Turkish Journal of Teacher Education

Volume 13, Issue 2, 2024 e-ISSN: 2147-5156

Which Intelligence Games are Used in Primary Education? A Systematic Literature Review

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Keywords

Games, Intelligence Games, Primary Education

Article History

Received
Oct 2, 2024
Revised
Dec 18, 2024
Accepted
Dec 23, 2024
Published
Dec 30, 2024

Abstract

This study aimed to conduct a systematic literature review of international research on using intelligence games at the primary education level between 2011 and 2023. We analyzed twenty research articles to determine thematic characteristics, game types, study groups, and key findings. The results indicated that most papers were in 2021, focusing on fifth–8th-grade students, followed by first–4th-grade students, teachers, and teacher candidates. We also found out that geometric-mechanical and strategy games were the most frequently used, with Tangram and Mangala being the most preferred games in their respective categories. In contrast, memory games were the least utilized. The findings demonstrated that intelligence games significantly enhance academic achievement, problem-solving skills, spatial reasoning, and motivation. For example, anagram games improved fluent reading skills, while Mangala contributed to mathematical motivation. Intelligence games fostered positive attitudes toward lessons and encouraged student cooperation. The study highlights challenges such as classroom management issues during intelligence game activities in large classes.

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Introduction

Intelligence games, once primarily considered tools for entertainment, have increasingly found their place in education. These games, defined as activities involving skills such as observation, information gathering, experimentation, and problem-solving (Alessi & Trollip, 2001), are essentially gamified versions of various problems, including real-world challenges (Ministry of National Education [MoNE], 2013). Research has demonstrated that integrating intelligence games into educational settings can enhance students' academic achievement (Baki, 2018; Bottino et al., 2013; Lin et al., 2011; Bottino & Ott, 2006), foster positive attitudes toward lessons (Baki, 2018; Demirel, 2015; Yilmaz, 2019), and improve skills such as reasoning (Bottino et al., 2013; Reiter et al., 2014), problem-solving (Kurbal, 2015; Mestre, 2007; Sahin, 2019), spatial thinking (Demirkaya & Masal, 2017; Yang & Chen, 2010), and creative thinking (Aral et al., 2012; Ott & Pozzi, 2012; Terzi, 2019). Additionally, intelligence games positively influence student communication (Sadikoglu, 2017).

Despite these documented benefits, systematic reviews examining intelligence games' educational role remain limited. In Türkiye, studies presenting a holistic perspective on intelligence games (e.g., Dokumacı Sutcu, 2021; Ozdevecioglu & Soylemez, 2021) highlight their growing importance. Since 2013, the Turkish MoNE has incorporated intelligence games as an elective course for grades 5–8. These games are categorized into reasoning and operation games, memory games, verbal games, strategy games, geometric-mechanical games, and brainteasers. This curriculum has popularized intelligence games' use and stimulated academic research on their implementation in educational contexts (Ozdevecioglu & Soylemez, 2021).

Postgraduate thesis analyses by Ozdevecioglu and Soylemez (2021) and Dokumaci Sutcu (2021) reveal that studies on intelligence games predominantly focus on primary education. According to Tay (2005), preschool and primary education children rely heavily on concrete concepts for learning, with games as essential tools for concretizing abstract ideas (Yiğit, 2007). Thus, examining the role of intelligence games at the primary level is particularly significant. A systematic review of intelligence games in primary education has not yet been conducted internationally, as revealed through major academic databases such as ERIC, Scopus, and Web of Science (WoS). This study addresses this gap by systematically reviewing global research between 2011 and 2023. The review identifies thematic characteristics, research trends, and key findings of studies focusing on intelligence games in primary education. The insights gained will serve as a valuable resource for future research, guiding scholars in tracking developments and exploring new directions in this field.

This study seeks to answer the following research questions:

1. What are the thematic general characteristics of studies on intelligence games in primary education?

a. How are these studies distributed by year?

b. How are these studies distributed across academic databases?

c. What are the purposes for using intelligence games in these studies?

d. What fields of study are explored in the research?

e. What types of games are used in the studies?

f. How do the types of games vary by game categories?

g. How are the studies distributed based on their study groups?

2. What are the key results and suggestions derived from studies on intelligence games in primary education?

Methodology

This study employed document analysis, a qualitative research method that systematically and meticulously analyzes the content of written documents (Wach & Ward, 2013). Document analysis involves examining and interpreting data from various printed and electronic documents to extract meaning, understand the subject matter, and develop empirical knowledge (Corbin & Strauss, 2008; Kiral, 2020; Bag & Kucuk, 2019). This research conducted a systematic literature review to analyze studies on intelligence games implemented in primary education internationally between 2011 and 2023. A systematic literature review systematically compiles, critically evaluates, and synthesizes all relevant studies on a particular topic using scientific strategies to minimize bias (Cook et al., 1995). This approach provides a comprehensive and reliable overview of the existing literature (Bilgic, 2022).

The study's literature search was conducted across three major academic databases: ERIC, Web of Science (WoS), and Scopus. Keywords aligned with the study's objectives were selected from sample games in the Intelligence Games Teaching Programme. Table 1 presents the selected keywords for each database.

Table 1.
Databases and Keywords

Databases	Keywords
ERIC	abstract: "Intelligence games" / abstract: "Mind games" / abstract: Sudoku/abstract: Griddlers / abstract: Kendoku / abstract: Kakuro/abstract: Anagram/abstract: Scrabble/abstract: Tangram/abstract: Polynomino / abstract: Puzzle AND abstract: education /abstract: Jenga/ abstract: "Go game" /abstract: Reversi/abstract: Mancala/ abstract: "Word hunt"/abstract: Battleship/abstract: "Find your partner."
Web of Science	TOPIC: "Intelligence games" / TOPIC: "mind games" / TOPIC: Sudoku AND TOPIC: Education/ TOPIC: Griddlers / TOPIC: Kendoku / TOPIC: Kakuro / TOPIC: Anagram AND Education/ TOPIC: Scrabble / TOPIC: Tangram AND Education/ TOPIC: Polynomino / TOPIC: Puzzle AND education AND game / TOPIC: Jenga/ TOPIC: "Go game" / TOPIC: Reversi/ TOPIC: Mancala/ TOPIC: "Word hunt"/ TOPIC: Battleship/ TOPIC: "Find your partner."
Scopus	"intelligence games" / "mind games" / Sudoku AND Education / Griddlers / Kendoku / Kakuro / Anagram AND Education / Scrabble AND Education / Tangram AND Education / Polynomino / Puzzle AND education AND game / Jenga AND education / "Go game" AND education / Reversi AND education / Mancala AND education / "Word hunt" AND education / Battleship AND Education AND Game / "Find your partner" AND education AND game. Article title, abstract, keywords were searched in the sections.

Data Collection Process

This study searched the selected keywords across three databases—ERIC, Web of Science (WoS), and Scopus—using different criteria for each platform. Specifically:

- For ERIC, the keywords were searched within the studies' abstracts.

- For WoS, the keywords were searched in the topic section, which includes titles, abstracts, and keywords.
- For Scopus, the keywords were searched in the titles, abstracts, and keywords sections.

Each keyword was entered into the databases individually, and the results from these searches formed the initial dataset for the study. The articles retrieved from the initial search results were further screened based on specific inclusion criteria, as follows: (i) Conducted in the field of education, (ii) Utilized games listed in the Intelligence Games Teaching Programme, (iii) Available as open-access full-text articles, (iv) Classified as research articles, (v) Written in Turkish or English, and (vi) Conducted at the primary education level. After applying these inclusion criteria, twenty studies were selected for the final analysis (see attachment). The list of studies included in the research is provided in the attachment.

Data Analysis

Figure 1 summarizes the evaluation process of the data obtained according to the search protocol and inclusion criteria.

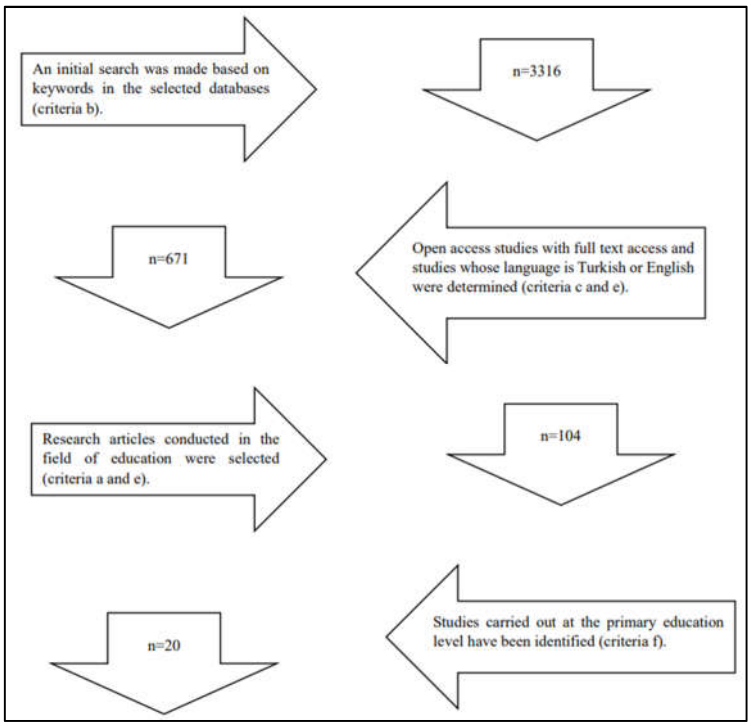

Figure 1. *Evaluation of the Data*

We found that five studies focused on opinion articles, exploring the perspectives of preservice teachers, teachers, and primary school students regarding intelligence games (M1, M4, M7, M9, and M20). 11 studies utilized intelligence games as teaching materials to support educational activities (M2, M5, M6, M8, M10, M11, M13, M14, M17, M18, and M20) and four studies examined the effects of brain teasers on specific skills, such as academic achievement, fluent reading, and problem-solving (M3, M12, M15, and M16).

Findings

This study examined twenty research articles focusing on using intelligence games in education at the international level between 2011 and 2023. The findings were analyzed based on the research questions.

Thematic General Characteristics of the Studies

Distribution of Studies by Year

All 20 studies included in this research were published between 2011 and 2023. As shown in Figure 2, most studies were conducted in 2021, indicating a peak in research interest during this year.

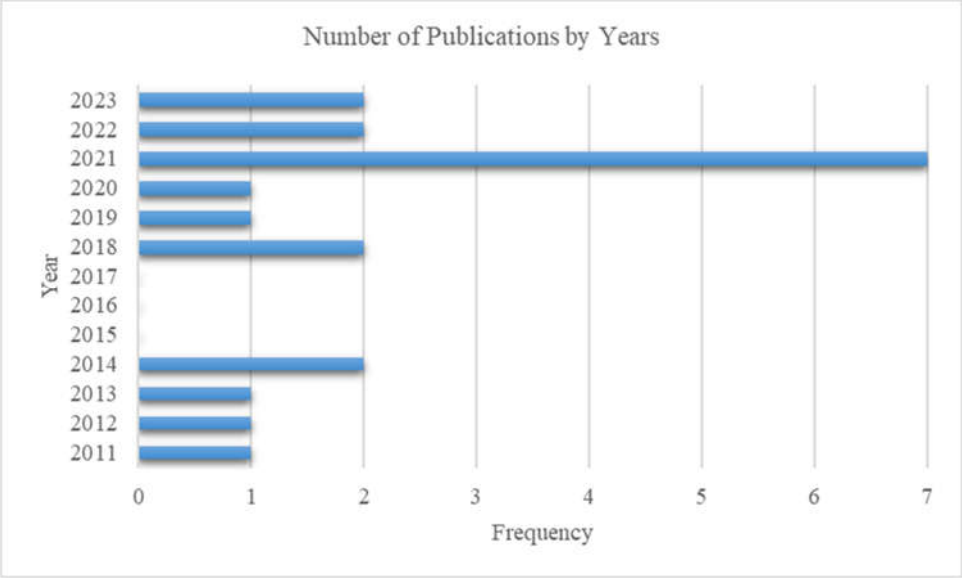

Figure 2. *Distribution of Studies by Database*

Table 3 shows the number of studies included in the research, categorized by the databases in which they were published.

Table 3
Number of Publications by Database

Databases	*Number of Publications*
Scopus	2
Web of Science	3
ERIC	15

As Table 3 shows, ERIC contains the highest number of studies (15), while Scopus has the fewest (2).

Distribution of Studies by Purpose of Using Intelligence Games

Figure 3 presents the purposes of using intelligence games in the studies analyzed. The majority of studies utilized intelligence games as teaching materials.

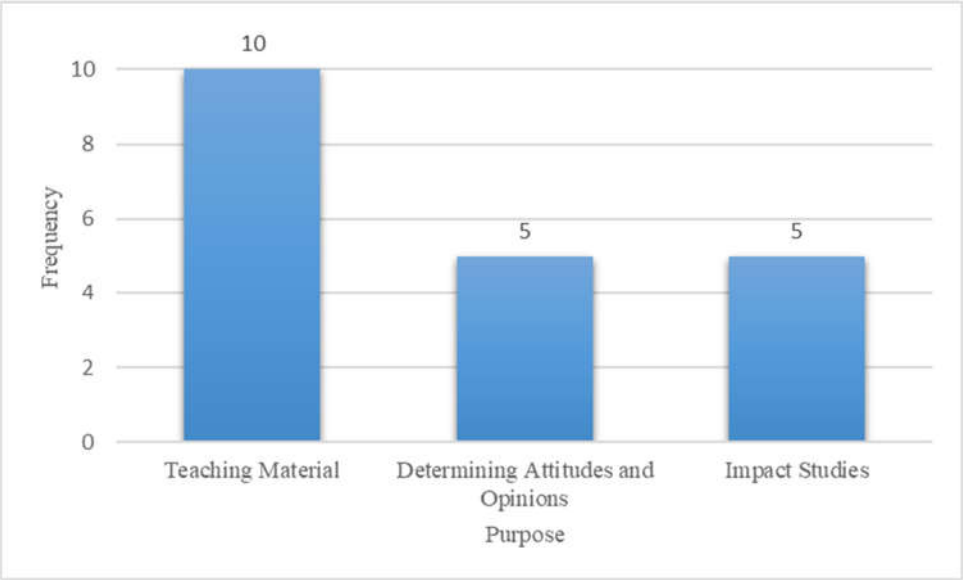

Figure 3. *Distribution of the Studies Included in the Study According to the Purposes of Using Intelligence Games.*

According to the figure: "10 studies used intelligence games as teaching materials. 5 studies focused on determining attitudes and opinions regarding intelligence games. Five studies investigated the impact of intelligence games on skills such as academic achievement, reading fluency, and problem-solving.

Distribution of Studies by Fields of Study

Figure 4 presents the distribution of intelligence game studies conducted at the primary education level according to their fields of study.

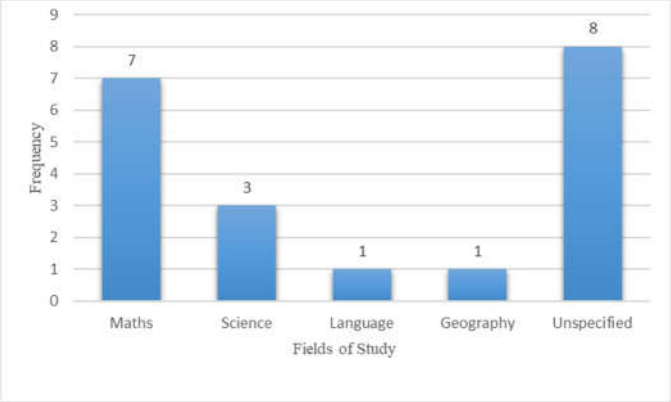

Figure 4. *Distribution of Studies by Fields of Study*

Figure 5 shows the distribution of the games used in the studies according to their types. The most frequently used game types were geometric-mechanical, and strategy games and the least frequently used game types were memory games.

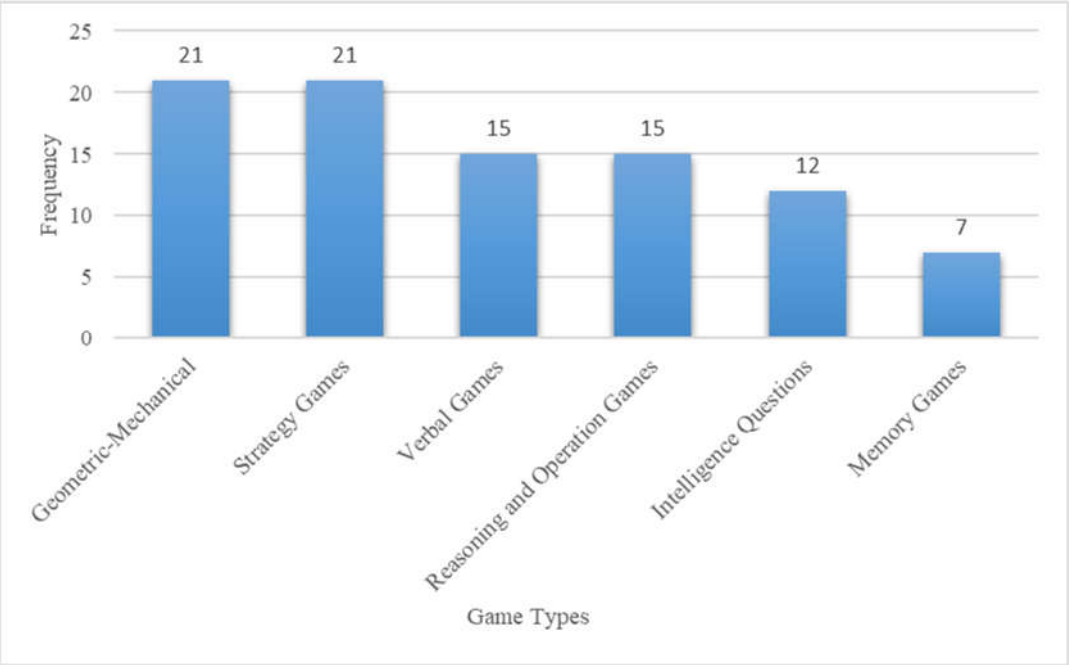

Figure 5. *Distribution of the Studies Included in the Study According to the Game Types Used*

According to Figure 5, the most frequently used game types were geometric-mechanical games and strategy games, and the least frequently used game type was memory games.

Table 4 lists the studies analyzed within the research scope according to the game types they contain.

Table 4
Studies According to Game Types

Game Type	Studies
Geometric-Mechanical Games	M2, M5, M6, M7, M8, M9, M9, M10, M14, M17, M19, M20
Strategy Games	M1, M7, M9, M11, M16, M19, M20
Verbal Games	M1, M4, M7, M12, M13, M15, M20
Reasoning and Operation Games	M7, M9, M18, M19, M20
Intelligence Questions	M1, M7, M20
Memory Games	M7, M19, M20

According to Table 4, it was determined that M7 and M20 included all game types together. This table maps the studies to their respective fields of study, highlighting the prevalence of Mathematics and the underrepresentation of other fields. The analysis reveals that Most studies (8) did not specify the field of study in which intelligence games were applied. Seven studies focused on Mathematics, highlighting its prominence in intelligence games research. Three studies explored the use of intelligence games in science. 1 study focused on Language, and another study addressed Geography.

Distribution of Games by Game Types

The distribution of geometric-mechanical games used in the analyzed studies is presented in Figure 6.

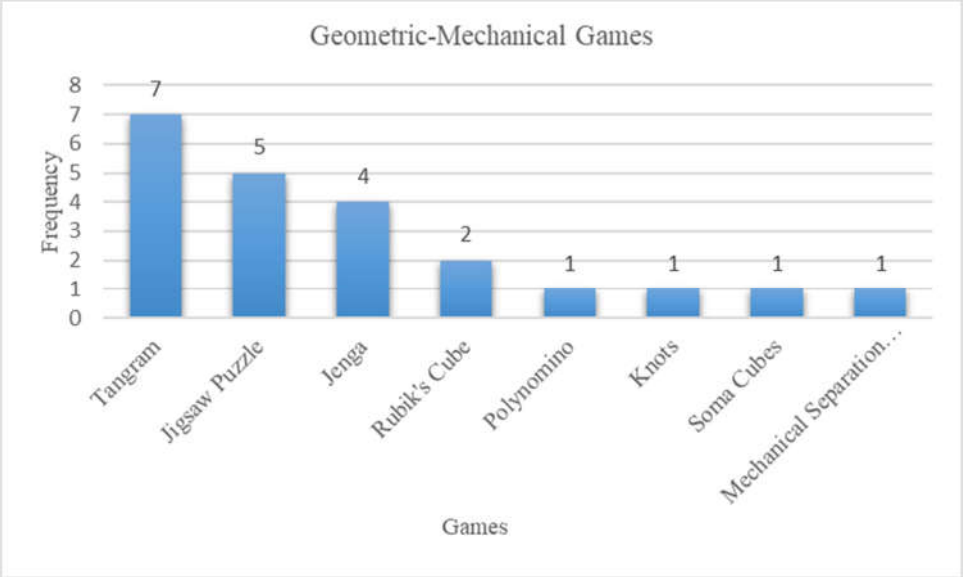

Figure 6. *Distribution of Geometric-Mechanical Games Used*

The analysis highlights that Tangram was the most frequently used game in 7 studies. Jigsaw puzzles and Jenga were also commonly used, appearing in 5 and 4 studies. Other games, such as Rubik's Cube, Polyomino, and Soma Cube, were each used in 1 or 2 studies.

Table 5
Studies with Geometric-Mechanical Games

Geometric-Mechanical Games	Studies
Tangram	M2, M7, M8, M9, M10, M14, M20
Jigsaw Puzzle	M5, M6, M7, M9
Jenga	M7, M9, M17, M20
Rubik's Cube	M7, M20
Polyomino	M7
Knots	M7
Soma Cubes	M7
Mechanical Separation Riddles	M7

The studies incorporating multiple geometric-mechanical games were M7, M9, and M20, with M7 including all geometric-mechanical games analyzed in this review.

The distribution of verbal games utilized in the studies is presented in Figure 7.

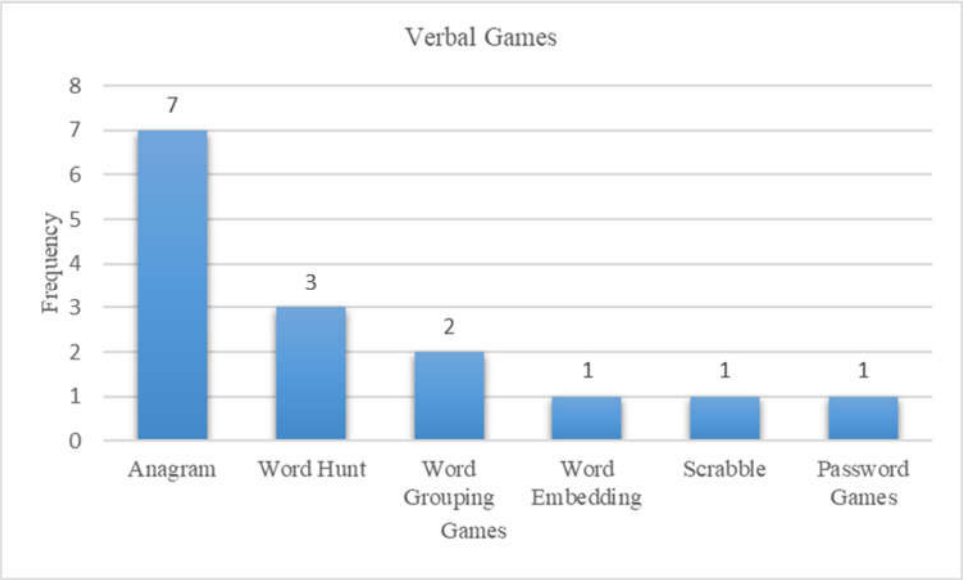

Figure 7. *Distribution of Verbal Games Used*

The findings indicate that Anagram was the most frequently used verbal game in 7 studies. Word Hunt appeared in 3 studies, while Word Grouping Games appeared in 2 studies. Word Embedding, Scrabble, and Password Games were each used in 1 study.

The findings show that the study coded M7 included all six verbal games, making it the most comprehensive study in this category. Studies M1 and M20 also incorporated multiple verbal games, demonstrating a broader approach to utilizing these games within educational contexts (See Table 6).

Table 6
Studies Involving Verbal Games

Verbal Games	Studies
Anagram	M1, M4, M7, M12, M13, M15, M20
Word Hunt	M1, M7, M20
Word Grouping	M1, M7
Word Embedding	M7
Scrabble	M7
Password Games	M7

The distribution of strategy games used in the studies is presented in **Figure 8**.

Figure 8. *Distribution of Strategy Games Used*

The analysis shows that seven different strategy games were included in the research. Mangala was the most frequently used strategy game, appearing in six studies. In contrast, the number guessing game was the least used, appearing in only one study.

The studies that included strategy games are listed in Table 7.

Table 7
Studies Involving Strategy Games

Strategy Games	Studies
Mangala	M1, M7, M9, M16, M19, M20
Battleship	M1, M7, M11
Go	M7, M9, M20
Reversi	M7, M9, M20
Chess	M9, M19, M20
Dama	M7, M9
Number Estimation	M7

Studies M1, M7, M9, M19, and M20 incorporated multiple strategy games, demonstrating a broader exploration of strategy-based activities within educational contexts.

Figure 9 presents the distribution of reasoning and operation games used in the studies. The findings reveal that seven games from this category were included in the analyzed studies. Among these, Sudoku emerged as the most frequently used game in five studies. In contrast, Kendoku and Division were the least used, appearing in one study.

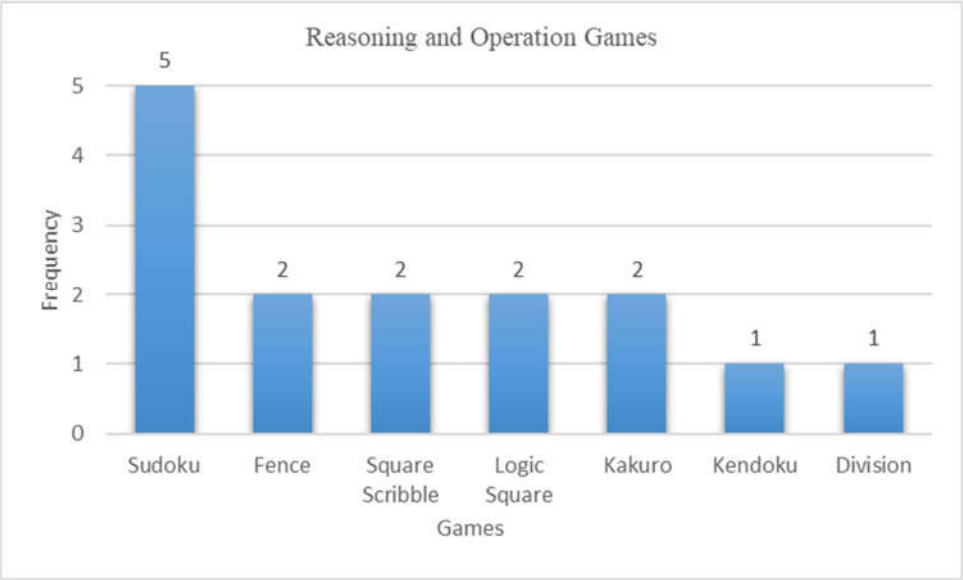

Figure 9. *Distribution of Reasoning and Operation Games Used*

The studies incorporating reasoning and operation games are detailed in Table 8.

Table 8

Studies Involving Reasoning and Operation Games

Reasoning and Operation Games	Studies
Sudoku	M7, M9, M18, M19, M20
Fence	M7, M20
Square Scribble	M7, M20
Logic Square	M7, M20
Kakuro	M7, M20
Kendoku	M20
Division	M7

It was observed that studies M7 and M20 included multiple reasoning and operation games, reflecting a diverse exploration of these game types within educational contexts.

The distribution of intelligence questions used in the studies is presented in Figure 10.

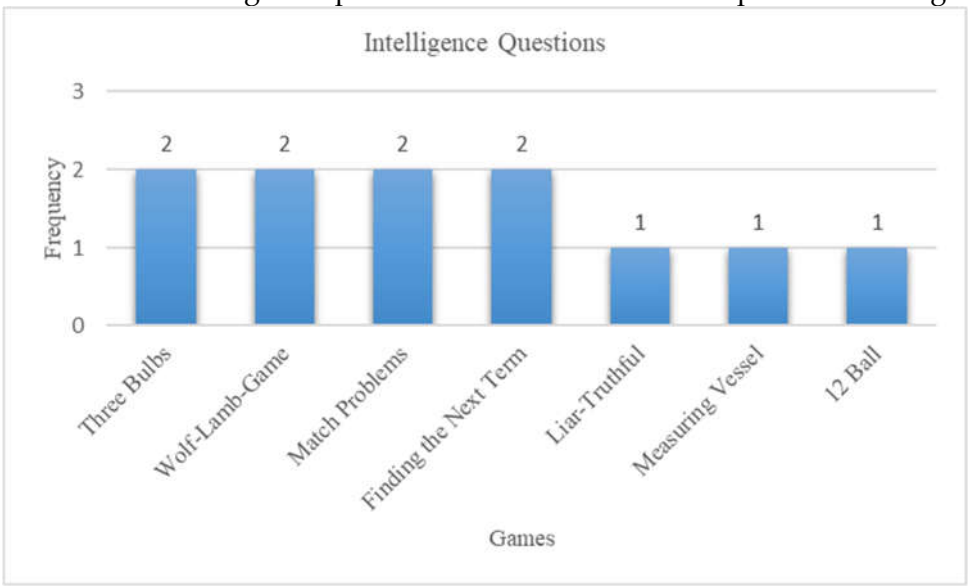

Figure 10. *Distribution of the Intelligence Questions Used.*

The analysis reveals that seven games under the intelligence questions category were used. The Three Light Bulbs, Lamb-Herb Game, Match Problems, and Finding the Next Term games were the most frequently used, appearing in two studies. In contrast, the Liar-Telling, Measuring Vessel, and 12 Ball games were each used in one study.
The studies incorporating intelligence questions are detailed in Table 9.

Table 9
Studies with Intelligence Questions

Intelligence Questions	Studies
Three Bulbs	M1, M7
Wolf-Lamb-Game	M1, M20
Match Problems	M7, M20
Finding the Next Term	M7, M20
Liar-Truthful	M7
Measuring Vessel	M7
12 Ball	M7

Studies M1, M7, and M20 included multiple intelligence questions, showcasing a broader utilization of these games in the educational context.

The distribution of memory games used in the studies is presented in Figure 11.

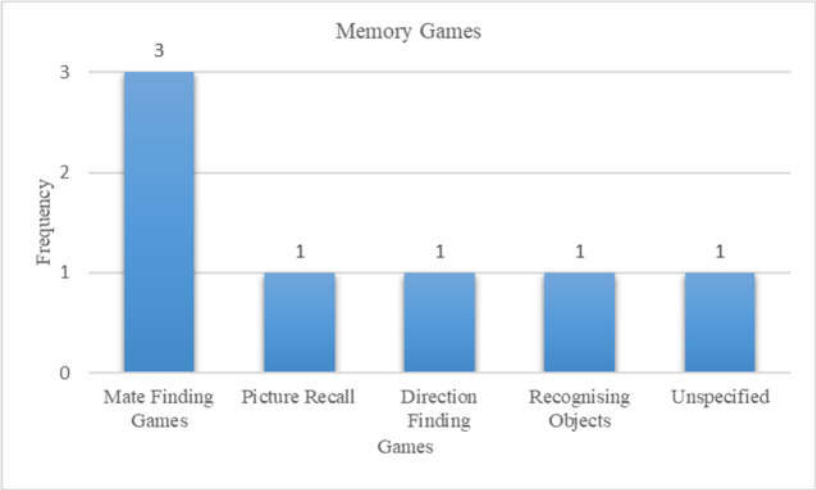

Figure 11. *Distribution of Memory Games Used.*

The analysis shows that five games classified under memory games were utilized. Among these, mate-finding games were the most frequently used, appearing in 3 studies. Other games, such as picture recall, direction finding, recognizing objects, and an unspecified memory game, each appeared in 1 study.

The studies that included memory games are detailed in Table 10.

Table 10
Studies Involving Memory Games

Memory Games	Studies
Mate Finding Games	M7, M19, M20
Picture Recall	M7
Direction Finding	M7

Recognizing Objects	M7
Unspecified	M4

Table 10 details the studies that included memory games. Study M7 incorporated multiple memory games, demonstrating a broader application of these games in educational contexts.

In the systematic literature review, one of the inclusion criteria was that the studies must include games listed in the Secondary School Intelligence Games Curriculum. Therefore, the research questions were explicitly addressed through these games. However, additional games not included in the curriculum were also identified during the screening process. These games were examined and classified based on their types, as detailed in studies by Adalar et al. (2022), Ergün and Gozler (2020), Kula (2021), and Yukselturk et al. (2022). The games identified are as follows:

- Geometric-Mechanical Games: Tetris, Hide and Seek, Quick Cups.
- Verbal Games: Word Associations, Let Us Tell Story Cubes, Deleted Word, Word Tours, Deficient Word, Yes/No, Name-Plant-Animal, Fen Bu, Sos Bu, Word Finder, Word Fill, Crosswords.
- Strategy Games: Corridor, Abalone, Pentago, Target 5, Paradux, Skippity, Riders, Kulami, Nim, Trax, Five Dots, Angry Brother, Surakarta, Round the Corner, Nine Stones, Break the Wall.
- Reasoning and Operation Games: Apartments, ABC Linking, Country-City Placement, Cross Number Puzzle, How Clever Are You, Snakes and Ladders.
- Intelligence Questions: Rebus.
- Memory Games: Tick-Tock Boom, Q-Bitz, LookLook, Dobble, Detective, Practice Cups.

These findings highlight the diverse range of games examined across studies and emphasize their varied classification into different game types.

Distribution of Studies by Study Groups

Figure 12 presents the distribution of studies on intelligence games in primary education, categorized by study groups. The findings indicate that the 5th–8th grade group had the highest number of studies, with 9. This was followed by the 1st–4th grade group, with seven studies, while teacher candidates and teachers were the focus in 3 studies.

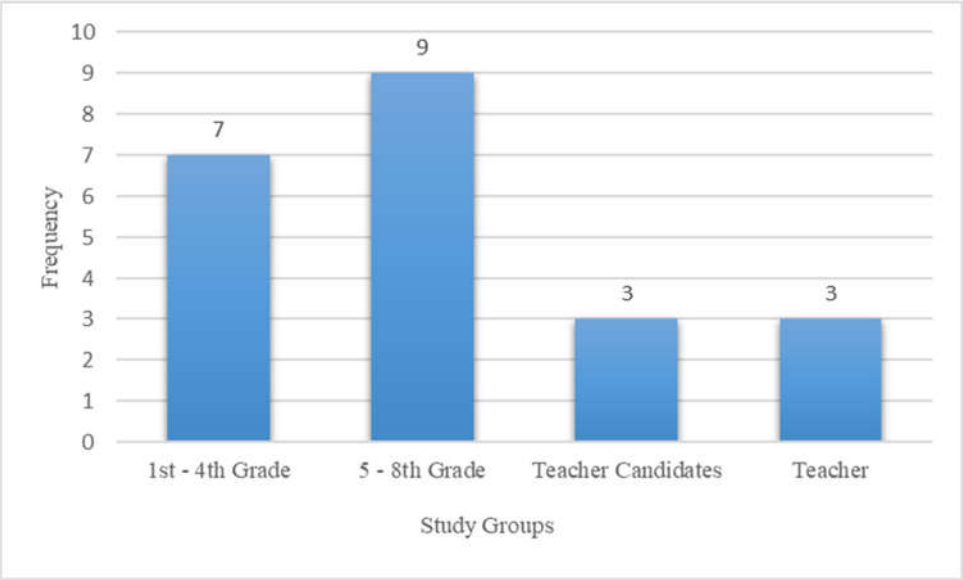

Figure 12. *Distribution of the Studies According to the Study Groups*

Table 11 details the studies analyzed within the research scope according to their respective study groups. Notably, studies M4 and M11 were conducted with more than one group.

Table 11
Studies by Study Groups

Study Group	Studies
1st–4th grade	M5, M14, M4, M3, M13, M8, M6
5th–8th grade	M11, M15, M2, M16, M12, M18, M10, M17, M19
Teacher Candidates	M11, M1, M20
Teacher	M4, M7, M9

This analysis highlights that research primarily focuses on 5th–8th grade students, followed by younger students and educators. Studies conducted with multiple groups, such as M4 and M11, further emphasize the diverse application of intelligence games in educational settings.

Discussion and Conclusion

The impact studies' results indicate that using Anagram, one of the verbal games, in primary education lessons increased students' self-efficacy and academic achievement while improving their fluent reading skills (M12, M15). Mangala, a strategic game, enhanced students' mathematical motivation (M16). Additionally, the integration of intelligence games into lessons at the primary education level improved students' visual perception skills (M3).

It was observed that the primary purpose of using intelligence games was their role as teaching materials, compared to studies focusing on attitudes, opinions, or impact. Tangram, a geometric-mechanical game, developed students' spatial skills and creativity (M8, M10, M14). Furthermore, Tangram improved students' abilities to understand, develop, and solve problems (M2). Similarly, including jigsaw puzzles in lessons helped students develop positive attitudes toward the course, boosted their self-confidence, and enabled them to perform arithmetic operations more effectively (M5, M6). Sudoku, a reasoning and operation game, positively contributed to students' understanding of lesson concepts (M17). Battleship,

a strategy game, fostered cooperation among students and encouraged the development of positive attitudes toward the course (M11). Additionally, a verbal game-based achievement test suggested that intelligence games could bring innovation to educational measurement tools (M13).

Findings from opinion studies revealed that the most preferred games among students were anagram and memory games (M4), while teachers favored chess and Mangala (M9). It was reported that intelligence games could be effectively used in lessons to capture students' attention, enhance their motivation, and support their communication skills (M1, M18). Furthermore, students who engaged in intelligence games improved academic achievement, problem-solving abilities, and reasoning skills (M1, M9, M18). However, challenges such as noise, unauthorized speech, and discipline problems during intelligence game lessons were identified, particularly in large classrooms, which made classroom management difficult (M9).

The recommendations proposed in the studies analyzed align closely with each other. For studies examining intelligence games as teaching materials or in impact studies, researchers suggested conducting similar studies across different educational levels with larger sample sizes. In opinion studies, it was recommended that intelligence games (M1, M4) be digitized, game rooms in schools should be established to address material deficiencies (M7), and student clubs for intelligence games should be created. Additionally, organizing competitions related to intelligence games was suggested to increase student participation and interest (M9).

Based on these studies, we conducted a systematic literature review of international research on intelligence games at the primary education level between 2011 and 2023, analyzing 20 research articles. The findings revealed that most studies were published in 2021, while no studies were identified in 2015, 2016, and 2017. This pattern may be attributed to introducing intelligence games as an elective course in 2013.

When categorized by fields of study, most studies did not specify a particular field. However, research focused primarily on mathematics, science, Language, and geography among the specified fields. The most commonly used game types were geometric-mechanical and strategy games, while memory games were the least explored. The most preferred games in each category were as follows: “Geometric-Mechanical Games: Tangram, Verbal Games: Anagram, Strategy Games: Mangala, Reasoning and Operation Games: Sudoku, Memory Games: Mate-Finding Games, Intelligence Questions: Three Light Bulbs, Wolf-Lamb Game, Match Problems, and Finding the Next Term.

When analyzed according to study groups, it was found that most research targeted 5th–8th-grade students, followed by studies with first–4th-grade students, teachers, and teacher candidates. Notably, no studies included families of primary school students, which presents a potential research gap. Engaging families could enhance students’ experiences with intelligence games and provide additional guidance for their application.

The findings also showed that using intelligence games as teaching materials yielded positive educational outcomes. For example, Anagram improved students' fluent reading skills and academic achievement (see M12, M15), Mangala contributed to students’ mathematical motivation (see M16), Tangram enhanced spatial skills and problem-solving abilities (see M8, M10, M14), Jigsaw Puzzles and Battleship fostered positive attitudes toward lessons and encouraged cooperation among students (see M5, M6, M11).

Studies investigating students' and teachers' attitudes and opinions revealed that students favored anagram and memory games, while teachers favored chess and Mangala.

Despite these benefits, challenges such as noise, unauthorized speech, and discipline issues in large classrooms were reported, making classroom management more complex (see M9).

When compared to domestic studies, such as those conducted by Ozdevecioğlu and Hark Soylemez (2020) and Dokumaci Sutcu (2021), it was noted that domestic research primarily examines the effects of intelligence games on various variables. In contrast, international studies tend to focus more on their use as teaching tools. Nonetheless, findings from both contexts align in highlighting the positive effects of intelligence games on skills such as problem-solving, critical thinking, spatial reasoning, and academic success (Bottino & Ott, 2006; Casey et al., 2022; Demirkaya & Masal, 2017; Mestre, 2007; Reiter et al., 2014).

Based on the results, we propose the following suggestions;

Research Scope: Future studies should explore the effects of intelligence games on different variables and include the opinions of students, teachers, prospective teachers, and families to provide a holistic perspective.

Field of Study: While most studies focus on mathematics, science, and Language, associating intelligence games with new fields such as art, social studies, or technology can enrich learning environments.

Education Levels: Similar studies can be extended to different education levels (e.g., secondary or high school) to determine the impact of intelligence games across age groups.

Game Types: Future research could focus on less-explored game types, such as memory games, and assess their impact on specific learning outcomes.

Digital Platforms: Transferring intelligence games to digital platforms can enhance accessibility and engagement, particularly in online or hybrid learning environments.

Infrastructure Development: Establishing game rooms in schools, creating student clubs, and organizing competitions can foster interest and motivation among students.

Curriculum Development: Investigating the use of games beyond the current curriculum can provide insights for curriculum updates and ensure broader implementation of intelligence games.

By addressing these suggestions, future research and educational initiatives can maximize the potential of intelligence games, contributing to both academic success and skill development among primary school students.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

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Attachment. Papers Included in the Research

Code	*Researcher/s - Research Year*	*Paper Name*
M1	Adalar et al., 2022	Teaching social studies with mind and intelligence games: A study of teacher candidates' views and experience
M2	Afriansyah & Arwadi, 2021	Learning trajectory of quadrilateral applying realistic mathematics education: origami-based tasks
M3	Altun, 2019	The effects of mind games and games containing physical activity on attention and visual perception levels of primary school students
M4	Anđić et al., 2018	A comparative analysis of the attitudes of primary school students and teachers regarding the use of games in teaching
M5	Chen et al., 2012	Collaborative cross-number puzzle game to enhance elementary students' arithmetic skills
M6	Cheng-Yu Hung et al., 2014	An interactive game approach for improving students' learning performance in multi-touch game-based learning
M7	Ergun & Gozler, 2020	Analysing of the opinion of teachers conducting mind game courses for the applicability of mind games
M8	Judd & Klingberg, 2021	Training spatial cognition enhances mathematical learning in a randomized study of 17,000 children.
M9	Kula, 2021	Mind games with the views of classroom teachers
M10	Lin et al., 2011	The impact of using synchronous collaborative virtual tangram in children's geometric
M11	Montejo Bernardo & Fernández González, 2021	Chemical battleship: Discovering and learning the periodic table playing a didactic and strategic board game
M12	Panagiotakopoulos & Sarris, 2013	"Playing with words": Effects of an anagram solving game-like application for primary education students
M13	Saglam et al., 2021	Development of verbal games achievement test of primary school 3rd grade science lesson "let's know about substance" unit.
M14	Siew & Chong, 2014	Fostering students' creativity through van hiele's 5 phase-based tangram activities
M15	Uchida et al., 2018	An induced successful performance enhances student self-efficacy and boosts academic achievement
M16	Master & Cagan, 2021	The effect of mangala, the intelligence game taught by distance education, on the mathematical motivations and problem-solving skill levels of 6th-grade students
M17	Wehmanen et al., 2023	Impact of health behaviors on community well-being and resilience: teaching K12 students with Jenga!
M18	Wijaya et al., 2021	A learning trajectory for probability: A case of game-based learning
M19	Yaman et al., 2023	Secondary school students' cognitive structures regarding educational games
M20	Yukselturk et al., 2022	Preservice teachers' views about the use of mind and intelligence games in education