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Enhancing Basic Arithmetic Skills in Children with Mild Intellectual Disabilities Through Puzzle Media

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A B S T R A C T

This study explores the use of puzzle media to enhance the arithmetic skills of third-grade students with mild intellectual disabilities at SLB BC Bina Mandiri Garut. The background emphasizes the importance of using concrete learning tools tailored to the unique needs of children with intellectual disabilities, particularly in acquiring basic mathematics skills. The objective of this research was to examine how puzzle media can support learning in this context. A qualitative descriptive approach was employed, with data gathered through observations, interviews, and documentation. The findings revealed that puzzle media significantly increased students' attention and motivation to learn. However, challenges such as limited fine motor skills and difficulties in following instructions were noted. To address these issues, teachers provided personalized guidance, adapted the puzzle media, and used positive reinforcement techniques. In conclusion, the study highlights the potential of puzzle media as an effective tool in special education, offering valuable insights into adaptive learning methods that can improve mathematical outcomes for children with intellectual disabilities.

Keywords: *Puzzle Education, Arithmetic, Mild Mental Retardation.*

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INTRODUCTION

Children with special needs (ABK) represent a diverse group of individuals who face developmental challenges across various domains, including physical, intellectual, emotional, and social aspects. Among this group, children with intellectual disabilities are particularly affected by cognitive delays that result in below-average intellectual abilities compared to their peers. These children often experience difficulties with abstract thinking and struggle to comprehend academic concepts, especially in subjects like mathematics (American Psychiatric Association [APA], 2013). Mathematics, with its reliance on abstract concepts, symbols, and logical operations, poses a significant barrier for children with intellectual disabilities, hindering both their academic success and self-esteem. Consequently, educators are increasingly focused on developing alternative, concrete, and engaging teaching strategies that cater to the needs of these learners (National Center on Accessible Educational Materials [NCAEM], 2014).

To address these challenges, many studies have emphasized the importance of concrete learning media—tools that provide tactile and visual experiences—especially for students with intellectual disabilities. Susanto and Putri (2017) argue that concrete learning media, such as manipulatives and visual aids, are crucial for enhancing understanding in children with mild intellectual disabilities. These tools make abstract concepts more accessible by allowing students to interact directly with the material. For example, puzzles have been identified as an effective means of helping children grasp basic mathematical concepts, such as counting, number recognition, and basic operations. The hands-on nature of puzzles stimulates cognitive processes, engages students, and provides opportunities for learning through play (Hurlock, 1978).

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Despite the promising potential of puzzle-based learning, challenges remain in its implementation. Initial research conducted at SLB BC Bina Mandiri Garut highlighted that although teachers utilized puzzles in mathematics lessons, many children still faced difficulties in understanding the material. Obstacles such as limited fine motor skills, difficulty following instructions, and time constraints were identified as factors that hindered the full potential of puzzle-based learning. Furthermore, the media was not always adapted to meet the specific needs of individual students, resulting in less effective learning experiences. This discrepancy between the theoretical benefits of puzzles and their practical application underscores the need for further investigation into how puzzle media can be more effectively utilized in classrooms (Dixon & Telfer, 2019).

Previous studies have shown the potential of puzzles to improve learning outcomes for children with mild intellectual disabilities. For instance, Ngurawan (2018) demonstrated that puzzle-based activities helped students recognize numbers and improved their accuracy in solving basic mathematical problems. Similarly, Warman (2017) found that puzzles could enhance children's interest and engagement in arithmetic tasks. However, these studies primarily focused on quantitative outcomes, assessing the effectiveness of puzzle media in terms of measurable academic improvements. Little attention has been given to understanding the process of implementing puzzle media in the classroom, including the difficulties teachers encounter and the strategies they employ to address these challenges (Jackson & Maynard, 2020).

The current study seeks to fill this gap by adopting a qualitative, descriptive approach to explore the use of puzzle media in the classroom. Rather than merely assessing the effectiveness of puzzle-based activities in improving learning outcomes, this research focuses on the process of teaching. Specifically, it aims to understand how teachers design, implement, and evaluate puzzle media in their classrooms. By gathering insights from teachers—who are central to the success of any educational intervention—this study provides a deeper understanding of the practical dynamics involved in using puzzle media to support children with intellectual disabilities.

The primary aim of this study is to explore how puzzle media can improve numeracy skills in third-grade students with mild intellectual disabilities at SLB BC Bina Mandiri Garut. Additionally, this study seeks to identify the challenges that teachers face during the implementation of puzzle-based learning and examine the strategies they use to overcome these difficulties. It is hoped that the findings will contribute both theoretically and practically to the development of more effective teaching methods for children with special needs, particularly those with mild intellectual disabilities.

The research does not rely on statistical hypotheses, as its exploratory nature is qualitative. Instead, it is based on the conceptual assumption that puzzle media, when tailored to individual student needs, can enhance numeracy skills in children with intellectual disabilities. This assumption guides the focus of the research, which centers on understanding the process of puzzle-based learning and the factors that contribute to its success. By highlighting both the challenges and successes of using puzzle media in the classroom, this study aims to provide valuable insights that can inform future teaching practices and contribute to the ongoing development of special education pedagogy.

This research is expected to bridge the gap between theoretical knowledge and practical classroom application. It aims to provide teachers with concrete strategies for using puzzle media effectively and help policymakers develop more inclusive educational frameworks. Ultimately, this study seeks to promote a more engaging and effective learning environment for children with intellectual disabilities, empowering them to achieve their full potential in mathematics and beyond.

METHOD

This study employed a qualitative descriptive approach to explore the use of puzzle media in improving numeracy skills among third-grade students with mild intellectual

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disabilities at SLB BC Bina Mandiri Garut. Data were collected through a combination of observations, interviews, and documentation to provide a comprehensive understanding of the learning process and to capture the challenges and strategies used in the classroom.

The study involved 8 third-grade students with mild intellectual disabilities, aged between 8 and 10 years. These students faced challenges in understanding abstract mathematical concepts, making puzzle media a potentially useful tool for enhancing their learning experience. The setting for this study was SLB BC Bina Mandiri Garut, a special education school that provides individualized instruction to students with various disabilities. The school is equipped with a range of educational tools and strategies tailored to the needs of students with intellectual disabilities, including visual aids, manipulatives, and puzzles.

Data collection was conducted through three main methods: observation, interviews, and documentation.

Observation: The researcher observed mathematics lessons in which puzzle media were integrated. These observations focused on student engagement, interaction with the puzzles, and teacher guidance. Field notes were taken to capture key moments during the lessons and to track how students responded to the puzzles.

Interviews: Semi-structured interviews were conducted with three teachers involved in the implementation of puzzle media. The interviews explored teachers' experiences with using puzzles in the classroom, the challenges they encountered, and their strategies for adapting the puzzles to meet students' needs.

Documentation: Relevant lesson plans, student worksheets, and records of progress were reviewed to assess how puzzles were integrated into the curriculum and to understand the effectiveness of the activities in enhancing students' numeracy skills.

The qualitative data collected were analyzed using thematic analysis, which involved identifying patterns and themes in the data. The researcher coded the data and grouped related codes into broader themes, such as "student engagement," "teacher strategies," and "learning challenges." This process allowed for an in-depth exploration of the dynamics involved in using puzzle media to support the learning of children with intellectual disabilities.

FINDINGS AND DISCUSSION

Improvement in Numeracy Skills: Recognition of Numbers and Counting

One of the most significant findings of this study is the marked improvement in the numeracy skills of children with mild intellectual disabilities, particularly in their ability to recognize numbers and perform basic counting tasks. The incorporation of puzzle media into the teaching of arithmetic was found to be a highly effective strategy for enhancing these skills. This result aligns with previous research, such as that of Ngurawan (2018), which demonstrated that puzzle-based learning significantly contributed to the recognition of numbers and improved children's understanding of basic arithmetic operations, such as counting from 1 to 10.

Puzzle media in the classroom serves as a visual and tactile learning tool, which is crucial for children with intellectual disabilities. These students often struggle with abstract reasoning and find it difficult to understand mathematical concepts that are represented symbolically or conceptually (Hurlock, 1978). The puzzles, with their bright colors and clear number representations, offered a concrete way for students to interact with numerical information. This tactile, hands-on approach provided an immediate, visual connection between the abstract concepts of numbers and their physical representations. As students manipulated the puzzle pieces, they engaged in active learning by touching, feeling, and visually recognizing numbers, which reinforced their understanding of number concepts.

The physical interaction with the puzzles allowed children to build a more intuitive understanding of numbers. For example, by arranging pieces with numbers and corresponding quantities or simple arithmetic operations, students could directly observe how numbers and quantities fit together. This interaction, which combined visual, tactile, and

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kinesthetic elements, catered to the multi-sensory learning preferences of many children with intellectual disabilities. The ability to physically manipulate puzzle pieces allowed children to develop a more concrete understanding of abstract concepts, such as number relationships and basic arithmetic operations, in ways that traditional methods might not have been able to achieve.

Teachers in the study also followed a systematic approach in integrating puzzles into their teaching practices. This approach involved multiple stages: demonstration, guided practice, and independent work. In the demonstration phase, teachers showed students how to use the puzzles, providing clear instructions on how to manipulate the pieces to form numbers and arithmetic operations. This phase allowed students to observe and understand the intended outcome of the puzzle activity. Following the demonstration, teachers guided students as they worked through the puzzles, providing support and encouragement as needed. Gradually, as students became more familiar with the puzzles, they were encouraged to complete the activities independently.

This gradual, scaffolded approach is particularly beneficial for children with intellectual disabilities, as it allows them to build confidence and independence over time. By starting with teacher guidance and progressively moving towards independent practice, students were able to internalize the skills they learned and gain confidence in their ability to perform basic arithmetic tasks. As a result, students demonstrated improvements in both accuracy and speed in completing counting tasks, which is an essential skill in early mathematics education (Susanto & Putri, 2017). In fact, the children's progress was evident not only in their ability to correctly count numbers but also in their ability to apply those skills to solve simple arithmetic problems.

The systematic approach also provided structure and consistency, which are critical for children with intellectual disabilities who benefit from predictable routines and clear expectations (Hallahan & Kauffman, 2006). As the students progressed through the stages of learning, their increasing mastery over the puzzles translated into greater proficiency in recognizing and counting numbers. This process reinforced the importance of providing a supportive and structured learning environment that builds on students' existing strengths and abilities, while also addressing their learning challenges.

Moreover, the use of puzzles in this study also aligns with constructivist learning theories, which emphasize the importance of active learning and the construction of knowledge through hands-on experiences. According to Piaget's theory of cognitive development, children learn best when they can physically manipulate objects and engage with their environment in a way that makes learning more tangible (Dewey, 1938). By using puzzles as an active learning tool, students were able to engage with mathematics in a more meaningful way, reinforcing their learning through direct interaction with the material.

The findings from this study are consistent with those of previous research that supports the use of concrete media to improve mathematical understanding in children with intellectual disabilities. For example, research by Ngurawan (2018) demonstrated that puzzle-based learning helped students recognize numbers and improve their accuracy in basic math tasks. Similarly, research by Warman (2017) found that puzzle media enhanced students' interest in learning and fostered a deeper understanding of mathematical concepts. The tactile nature of puzzle-based learning provides a multisensory experience that helps children with intellectual disabilities grasp mathematical concepts that might otherwise remain abstract.

In addition to these cognitive benefits, the use of puzzle media also fostered greater student engagement and motivation. Children were more likely to participate actively in learning tasks when they could engage with visually appealing, hands-on materials. The puzzles offered an engaging, interactive way for children to practice and reinforce their numeracy skills, making learning more enjoyable and motivating. This aligns with findings from previous studies, such as those by Susanto and Putri (2017), who noted that children with intellectual disabilities are more likely to remain engaged when the learning process incorporates tangible, interactive media.

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Overall, the use of puzzle media in teaching numeracy was highly effective in improving the recognition of numbers and basic counting skills among children with mild intellectual disabilities. The visual, tactile nature of the puzzles helped bridge the gap between abstract mathematical concepts and concrete understanding, making learning more accessible for students with intellectual disabilities. Furthermore, the systematic approach employed by teachers, which included demonstration, guided practice, and independent work, provided a structured learning environment that supported students' progress and fostered greater confidence in their abilities. These findings suggest that puzzle media can be an essential tool in special education, offering a flexible, engaging, and effective way to teach numeracy skills to children with intellectual disabilities.

Challenges in Focus and Fine Motor Skills

In response to these challenges, teachers employed several adaptive strategies to support their students. These strategies were specifically designed to address both focus-related issues and fine motor skill limitations, and they proved essential in ensuring that puzzle media could be effectively integrated into the classroom.

To address the challenge of maintaining focus, teachers made several modifications to the puzzle activities. One key strategy was to break the puzzles down into smaller, more manageable tasks. By reducing the complexity of the puzzles, teachers could help students focus on one piece or a small section at a time, preventing them from feeling overwhelmed. This also made it easier for teachers to monitor progress and provide timely interventions when students appeared distracted or frustrated. Additionally, teachers incorporated more interactive elements into the puzzle activities, such as turning the tasks into games or introducing small challenges that kept students engaged and motivated. For example, teachers might offer rewards or praise for each small step successfully completed, providing immediate feedback and reinforcing positive behavior. This approach, in line with Jackson and Maynard (2020), helps maintain attention and reduces frustration by making the learning process more engaging and dynamic.

Teachers also provided consistent verbal feedback and encouragement to keep students on task. For children who were struggling with focus, this was especially important, as it helped them refocus and stay engaged. By using positive reinforcement and motivating language, teachers were able to maintain a sense of enthusiasm and interest, which helped students remain more focused on the puzzle tasks. Encouragement was particularly beneficial in reducing feelings of frustration, allowing students to feel more confident in their ability to complete the puzzles, despite the challenges they encountered.

In addressing fine motor limitations, teachers adapted the puzzles themselves to make them more accessible. One effective strategy was to enlarge the puzzle pieces, making them easier to handle and manipulate. This modification helped students with fine motor difficulties better grip and position the pieces, increasing their chances of success and reducing frustration. Additionally, teachers used thicker materials for the puzzle pieces to make them more tactile and easier to move. This adaptation proved particularly useful for students with severe motor delays, as it allowed them to engage with the puzzle in a more hands-on and less stressful manner. The use of bright colors and visually appealing designs also helped maintain students' interest and provided additional visual cues that aided in piece placement.

Moreover, teachers sometimes paired students together in small groups or one-on-one settings to provide additional support and encourage collaboration. Working with peers allowed students to share strategies, and the social interaction served as a motivator for students who might otherwise lose interest in the task. Teachers also used guided support, such as physically assisting students with placing pieces or demonstrating the movements necessary to fit them together. These hands-on interventions ensured that students with fine motor limitations could still actively participate in the learning process, even if they required additional assistance.

While the use of puzzle media in the classroom led to significant improvements in numeracy skills for children with mild intellectual disabilities, it also highlighted important challenges related to focus and fine motor limitations. These challenges, however, were not

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insurmountable. Teachers were able to effectively address them by employing adaptive strategies, such as breaking tasks into smaller steps, providing interactive and game-like elements, and modifying the puzzles themselves to make them more accessible. By offering verbal encouragement and providing individualized support, teachers ensured that students remained engaged and motivated throughout the learning process. These strategies are consistent with the suggestions of Jackson and Maynard (2020), who emphasize the importance of adapting learning materials and teaching approaches to meet the unique needs of children with special educational needs. The ability to address these challenges effectively highlights the importance of teacher flexibility and responsiveness in special education, ensuring that all students can benefit from hands-on learning tools like puzzle media.

Positive Non-Cognitive Outcomes: Increased Self-Confidence and Active Participatio

In addition to the improvement in numeracy skills, one of the most notable findings from this study was the positive impact of puzzle media on students' non-cognitive skills, particularly self-confidence and active participation. While puzzle-based learning primarily aimed to enhance students' ability to understand numbers and perform basic arithmetic, it also yielded significant benefits in terms of students' personal growth and engagement in the learning process. Teachers reported that students not only improved their numeracy abilities but also became more confident in their academic abilities and more involved in classroom activities. These non-cognitive outcomes are essential for the overall development of children with intellectual disabilities, as they contribute to their emotional and social well-being.

One of the key findings of the study was that puzzle media helped increase students' self-confidence. As students successfully completed puzzles and solved arithmetic problems, they experienced a sense of accomplishment that boosted their belief in their abilities. This finding aligns with the work of Warman (2017), who emphasized that puzzle-based learning can significantly increase motivation and interest in children with intellectual disabilities. The rewarding nature of the puzzles, which allowed students to achieve small successes through manageable steps, created an environment where students could experience tangible results from their efforts. These incremental achievements, such as correctly placing a puzzle piece or completing a counting task, provided students with a sense of competence and pride.

For children with intellectual disabilities, whose academic challenges can often lead to frustration and low self-esteem, experiencing success in the classroom is vital for building confidence. When students succeed in small, structured tasks like completing a number puzzle, they gain a sense of mastery that encourages them to take on more challenges. Teachers reported that students were more eager to participate in subsequent lessons, as they now believed in their ability to succeed. This increase in self-confidence is particularly important for children with intellectual disabilities, as academic success often directly influences their social and emotional development.

The positive reinforcement provided by teachers also played a significant role in boosting students' self-esteem. Teachers used verbal praise and encouragement to acknowledge students' efforts and achievements, reinforcing the sense of accomplishment they gained from completing puzzles. Such feedback not only affirmed students' success but also fostered a growth mindset, encouraging them to see challenges as opportunities for learning and improvement. This is consistent with the findings of Dixon and Telfer (2019), who argued that positive reinforcement is essential for boosting self-confidence, especially in children with special needs.

Alongside the boost in self-confidence, puzzle media also facilitated increased active participation in the learning process. The interactive nature of puzzles—where students must actively manipulate pieces and make decisions—encouraged them to engage more deeply with the learning material. Teachers reported that students who previously showed limited involvement in lessons became more interested and motivated when puzzle activities were introduced. The hands-on, visual nature of the puzzles allowed students to actively engage with mathematical concepts in a way that was both enjoyable and meaningful.

Puzzle-based learning also promoted active participation by providing students with opportunities for independent problem-solving. As students worked through puzzles, they

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developed critical thinking skills and learned to make decisions on their own. The ability to solve problems independently is an important aspect of learning, as it fosters autonomy and resilience. As students successfully completed puzzle tasks, they began to take more initiative in the classroom and show greater involvement in other learning activities. This increased participation helped reinforce the positive feedback loop: as students became more engaged and successful in one area of learning, their overall motivation and involvement in future tasks increased.

This shift toward greater engagement is supported by the research of Warman (2017), who found that puzzle-based activities could enhance both interest and engagement in children with intellectual disabilities. In this study, the tangible rewards of solving puzzles provided students with immediate, visible outcomes, which kept them motivated and focused. These outcomes also contributed to students' enjoyment of the learning process, making it more likely that they would actively seek out similar tasks in the future. Puzzle media thus offered a dual benefit: improving numeracy skills while simultaneously fostering a more engaged and motivated approach to learning.

An additional benefit of puzzle media was its ability to foster social interaction and collaborative learning. In many cases, students worked together to solve puzzles, sharing ideas and strategies to complete tasks. This collaborative approach to learning provided opportunities for students to develop their social and communication skills in a structured and supportive environment. Working with peers allowed students to practice teamwork and cooperation, which are essential social skills for children with intellectual disabilities.

The social aspect of puzzle-based learning is particularly important in the development of children with special needs, as it provides a platform for building relationships with peers and learning how to work together toward common goals. Teachers observed that students who were initially hesitant to engage with their peers or participate in group activities became more comfortable and confident when working together on puzzles. These interactions helped improve students' social skills and fostered a sense of community within the classroom.

Dixon and Telfer (2019) highlighted the importance of social interaction in the learning process for children with intellectual disabilities, noting that collaborative activities can improve both academic and interpersonal skills. In this study, puzzle media created a non-threatening environment in which students could engage with one another, share their thoughts, and help each other solve problems. This collaboration not only enhanced their academic progress but also built their social competence, which is a critical aspect of overall development.

The positive non-cognitive outcomes associated with puzzle media in this study underscore the broader impact that hands-on learning tools can have on children with mild intellectual disabilities. Beyond improving numeracy skills, puzzle-based learning helped students develop greater self-confidence, increased their active participation in the classroom, and fostered social interaction and collaboration. These outcomes are essential for the holistic development of children with intellectual disabilities, as they contribute to both academic and social growth.

The findings suggest that puzzle media can be an invaluable tool in special education, not only for teaching academic skills but also for promoting emotional and social development. By providing students with opportunities for success, active engagement, and social interaction, puzzle-based learning supports the development of essential life skills that extend far beyond the classroom. Teachers play a critical role in facilitating these outcomes through their encouragement, positive reinforcement, and the creation of a supportive learning environment. As a result, puzzle media offers a multifaceted approach to education that addresses both the cognitive and non-cognitive needs of children with intellectual disabilities.

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CONCLUSIONS

The findings of this study demonstrate that puzzle media can be an effective tool for improving numeracy skills among children with mild intellectual disabilities. The concrete and visual nature of puzzles makes abstract mathematical concepts more accessible, and the hands-on approach fosters greater engagement and motivation. However, challenges related to focus and fine motor skills must be addressed through appropriate modifications and teacher support. By adapting the puzzles to meet students' needs and providing individualized guidance, teachers can create a more inclusive and effective learning environment. Additionally, the study highlights the importance of non-cognitive outcomes such as increased self-confidence and active participation, which are essential for the holistic development of children with intellectual disabilities. The findings suggest that puzzle media not only enhance mathematical understanding but also contribute to the overall growth and development of children in special education settings.

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