Games Education in Teacher Educators are analyzed for primary school mathematics curriculum learning outcomes.

Design/Methodology/Approach: This study uses a document analysis model among qualitative research methods. The descriptive analysis method among qualitative data analysis techniques was applied for data analysis.

Findings: As a result of the research, it was determined that the most outcomes and game matches were in the 1st grade; mind and intelligence games mostly matched with outcomes in learning areas of numbers and operations and geometry; It is seen that the outcomes under the sub-learning domains Spatial Relations, Geometric Objects and Shapes, Natural Numbers match more with the game contents.

Highlights: The study results show that mind and intelligence games were included in the Ministry of National Education (MoNE) curriculum in 2013. In the following years, the subject received interest in investigating its contributions to the education field. This study might recommend that skills aimed for the mathematics class might be offered based on intelligence games when the curriculum is considered based on activities.

Öz

Çalışmanın amacı: Bu çalışmada Türkiye Akıl ve Zekâ Oyunları Federasyonunun Zekâ Oyunları Eğitici Eğitiminde kullanılan akıl ve zekâ oyunlarının ilköğretim matematik dersi kazanımları açısından analizi yapılmıştır.

Materyal ve Yöntem: Araştırmada nitel araştırma yöntemlerinden doküman incelemesi kullanılmıştır. Verilerin analizinde nitel analiz tekniklerinden betimsel analiz kullanılmıştır.

Bulgular: Araştırma sonucunda en çok kazanım ve oyun eşleşmesinin 1. Sınıfta olduğu; akıl ve zeka oyunların en çok sayı ve işlemler ile geomteri öğrenme alanlarında kazanımlar ile eşleştiği; Uzamsal İlişkiler, Geometrik Cisimler ve Şekiller, Doğal Sayılar alt öğrenme alanları altında bulunan kazanımların oyun içerikleriyle daha fazla eşleştiği görülmektedir.

Önemli Vurgular: Araştırma sonuçlarına göre akıl ve zekâ oyunlarının Milli Eğitim Bakanlığı (MEB) müfredatındaki çalışmaları 2013 yılında programda yerini almıştır. Sonraki yıllarda bu konu eğitim alanındaki katkıları incelenmek üzere daha çok ilgi görmüştür. Çalışmanın, oluşturulacak programlarda etkinlik bazında dikkate alındığında matematik dersinde kazandırılmak istenen becerilerin verilmesinde olumlu etkisinin olacağından bahsedilmiştir.

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INTRODUCTION

Humans have played games since babyhood. A baby does not need to learn how to play a game because the game is an instinct for humankind (Berber, 2018). Playing games contribute to children's physical, mental, emotional and social development. While games are a need for children, they act as an education tool that impacts the children's development processes. Each game addresses the different developmental properties of the children. Therefore, a child in the developmental period must play different games (Halmatov, 2019).

Teaching with games, one of the modern education methods, can be seen as essential in terms of learners' success, motivation for class and positive effects on the students. When the studies regarding the effects of games on development are investigated, it can be seen that the games impact various developmental fields. The relationship between mathematics and games shows that mathematics and intelligence games are intertwined (Ugurel & Morali, 2008). Mental processes such as creating hypotheses, induction, deduction, applying strategies, relational thinking, classification, looking for different solutions methods for the problem and creating models while playing games form the mathematics class's core.

Games played for centuries are also crucial for sustaining cultural values. However, the games diversified as the conditions of today's world changed. For example, games today are more played indoors, and the opportunities to benefit from the educational properties increased. Therefore, this change in the games that changed and enriched over time reflected the used materials. Today, educational games are used to improve learning with fun, concept teaching, problem-solving skills, strategy development, focusing on the target, and participation in individual or group work. Since educational games can be concretized with visual materials, using these games in mathematics class with abstract statements can increase the interest in the class and contribute to learning the subject (Oz Pektas, 2017).

Until today, game categorization has been undertaken around the world. Accordingly, intelligence games were not categorized with absolute results. It is seen that various researchers adopted different categorizations. Intelligence games include various verbal or non-verbal games as well as games with or without visual materials. In the end, the general assumptions about the various intelligence games have problem-solving, reasoning, and alternative solution creating discourses. Oldfield called intelligence games mathematics games and explained these games under 12 titles. Hack and Duhl explained the classification of strategic games such as chess and the go-on probability concept. In mathematics teaching, Offenholley investigated intelligence games as the games that could be used in mathematics classes. Compared to other verbal lessons, mathematics is based on the skill of analyzing by understanding rather than memorizing (cited in Erdogan et al., 2017). Concretization of this class with abstract concepts ensures permanent learning at the primary school level. Active use of intelligence games should be emphasized in gamification. It is believed that students' reasoning activities during the intelligence game-playing process increase their success and flexibility in calculation and numerical operations, which are among the mathematics class subjects (Aksakal, 2020). All this theoretical knowledge shows that intelligence games should be related to mathematics class due to the strategic aspects of these games. It is believed that individuals successful in intelligence games have high mathematics success today. The opposite is also valid today.

According to the constructivist education approach, reasoning skills enable forming relationships between concepts. The activities that develop reasoning skills should be included in the educational setting. Reasoning skill that is included among the core skills of the primary school mathematics class increases the learners' academic success in the learning environment and creates a positive perspective about the mathematics class. It is believed that using intelligence games in the game and learning methods adopted in the mathematics class will play an influential role in learning these skills and attitudes (Yilmaz, 2019).

Intelligence games are the entire activities that enable individuals to create different solutions to problems and to reveal their potential. In this sense, these games help individuals improve their number, operation, strategy, logic, reasoning and creativity skills, increasing their mathematical success (Seb & Bulut Serin, 2017).

As a result of the studies in Turkey, intelligence games were first included in the Ministry of National Education (MoNE) curriculum in 2013 as an elective course. The primary purpose of the intelligence games class expressed as "intelligence games class aims students' to recognize and develop their intellectual potential, create different and unique strategies against problems, make fast and correct decisions, develop a systematic thought structure, develop individual, team and competitive working skills within intelligence games context and develop a positive attitude towards problem-solving" and the core elements of MoNE Intelligence Games Class Curriculum are explained as "the focus of the program is to develop students' problem-solving, communication and reasoning, self-regulation and psychomotor skills and affective characteristics(MoNE, 2013).

The same curriculum divided intelligence games into 6 units: Reasoning, Operation Games, Geometric-Mechanical Games, Strategy Games, Memory Games, Verbal Games and Intelligence Questions. Each unit was explained with tables with game examples and related skills (MoNE, 2013).

The factors that need to be considered in mathematics curriculum application are

· The students' differences must not be disregarded. Therefore, mathematics teaching activities should highlight activities that emphasize students' learning styles and strategies.

· Students' previous learning should be identified, opportunities to build new mathematical concepts over the old ones should be provided with activities that support effective learning, and students should be encouraged in this process.

· Tangible materials should be used in new concept teaching and assessment as much as possible. Materials such as number cards, decimal blocks, fraction teams, and various models obtained from basic daily materials could be given as examples.

· In the mathematics learning-teaching process, students' verbal expression of their thoughts and internalizing, understanding and structuring mathematical concepts play an essential role. Students should exhibit how they structured the concepts in the learning process and are encouraged to communicate at the individual and inter-individual levels.

· In the mathematical concept learning process, it is essential for the teacher to guide the students to express their thoughts.

· Accordingly, questions such as "Have you ever seen a problem similar to this problem? If yes, do you remember your method? Do you know the method that will work to solve this problem?" should be asked to permit the students to reveal and consolidate their thinking processes. The effect of developing a positive attitude towards mathematics on mathematical success is undeniable. Mathematical games should be included in the appropriate sections related to the unit content (MoNE, 2018).

The Intelligence Games training program consists of 3 steps;

Level 1 (Beginner): It includes learning the rules of the games, gaining essential knowledge and skills, playing beginner-level games and solving puzzles.

Level 2 (Intermediate): It includes making logical inferences, starting from the right place in puzzles, applying basic strategies in strategy games, playing intermediate games and solving puzzles.

Level 3 (Advanced Level): It includes high-level knowledge and skills such as creative thinking, analysis, original strategies, evaluating and generalizing. Playing advanced games, solving puzzles and benefiting from the experiences of others are included in this step (MoNE, 2013).

The cognitive skills such as problem-solving, reasoning and forming a cause-effect relationship in intelligence games match the general targets of the mathematical class learning outcomes. At the same time, it is believed that the attitude towards mathematical class will change positively by using intelligence games (Alkas Ulusoy et al., 2017). Individuals' thinking and reasoning skills are linked with the mathematical education they receive from school-age to adulthood. The learning outcomes of the mathematics class emerge in various aspects of life to facilitate our lives. At this point, the traditional mathematics teaching methods are replaced by modern education approaches appropriate for today's education understanding. Intelligence games education as the sub-subject of game methods that help to gain problem-solving skills is included among these methods that should be highly used in mathematics (Tural Sonmez & Dinc Artut, 2012). The reason for the brain games course to be taught as an elective course in secondary schools in the 2012-2013 academic year is based on these basic assumptions (Dokumaci Sutcu, 2021b).

In this study, the content of intelligence games in Primary School Mathematics Curriculum and Turkish Federation of Mind and Intelligence Games, Intelligence Games Education of Teacher Educators. It is believed that the study results will be beneficial in providing information about using games to help students gain the skills included in the primary school mathematics class general targets. Additionally, it is predicted that the curriculum-makers can benefit from this study by including intelligence games in more in-class activities.

According to the intelligence games class curriculum and information in the mathematics curriculum, it is seen that the relationship between intelligence games-mathematics will serve similar purposes. When the expected points are considered, subject learning outcome-game skill should be matched for the teachers' use and expanding intelligence games education in primary school mathematics class. It is hoped that this study will benefit teachers t find which intelligence game can be used for which learning outcome. When the research studies about Intelligence Games Lesson Program at the secondary level are examined, it is seen that they focus on teachers' opinions about the Intelligence Games Lesson Curriculum and the intelligence games lesson, the effects of intelligence games on primary and secondary school students, and pre-service teachers, primary school students' attention level, values education and special education, in-service teachers' views on the process and studies on intelligence games, and literature reviews(Adalar, 2017; Altun, 2019; Bas et al., 2020; Bottino et al., 2013; Cagir & Oruc, 2020); Can, 2020; Cilingir Altiner, 2018; Dagli, 2020; Demirkaya & Masal, 2017; Devecioglu & Karadag, 2014.; Dokumaci Sutcu, 2021a; Ekici et al., 2017; Ergun & Gozler, 2020; Gencay et al., 2019; Kula, 2020; Kuzu & Durna, 2020; Sadikoglu, 2017; Sahin, 2019; Sargin & Tasdemir, 2020; Saygi & Alkas Ulusoy, 2019; Yilmaz & Yildiz Ikikardes, 2020). However, to the best of the researcher's knowledge, no studies are analyzing the relationship between mind and intelligence games and Primary School Mathematics Curriculum learning outcomes. Therefore, the current study fills a gap in the literature.

Problem

Which learning outcomes do the intelligence games recommended by Turkish Federation of Mind and Intelligence Games include in the primary school curriculum?

Sub-Problems

1. Which learning outcomes do intelligence games include for different class levels?
2. Which learning outcomes do these games include based on learning fields in the primary school curriculum?
3. Which learning outcomes do these games include based on sub-learning fields in the primary school curriculum?

METHOD/MATERIALS

This study that investigated mind and intelligence games are investigated for primary school mathematics curriculum learning outcomes were conducted with qualitative research methods. With the case study, each context is evaluated with an in-depth, detailed and holistic perspective, the differences that occur according to each context and the underlying reasons are explained, and the reader or interested persons are described(Akar, 2017). This study used a document analysis pattern. Document analysis that is one of the scientific methods that analyze the data collected systematically about the research topic in the shortest time helps to infer and to interpret the data. This is a scientific method that involves collecting, questioning and interpreting various documents for the research(Ozkan, 2019).

The research data was collected with Learning Outcome Identification Form and the control list was created based on expert view. The properties of mind and intelligence games were matched with Primary School Mathematics Curriculum learning outcomes.

The descriptive analysis method among qualitative analysis method was applied. Descriptive analysis that aims to transfer the obtained data in organized and interpreted format includes creating a frame, data processing, finding identification and interpretation stages. The results are found from cause-effect relationships formed based on interpretations. It is possible to make predictions by considering these results (Simsek & Yildirim, 2018). The differences in opinions and differences were identified and the fitness values between the coders were investigate(Miles & Huberman, 1994). The analysis results showed that the fitness between the researchers was at an acceptable level (87.36 %). The acceptable fitness between the coders must be at least 70%.In this study, the purpose is to analyze the obtained data under scientific rules and objectively interpret the findings.

Research Unit

Primary School Mathematics Curriculum learning outcomes were analysed for equilibrio, tangramino, perspecto, architecto, metaforms, kulami, match madness, whatzizz, zigzag, cumulo, pomela, rondo vario, dizios 6+, mind- qwirkle 6+, mind-qbitz8+, pattern play 3+ , skippity, blockbuddies, patternplay3d, look look, pentago, triangle game, skilled structures 200, tangram set, pentomino, mangala, reversi, colours, shapy, candy, six, numbers mind and intelligence games properties used in Turkish Federation of Mind and Intelligence Games Education of Teacher Educator.

FINDINGS

The findings of this study were obtained by analysing the primary school mathematics curriculum and intelligence games content in the Turkish Federation of Mind and Intelligence Games Intelligence Games Education of Teacher Educators. The obtained findings were investigated for sub-problems. The data obtained from the findings are given in the tables below.

Sub-Problem 1: Which learning outcomes do intelligence games include for different class levels?

Table 1 analysed the distribution of 32 games according to primary school mathematics curriculum learning outcomes. It is predicted that each game can be used for multiple learning outcomes for different class levels. While different class levels can benefit from the same game, multiple games can be used for one learning outcome.

Table 1. Analysis of mind and intelligence games for primary school mathematics curriculum learning outcomes

Game Name	1. Grade	2. Grade	3. Grade	4. Grade
Equilibrio	1.2.1.1./1.3.4.1.	2.2.1.1./2.2.1.2./2.2.1.3.	3.2.1.1.	4.2.1.1.
Tangramino	1.2.1.1./1.3.4.1.	2.2.1.1./2.2.1.2./2.2.1.3.	3.2.1.1.	
Perspecto	1.2.1.1./1.3.4.1.	2.2.1.1./2.2.1.2./2.2.1.3.	3.2.1.1.	
Architecto	1.2.1.1./1.3.4.1.	2.2.1.1./2.2.1.2./2.2.1.3.	3.2.1.1.	
Meta-Forms	1.2.1.1./1.2.1.2./1.2.2.1.	2.2.1.1./2.2.1.2./2.2.2.1.	3.2.1.4.	4.2.1.2.
Kulami		2.2.2.1.	3.2.4.2.	
Game Name	**1. Grade**	**2. Grade**	**3. Grade**	**4. Grade**
Match Madness	1.2.1.2./1.2.2.1./1.2.2.2./1.2.3.2.	2.2.1.2./2.2.1.4./2.2.2.1./2.2.3.2.		
Whatzizz		2.2.2.2.	3.2.2.1./3.2.2.2.	4.2.2.1./4.2.2.2.
Zigzag	1.2.2.1.	2.2.2.1.		
Cumulo	1.2.2.2.			
Pomela	1.2.2.1./1.2.2.2.	2.2.2.1.		
Rondo Vario	1.2.1.1./1.2.2.1./1.2.2.2./ 1.3.1.1.	2.2.1.1.		4.2.1.1./4.2.1.2.
Dizios 6+	1.2.2.1./1.2.2.2./1.2.3.1. 1.2.3.2.	2.2.2.1./2.2.3.1./2.2.3.2.		
Mind- Qwirkle 6+	1.2.2.1./1.2.2.2./1.2.3.1. 1.2.3.2.	2.2.2.1./2.2.3.1./2.2.3.2.		
Mind-Q Bitz 8+	1.2.1.1./ 1.2.2.1.	2.2.2.1./2.2.2.2.	3.2.2.2./3.2.3.1.	

Game Name	1. Grade	2. Grade	3. Grade	4. Grade
Pattern Play 3+	1.1.1.8./1.1.4.1./1.2.2.1./ 1.2.2.2.	2.1.1.7./2.1.6.1./2.2.1.2.		
Skippity	1.1.1.3./1.1.1.4.	2.1.1.1.		
Block Buddies	1.2.2.1./1.2.2.2./1.2.3.1.	2.2.1.1./2.2.1.2./2.2.1.4. 2.2.2.1./2.2.2.2./2.2.3.1. 2.2.3.2.	3.2.1.4.	4.2.1.5.
Pattern Play 3d	1.1.1.8./1.1.4.1./1.2.2.1. 1.2.2.2.	2.1.1.7./2.1.6.1./2.2.1.2.		
Look Look	1.1.2.1./1.1.2.2./1.1.2.5. 1.1.3.1./1.1.3.2./1.1.3.3.			
Pentago		2.2.2.1.	3.2.4.2./3.2.4.3.	
Triangle Game	1.2.1.2.	2.2.1.2.		
Skilled Structures-200	1.2.2.1./1.2.1.2.	2.2.1.2./2.2.2.1.		
Tangram Set	1.2.1.1./1.3.4.1.	2.2.1.1./2.2.1.2./2.2.1.3.	3.2.1.1.	
Pentomino	1.2.1.1./1.3.4.1.	2.2.1.1./2.2.1.2./2.2.1.3.	3.2.1.1.	
Mangala	1.1.1.3./1.1.2.2./1.1.2.5.	2.1.2.4./2.1.1.3.	3.1.2.4.	
Reversi	1.2.2.1.	2.2.2.1.	3.2.4.3.	
Colours	1.2.1.1./1.2.1.2./1.2.2.1.	2.2.1.1./2.2.1.2./2.2.2.1.	3.2.1.4.	4.2.1.2.
Shapy	1.2.1.1.	2.2.1.1.		4.2.1.1./4.2.1.2.
Candy	1.2.1.1.	2.2.1.1.		
Six	1.2.2.1./1.2.3.1./1.2.3.2.	2.2.2.1./2.2.3.1./2.2.3.2.	3.2.4.3.	
Numbers	1.1.2.1./1.1.2.2./1.1.2.5. 1.1.2.6./1.1.3.1./1.1.3.3. 1.1.3.4.	2.1.2.4./2.1.2.5./2.1.3.6./2.1.4.1./ 2.1.4.2./2.1.4.3. 2.1.5.1.	3.1.2.4./3.1.2.6. /3.1.3.4.	4.1.2.4./4.1.3.4. 4.1.4.6./4.1.5.6.
Total	**80**	**76**	**22**	**14**

According to Table 1 is examined, it is seen that the most outcomes and game pairing is in the 1st grade; it can be seen that "Understands the meaning of addition operation.", "Classifies and names geometric shapes based on the number of corners and edges." and "Uses mathematical language to signify location, direction and movement" learning outcomes were similar to the skills aimed with the games. Accordingly, the games that have learning outcomes for mathematics teaching could be selected and used in the class. For example, it is shown on the table that "Classifies and names geometric shapes based on the number of corners and edges." learning outcome can be gained by playing Equilibrio, Perspecto, Tangram Set, Tangramino, Architecto games. The connection between materials in the content of these games and learning the shapes was formed.

Sub-Problem 2: Which learning outcomes do these games include based on learning fields in the primary school curriculum?

Table 2 shows the analysis of intelligence games for primary school mathematics curriculum learning areas. 4 learning areas in the primary school mathematics curriculum are Numbers and Operations, Geometry, Measurement and Data Processing. When the table is analysed, it can be seen that mind and intelligence games can contribute to learning outcomes if these games are used in the education-training field as these games serve to the learning outcomes in Geometry, Numbers and Operations learning field. It can be seen that mind and intelligence games can be effective in Measurement and Data Processing learning areas.

Table 2: Analysis of intelligence games for primary school mathematics curriculum learning areas

Game Name	Number And Operations	Geometry	Measurement	Data Processing
Equilibrio		1.2.1.1./2.2.1.1./2.2.1.2. 2.2.1.3./3.2.1.1.	1.3.4.1.	
Tangramino		1.2.1.1./2.2.1.1./2.2.1.2. 2.2.1.3./3.2.1.1.	1.3.4.1.	
Perspecto		1.2.1.1./2.2.1.1./2.2.1.2. 2.2.1.3./3.2.1.1.	1.3.4.1	
Architecto		1.2.1.1./2.2.1.1. /2.2.1.2. 2.2.1.3. /3.2.1.1.	1.3.4.1.	
Meta-Forms		1.2.1.1. /1.2.1.2. /1.2.2.1. 2.2.1.1. /2.2.1.2. /2.2.2.1. 3.2.1.4. /4.2.1.2.		
Kulami		2.2.2.1./3.2.4.2.		
Match Madness		1.2.1.2. /1.2.2.1. /1.2.2.2. 1.2.3.2. /2.2.1.2. /2.2.1.4.		

Game Name	Number And Operations	Geometry	Measurement	Data Processing
		2.2.2.1. /2.2.3.2.		
Whatzizz		2.2.2.2. /3.2.2.1. /3.2.2.2. 4.2.2.1. /4.2.2.2.		
Zigzag		1.2.2.1./2.2.2.1.		
Cumulo		1.2.2.2.		
Pomela		1.2.2.1./1.2.2.2./2.2.2.1.		
Rondo Vario		1.2.1.1./1.2.2.1./1.2.2.2. 2.2.1.1.	1.3.1.1.	
Dizios 6+		1.2.2.1. /1.2.2.2. /1.2.3.1. 1.2.3.2. /2.2.2.1. /2.2.3.1. 2.2.3.2.		
Mind- Qwirkle 6+		1.2.2.1. /1.2.2.2. /1.2.3.1. 1.2.3.2. /2.2.2.1. /2.2.3.1. 2.2.3.2.		
Mind-Q Bitz 8+		1.2.1.1. /1.2.2.1./ 2.2.2.1. 2.2.2.2. /3.2.2.2. /3.2.3.1.		
Pattern Play 3+	1.1.1.8. /1.1.4.1. 2.1.1.7. /2.1.6.1.	1.2.2.1. /1.2.2.2. /2.2.1.2.		
Skippity	1.1.1.3./1.1.1.4./2.1.1.1.			
Block Buddies		1.2.2.1. /1.2.2.2. /1.2.3.1. 2.2.1.1. /2.2.1.2. /2.2.1.4. 2.2.2.1. /2.2.2.2. /2.2.3.1. 2.2.3.2. /3.2.1.4. /4.2.1.5.		
Pattern Play 3d	1.1.1.8. /1.1.4.1. /2.1.1.7. 2.1.6.1.	1.2.2.1. /1.2.2.2. /2.2.1.2.		
Look Look	1.1.2.1. /1.1.2.2. /1.1.2.5. 1.1.3.1. /1.1.3.2. /1.1.3.3.			
Pentago		2.2.2.1./3.2.4.2.		
Triangle Game		1.2.1.2. /2.2.1.2.		
Skilled Structures-200		1.2.2.1. /1.2.1.2. /2.2.1.2. 2.2.2.1.		
Tangram Set		1.2.1.1./2.2.1.1. /2.2.1.2. 2.2.1.3. /3.2.1.1.	1.3.4.1.	
Pentomino		1.2.1.1./2.2.1.1. /2.2.1.2. 2.2.1.3. /3.2.1.1.	1.3.4.1.	
Mangala	1.1.1.3./1.1.2.2./1.1.2.5. 2.1.2.4./2.1.1.3./3.1.2.4.			
Reversi		1.2.2.1. /2.2.2.1. /3.2.4.3.		
Colours		1.2.1.1. /1.2.1.2. /1.2.2.1. 2.2.1.1. /2.2.1.2. /2.2.2.1. 3.2.1.4. /4.2.1.2.		
Shapy		1.2.1.1./2.2.1.1./4.2.1.1. 4.2.1.2.		
Candy		1.2.1.1. /2.2.1.1.		
Six	1.2.2.1. /1.2.3.1. /1.2.3.2. 2.2.2.1. /2.2.3.1. /2.2.3.2. 3.2.4.3.			
Numbers	1.1.2.1. /1.1.2.2. /1.1.2.5. 1.1.2.6. /1.1.3.1. /1.1.3.3. 1.1.3.4. /2.1.2.4. /2.1.2.5. 2.1.3.6. /2.1.4.1. /2.1.4.2. 2.1.4.3. /2.1.5.1. /3.1.2.4. 3.1.2.6. /3.1.3.4. /4.1.2.4. 4.1.3.4. /4.1.4.6. /4.1.5.6.			
TOTAL	**44**	**134**	**7**	

Table 2, it is determined that game content and the learning outcomes in Numbers and Operations, Geometry learning areas matched at a high level. It can be seen that the related games should be used especially for the 1st and 2nd-grade learning outcomes. For example, the table shows that the Numbers game can benefit learning outcomes in the Numbers and Operations learning area. Numbers game aim the child to find the results for operations that become harder in higher levels by using visual tips. The children need to use story problem skills to find the results in the higher levels.

Sub-Problem 3: Which learning outcomes do these games include based on sub-learning fields in the primary school curriculum?

Table 3 shows the analysis of intelligence games for primary school mathematics curriculum sub-learning areas. Table 2 stated that mind and intelligence games will have the best benefit for the learning outcomes in Geometry and Numbers and Operations learning areas. It is listed that the same games were beneficial for learning outcomes in Natural Numbers, Addition with Natural Numbers, Subtraction with Natural Numbers, Multiplication with Natural Numbers, Division with Natural Numbers, and Fractions sub-learning areas in the Numbers and Operations learning area. In the Geometry learning area, it is seen that the mind and intelligence games developed the Basic Concepts in Geometry, Geometric Objects and Shapes, Spatial Relations and Geometric Patterns sub-learning areas the most. There were games to improve the skills for Weighting sub-learning area learning outcomes in the Measurement learning area.

Table 3: Analysis of intelligence games for primary school mathematics curriculum sub-learning areas

Game Name	Numbers and Operations	Geometry	Measurement	Data Processing
Equilibrio		Geometric objects and shapes	Weighting	
Tangramino		Geometric objects and shapes	Weighting	
Perspecto		Geometric objects and shapes	Weighting	
Architecto		Geometric objects and shapes	Weighting	
Meta-Forms		Geometric objects and shapes Spatial relations		
Match Madness		Geometric objects and shapes Spatial relations Geometric patterns		
Whatzizz		Spatial relations		
Zigzag		Spatial relations		
Cumulo		Spatial relations		
Pomela		Spatial relations		
Rondo Vario		Geometric objects and shapes/Spatial relations/Length measurement		

Game Name	Numbers and Operations	Geometry	Measurement	Data Processing
Dizios 6+		Geometric objects and shapes/Spatial relations/Geometric patterns		
Mind- Qwirkle 6+		Spatial relations/Geometric patterns		
Mind-Q Bitz 8+		Geometric objects and shapes/Spatial relations		
Pattern Play 3+	Natural numbers Fractions	Spatial relations/Geometric patterns		
Skippity	Natural numbers			
Block Buddies		Spatial relations/Geometric patterns/Geometric objects and shapes		
Pattern Play 3d	Natural numbers/Fractions	Spatial relations/Geometric patterns		
Look Look	Addition with natural numbers/Subtraction with natural numbers			
Pentago		Spatial relations/Basic concepts in geometry		
Triangle Game		Geometric objects and shapes		

Game Name	Numbers and Operations	Geometry	Measurement	Data Processing
Skilled Structures-200		Spatial relations/Geometric objects and shapes		
Tangram Set		Geometric objects and shapes	Weighting	
Pentomino		Geometric objects and shapes	Weighting	
Mangala	Natural numbers/Addition with natural numbers			
Game Name	**Numbers and Operations**	**Geometry**	**Measurement**	**Data Processing**
Reversi		Spatial relations/Basic concepts in geometry		
Colours		Geometric objects and shapes/Spatial relations		
Shapy		Geometric objects and shapes		
Candy		Geometric objects and shapes		
Game Name	**Numbers and Operations**	**Geometry**	**Measurement**	**Data Processing**
Six		Spatial relations/Geometric patterns/Basic concepts in geometry		
Numbers	Addition with natural numbers/Subtraction with natural numbers/Multiplication with natural numbers/Division with natural numbers			

Table 3 shows that the learning outcomes in Spatial Relations, Geometric Objects and Shapes and Natural Numbers sub-learning areas matched the most with game contents. By looking at the table, it is seen that the Zigzag game is related to spatial relations sub-learning area. The Zigzag game aims to sew a button on a shirt by following the instructions for the tip of the scissors on a wood. The instructions are given below, top, side or crosswise compared to the previous button. Therefore, the Zigzag game might be effective to improve the child's location-direction knowledge. It would be beneficial to use the games that match the learning outcomes as activities.

DISCUSSION

In today's education approach, the main aim is to raise individuals who think, create ideas, criticize, continuously develop and quickly adapt to new conditions. Different methods and techniques must be used to learn these thinking skills in the education environment. It is necessary to have active reasoning in mathematics class, where problem-solving, analyzing, generalizing and high-level cognitive skills are used. While it is expected to have reasoning, problem-solving, and critical thinking individuals in the education environment, where these individuals can show these characteristics should be created (Dogan Tas & Yondemli, 2018). Mathematics as a class that can show these characteristics requires various methods in the education environment. One of the methods and techniques activating the students in this process is games. When it is considered that the classical school and class environment has become incredibly dull for the children of the digital age, the studies clearly showed that the intelligence games that enable learning with fun are more attractive.

The magazines published at the beginning of the 1920s included intelligence games to develop children's multiple intelligence. These games ensure children learn cognitive skills such as reasoning, creative thinking and evoking interest (Sarikaya, 2018). The aim was to improve the analysis skill of the children for the same game when the children worked on solving the games in the magazines (Sarici Bulut & Sarikaya, 2018). It is stated that the children who face the problem and find opportunities to solve it at a very young age learn these skills better. For this purpose, games as main applications and intelligence games as sub-applications should be utilized to ensure the children gain problem-solving skills in the education environment. While the teachers argue that intelligence games positively affect mathematical thinking skills, students reported that the games especially developed reasoning, relating and problem-solving skills (Alkas Ulusoy et al., 2017). When the students' views were asked in addition to the teacher, the students expressed positive effects of the games on them. Unlike the teachers, the students reported that their academic success

increased and they socialized with intelligence game activities (Demirel & Yilmaz, 2019). They reported that the mind and intelligence games would contribute to relating, reasoning, mathematical communication and problem-solving skills (Cetin & Ozbugutu, 2020). Teachers expressed their desire to use games in the class because they made the mathematics class more fun and understandable (Usta et al., 2017). Prospective teachers reported that they would include intelligence games during education in the following processes (Savas, 2019). In addition to the cognitive and affected skills that the intelligence games contribute, these games also have a contribution to values education(Sadikoglu, 2017). It is possible to state that such activities both strengthen the social relationships in the family and ensure the gaining of cognitive skills (Alkan & Mertol, 2017). Teachers including geometric intelligence games in this class would develop students' mechanical intelligence (Dokumaci Sutcu, 2018). As a result of Aslan's research, when the findings of the question "What are the problems you have in the Intelligence Games lesson to the teachers participating in the research," the problem of "material deficiency" was determined in the first place(Aslan, 2019). When the existing studies on this topic are considered, the positive effects of mind and intelligence games on the education process can be seen. The effects of intelligence games on some variables are generally investigated. For example, intelligence games can affect attitudes towards geometry, helping and problem-solving beliefs, strategy and reasoning skills, spatial ability, logic and reasoning skills, cognitive skills, motivation, attention and concentration, spatial reasoning skills, mathematics achievement and spatial sense development and mind turning. It has been revealed that the effect on their tasks has been examined (Dokumaci Sutcu, 2021b). Based on the research on mind games, compared with the control group, students in the experimental group who played mind games showed the development of their perception problem-solving ability and performance (Demirel & Yilmaz, 2019).

Organizing the learning environment with criteria that enable intelligence games will benefit the students. In line with the desired targets, the results reveal teachers' necessity to receive education about the intelligence games curriculum (Demir, 2016). With games, it is possible to teach concepts such as shape, colour, size, volume, counting, distance, time and intellectual processes such as classification, ranking, problem-solving, analysis, matching and assessment with fun. Although positive views regarding the contribution of intelligence games to intellectual skills such as problem-solving were reported, the number of research studies on intelligence games must be increased to support this claim.

CONCLUSION AND RECOMMENDATIONS

In this study, the relationships of 32 box games which were showed in Turkish Federation of Mind and Intelligence Games, Intelligence Games Education of Teacher Educator were analyzed in terms of learning outcome, learning and sub-learning area in different grade levels. It is expected that these tables will be helpful for teachers who know the game content to choose the suitable game for the desired skill and learning outcome. It can be seen that most of the learning outcomes for the mathematics class were connected to the game content in the investigated mind and intelligence games. When our desire is to enrich the learning environment with different activities, using intelligence games in the mathematics class will help students to reinforce the subjects. This study might recommend that skills aimed for the mathematics class might be offered based on intelligence games when the curriculum is considered based on activities.

Teachers' efforts to transfer theoretical knowledge to the application are insufficient (Yilmaz, 2019). Therefore, it is believed that teachers receiving necessary applied education to apply intelligence games activities in the learning environment will increase the effect of intelligence games on the students.

Education at the undergraduate level and in-service education will be effective for teachers to gain new generation skills about intelligence games. The most distinct result in the studies is the need to add mind and intelligence games as an elective course to all education levels (Zengin, 2018). In terms of students' thinking skill development, it could be recommended to include intelligence game activities more in the curriculum.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers. 1. Author: Finding the research topic, theoretical framework, consulting the research process, data analysis, writing the discussion part, reporting the research (%50), 2. Author: Related researches, data analysis, report the research (%30), 3. Author: Descriptive analysis and checking tables, reporting the research, language translation (%20). All authors discussed the results and contributed to the final manuscript.

Ethics Committee Approval Information

Research does not require ethics committee approval.

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