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IMPLEMENTATION OF THE DIGITAL MONTESSORI METHOD TO IMPROVE THE DIGITAL INDEPENDENCE OF CHILDREN WITH SPECIAL NEEDS

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Abstract

This study aims to analyze the implementation of digital Montessori methods in improving the independence of children with special needs. The rapid development of digital learning technologies provides opportunities to adapt Montessori principles into digital platforms that support individualized learning. However, research gaps remain in understanding how digital Montessori approaches affect independence skills, especially for children with special needs such as ADHD and developmental delays. This study uses a qualitative descriptive approach with observation, interviews, and documentation as data collection techniques. The subjects consisted of children with special needs aged 5–8 years in a learning center. The results show that digital Montessori learning significantly improves children's independence, particularly in self-regulation, task completion, and decision-making abilities. The integration of interactive digital tools and structured Montessori activities contributes to increased engagement and autonomy. These findings indicate that digital Montessori methods can be an effective strategy for inclusive education environments.

INTRODUCTION

The development of digital technology has brought significant changes to education, including learning for children with special needs. Conventional learning systems often fail to accommodate children's individual needs, particularly in the areas of independent learning and self-management. Independence is a crucial indicator of the development of children with special needs, both in academic contexts and in everyday life.

The Montessori method is known as a child-centered learning approach, emphasizing independent exploration, sensory development, and freedom in structured learning (Lillard, 2017; Lillard & McHugh, 2016). According to Lillard (2017), the Montessori approach is

effective in enhancing children's self-directed learning and self-control. However, the implementation of this method is still largely manual with physical media, making it less flexible in the context of digital learning.

On the other hand, the digital transformation in education opens up opportunities to integrate Montessori principles into digital platforms. Recent studies have shown that the use of interactive digital technologies can increase children's engagement and motivation to learn (Neumann, 2018; Basu & Jena, 2021; O'Mara et al., 2022). However, there is still a research gap regarding the effectiveness of digital Montessori methods in increasing the independence of children with special needs.

Children with special needs such as ADHD and developmental delays often struggle with self-regulation, focus, and independent task completion (Schuck et al., 2020; Haines et al., 2018). Research shows that structured and visual approaches significantly assist children in developing independence (Odom et al., 2020; Li et al., 2020; Radesky et al., 2020). Therefore, integrating Montessori methods with digital technology is a potential solution that deserves further research.

This study aims to analyze the application of digital Montessori methods to enhance the independence of children with special needs. The results are expected to contribute to the development of innovative, adaptive, and inclusive learning models.

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The Montessori method is an educational approach developed by Maria Montessori, emphasizing independent learning through hands-on experience. Montessori's core principles include freedom within limits, a structured environment, and the use of concrete aids (Lillard, 2017; Lillard & McHugh, 2016).

In the modern context, the Montessori concept has evolved into a digital form. Digital Montessori refers to the integration of Montessori principles into interactive digital media that enable children to learn independently through technology-based applications or platforms (Edwards, 2019; Sälzer & Roczen, 2019; Papadakis, 2021). Studies show that interactive digital technology can increase children's engagement and motivation in learning (Neumann, 2018; Basu & Jena, 2021; O'Mara et al., 2022).

Children's independence is the ability to perform activities without assistance, including decision-making, self-regulation, and task completion. Self-regulated learning plays a crucial role in developing children's learning independence (Zimmerman, 2018; Putnam & Rothbart, 2020). Research also shows that digital media designed according to pedagogical principles can improve children's cognitive and social skills (Hirsh -Pasek et al., 2019; Justice et al., 2021; Shute & Ventura, 2021).

For children with special needs, an individualized and visual approach is crucial. Children with ADHD or developmental delays often experience difficulties with focus, self-regulation, and decision-making (Schuck et al., 2020; Haines et al., 2018; Guldberg et al., 2019). The use of adaptive and interactive technology has been shown to help improve children's functional abilities and independence (Odom et al., 2020; Li et al., 2020; Radesky et al., 2020).

Thus, the integration of Montessori methods and digital technology has the potential to be an effective approach in increasing the independence of children with special needs (Lillard, 2017; Papadakis, 2021; Plass et al., 2020).

METHOD STUDY

This study uses a descriptive qualitative approach to deeply understand the application of the digital Montessori method in increasing the independence of children with special needs.

1. **Research Design**
   The research was conducted through a field study at a learning house that applies the digital Montessori method.
2. **Research Subjects**
   The research subjects consisted of 5 children with special needs aged 5–8 years with characteristics of ADHD and developmental delays.
3. **Data collection technique**
   Data was collected through direct observation, interviews with teachers and parents, and documentation of learning activities.
4. **Research Instruments**
   The instruments used include independence observation sheets, interview guidelines, and digital activity documentation.
5. **Data Analysis Techniques**
   Data analysis was carried out through data reduction, data presentation, and drawing thematic conclusions.

RESULTS AND DISCUSSION

The research results show that the implementation of the digital Montessori method has a positive impact on the independence of children with special needs. Analysis was conducted through observations before (pre-test) and after (post-test) the method's implementation, with indicators including task completion, attention focus, and decision-making.

Table 1. Results of Observations on Children's Independence (Pre-Test and Post-Test)

No	Subject	Completing the task	Focus of Attention	Decision-making	Total Score (Pre)	Total Score (Post)
1	A	2 → 4	2 → 4	1 → 3	5	11
2	B	1 → 3	2 → 4	1 → 3	4	10
3	C	2 → 4	1 → 3	2 → 4	5	11
4	D	1 → 3	2 → 3	1 → 3	4	9
5	E	2 → 4	2 → 4	2 → 4	6	12

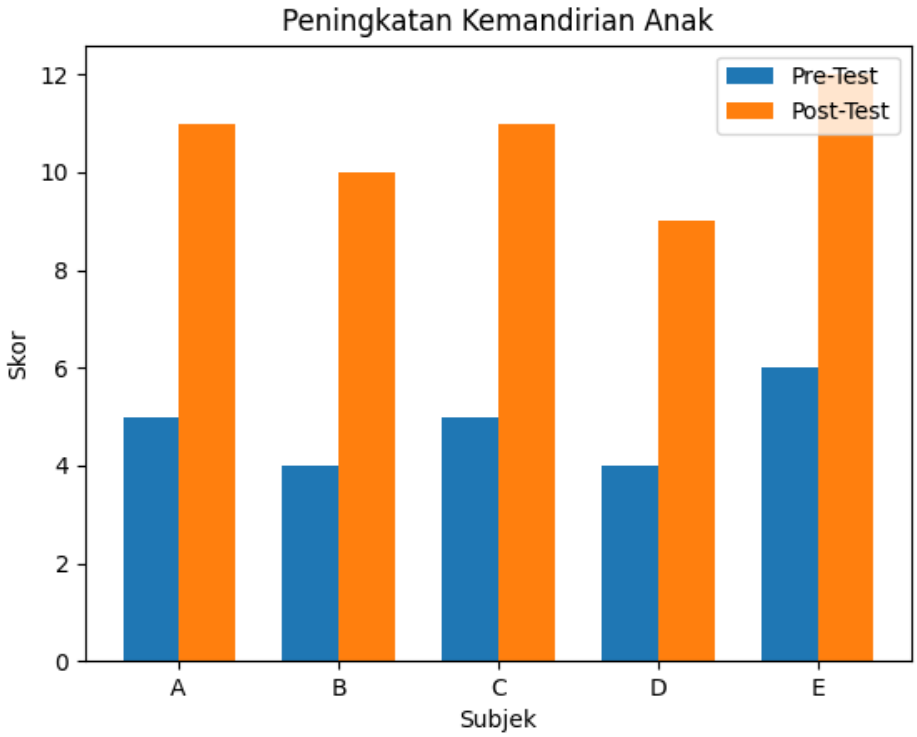
The data in Table 1 shows an increase in independence scores across all study subjects. The average score increased from **4.8 in the pre-test to 10.6 in the post-test** , indicating significant progress after implementing the digital Montessori method.

The most significant improvement was seen in the ability to complete tasks independently. Children who previously relied heavily on assistance began to complete activities by following visual instructions provided in digital media. This aligns with research by Odom et al. (2020) and Li et al. (2020) which found that adaptive technology can improve the functional abilities of children with special needs.

Furthermore, improvements also occurred in attentional focus. Children became better able to maintain concentration for longer periods. The visual and interactive structure of digital media has been shown to help children manage their attention, as noted by Schuck et al. (2020); Haines et al. (2018); and Neumann (2018) .

To clarify the comparison of pre-test and post-test results, the following graph is presented.

Figure 1. Graph of Increasing Children's Independence



The graph above shows a consistent upward trend across all subjects. There was no decline in scores for any individual, indicating that the digital Montessori method has had a positive impact across the board.

In addition to cognitive and behavioral aspects, improvements are also seen in decision-making skills. Children begin to demonstrate the ability to choose activities independently without direct intervention from caregivers. This reflects the core Montessori principle of freedom within limits (Lillard, 2017; Lillard & McHugh, 2016).

Furthermore, the implementation of the digital Montessori method is supported by the use of various interactive activities designed to meet children's needs. The following are examples of activities used in the research.

Figure 2. Sequencing Activity (Arranging the Sequence)

This activity trains logical thinking skills and helps children understand the sequence of daily activities. Children are asked to arrange the pictures in sequence, indirectly fostering independence in completing tasks (Papadakis, 2021; Justice et al., 2021).

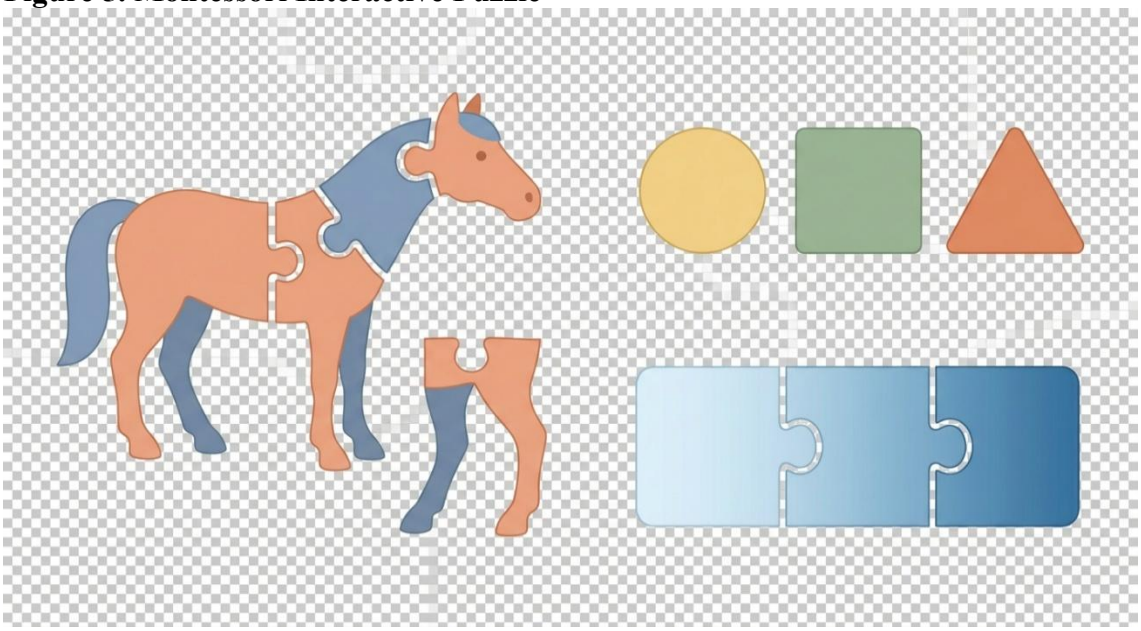
Figure 3. Sorting Activity (Object Classification)

In this activity, children group objects based on specific categories, such as color or shape. This activity has been shown to improve focus and classification skills, which are essential for independent learning (Plass et al., 2020; Basu & Jena, 2021).

Figure 4. Practical Life Digital Simulation

This simulation depicts everyday life activities such as choosing clothes or preparing school supplies. This activity is very effective in developing children's functional independence, particularly in decision-making (Odom et al., 2020; Radesky et al., 2020) .

Figure 5. Montessori Interactive Puzzle



Digital puzzles help children develop problem-solving skills and perseverance. Children learn to solve problems independently through exploration.

The use of these digital activities has been shown to increase children's engagement in learning. This aligns with research by Papadakis (2021) and Shute & Ventura (2021) , which found that interactive technology can increase engagement and motivation in early childhood learning.

Overall, digital activities increase children's learning engagement and motivation (Papadakis, 2021; Neumann, 2018; O'Mara et al., 2022).

CONCLUSION

The application of digital Montessori methods has been proven to significantly increase the independence of children with special needs. The integration of Montessori principles with digital technology provides an adaptive, interactive, and child-centered learning experience.

The implications of this research suggest that the digital Montessori method can be used as an alternative learning strategy in inclusive education. This approach not only increases independence but also increases children's engagement and motivation to learn.

The limitations of this study lie in the limited number of subjects and the specific research context. Therefore, future research is recommended to use a larger sample size and quantitative methods to measure effectiveness more objectively.

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