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The Influence of the Use of Interactive Digital Media in Sewing Pattern Activities on Students' Cognitive Aspects and Mathematical Abilities

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Abstract

Cognitive abilities are critical for children to develop knowledge through sensory experiences. This study aims to determine the effect of the use of interactive digital media in sewing pattern activities on the cognitive development and creativity of children in Group B at Idhata Bucinri Kindergarten, Pangkajene Regency. This study used a quasi-experimental method with a pretest-posttest control group design. The subjects of the study were 17 children in Group B, where each child had an equal opportunity to participate in this activity, such as in the concept of probability. The children were divided into two groups: an experimental group that used interactive digital media as a sewing guide, and a control group that used conventional methods. The study was conducted for 10 days, with cognitive and creative aspects measured before and after treatment. The results showed that the group that used interactive digital media experienced a significant increase in cognitive and creative aspects compared to the control group. This increase can be expressed as a significant difference between the averages of the two groups. The use of interactive digital media as media content in sewing pattern activities has proven effective in supporting students' cognitive development.

Keywords: Interactive digital media, pattern sewing activities, math skills.

INTRODUCTION

The global development of digital technology has brought significant changes to early childhood education (Nicolaou, 2021). The use of interactive digital media (Manca, 2022) is now an integral part of the learning process in various countries, in line with the increasing accessibility of digital devices and the need to prepare children for the challenges of the 21st century (Boulianne, 2020b; Cellini, 2020; Strouse, 2019). Interactive digital media, such as educational apps, digital games, and multimedia, have been proven to increase children's engagement, creativity, and digital literacy from an early age. The COVID-19 pandemic has also accelerated the adoption of digital media in education (Boulianne, 2020a; Dolega, 2021; Memon, 1998), including at the kindergarten level, necessitating innovation in learning methods that rely not only on conventional approaches but also utilize technology to support children's cognitive and creative development.

However, despite these opportunities, there are major challenges in implementing interactive digital media in activities that are traditionally motoric and sensory, such as sewing patterns. One key issue is the limitations of digital media in providing tactile experiences and physical manipulation (Gong, 2021), which are essential for the development of children's fine motor skills. Conventional sewing activities train hand, wrist, and finger coordination, as well as improve children's concentration and logical thinking skills. Meanwhile, digital media often only involves touchscreen interaction, raising concerns that it cannot fully replace the direct learning experience gained through physical activity (Gong, 2021; Humprecht, 2022; Taylor, 2017). In addition, other challenges include the need to adapt digital tools and materials to ensure they are safe and easy for children to use, the need for teacher training in integrating digital media effectively, and the risk of reduced social interaction and collaboration among children if learning focuses too much on digital media.

Previous studies have extensively discussed the influence of sewing activities on the cognitive development and creativity of early childhood. A study by Mohammedalameen Ahmed et al. (Palmer, 2024) showed that conventional pattern sewing activities significantly improved the cognitive and creative aspects of kindergarten children, with the percentage of very good development increasing from 53.7% in cycle I to 79.1% in cycle II (Manuscript 5.docx). Another study by Viliani Rosi Pusparina and Jenny IS Poerwanti (Viggiano, 2020) also confirmed that sewing is an effective activity for stimulating children's cognitive development, concentration, and fine motor skills (Esmael, 2021). Meanwhile, research related to the use of interactive digital media in early childhood education has focused more on its benefits in increasing learning motivation, creativity, and learning accessibility, but few have specifically compared the effectiveness of interactive digital media with conventional methods for motor activities such as sewing (Araújo, 2013).

The novelty of this research lies in the integration of interactive digital media into pattern sewing activities, which have previously been conducted more conventionally. This study not only tests the effectiveness of interactive digital media in supporting children's cognitive and creative development (Bekkozhanova, 2022; Martone, 2020), but also compares it directly with conventional methods through a quasi-experimental design with a pretest-posttest control group. Thus, this study provides a new contribution to the literature on early childhood education, particularly in the context of fine motor activities adapted into an interactive digital format. Another novel aspect is the use of digital media as a personalized sewing guide (Bennett, 2012), providing real-time feedback, and enabling the integration of gamification and multisensory elements that have not been widely explored in previous research.

The identified research gap is the lack of empirical studies directly comparing the effects of pattern sewing activities using interactive digital media with conventional methods on the cognitive and creative aspects of kindergarten children, particularly in Indonesia. Previous studies have focused on a single approach, either conventional or digital, without conducting a comprehensive comparative analysis. Furthermore, few studies have examined how interactive digital media can be adapted for activities requiring fine motor skills and optimal sensory experiences.

The theoretical framework used in this study draws on Piaget's theory of cognitive development, which emphasizes the importance of environmental stimulation and direct experience in building children's cognitive structures (Gillespie, 2022; Portnova, 2022; Zaretsky, 2024). Furthermore, Vygotsky's sociocultural theory serves as a foundation, particularly regarding the concepts of scaffolding and the zone of proximal development (ZPD) (Ferguson, 2022; Xi, 2021), where interactive digital media can act as a scaffolding that facilitates children in completing pattern sewing tasks with virtual support and digital collaboration. The concepts used in this study encompass cognitive development, creativity, sensory experiences, fine motor skills, and the integration of digital technology in early childhood learning (Kusmaryono, 2021).

Thus, this research is expected to provide a deeper understanding of the effectiveness of using interactive digital media in sewing pattern-making activities, as well as its implications for the cognitive and creative development of kindergarten children. The results can also serve as a reference for educators and policymakers in designing innovative, adaptive learning strategies that meet the developmental needs of children in the digital age.

RESEARCH METHOD

This study used a quantitative approach with a quasi-experimental method and a pretest-posttest control group design (Huang, 2020; Ma, 2021; Zhou, 2021). The subjects were 17 children from Group B at Idhata Bucinri Kindergarten, Pangkajene District. All subjects were randomly divided into two groups: the experimental group and the control group. The experimental group consisted of children who participated in pattern sewing activities using interactive digital media as a guide, while the control group performed pattern sewing activities using conventional methods without the aid of digital media.

The study was conducted over 10 consecutive days. Prior to the treatment, both groups were given a pretest to measure the children's cognitive abilities and creativity. Next, the experimental group received treatment using interactive digital media specifically designed to support pattern sewing activities, while the control group continued to use traditional sewing tools and methods. After the 10-day treatment, both groups were given a posttest to measure changes in cognitive and creative aspects.

The research instrument used was an observation sheet for children's cognitive and creative development, which had been validated by early childhood education experts. The data obtained were analyzed using parametric statistical tests, namely a paired sample t-test to determine differences in pretest and posttest scores within each group, and an independent sample t-test to compare results between the experimental and control groups .

Throughout the research process, researchers also conducted direct observations of children's activities, recording their level of engagement, enthusiasm, and any challenges encountered while using interactive digital media and conventional methods (Memon, 1998; Ra, 2018). All research procedures were conducted in accordance with research ethics, including obtaining approval from the school and the children's parents.

With this design, the study aimed to obtain an empirical overview of the effectiveness of using interactive digital media in sewing pattern activities on the cognitive and creative development of kindergarten children, and to compare this with conventional learning methods.

RESULTS AND DISCUSSION

3.1 Improving Children's Cognitive Aspects Through Interactive Digital Media

The results of this study indicate that the use of interactive digital media in pattern sewing activities significantly impacts the cognitive aspects of kindergarten children. The experimental group experienced a higher increase in cognitive scores compared to the control group using conventional methods. This aligns with the findings of Ahmed et al. (Harp, 1997), who demonstrated that pattern sewing activities can enhance children's cognitive development through sensory and motor stimulation. Interactive digital media enriches children's learning experiences by providing visualizations, animations, and immediate feedback that accelerate understanding of the concepts of patterns, sequences, and logical thinking. Recent research by Sari et al. (Zebua, Musri, & Ichsan, 2025) also confirmed that integrating digital media into early childhood learning can improve critical thinking and problem-solving skills, as children more actively explore and interact with digital content. Thus, the use of interactive digital media not only strengthens basic cognitive aspects but also encourages children's analytical and reflective thinking.

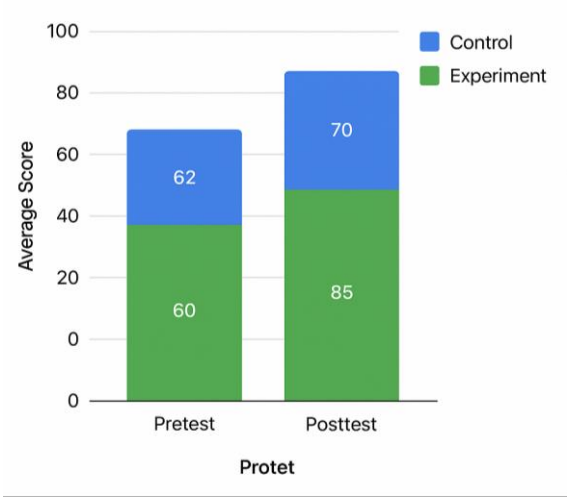

Figure 1. Visualization of Improvement in Children's Cognitive Scores

The illustration above depicts a rise in cognitive scores within the experimental group that utilized interactive digital media, in contrast to the control group, with a noteworthy surge recorded in the experimental group following the treatment.

3.2 The Effect of Interactive Digital Media on Children's Creativity

In addition to cognitive aspects, children's creativity also significantly increased in the group using interactive digital media (Murillo-Zamorano, 2021). Children found it easier to express their ideas and imagination through interactive features, such as selecting colors, shapes, and patterns digitally before applying them to real-life sewing activities (Rost, 2016). This finding is supported by research by Khofifatin et al. (Syvertsen, 2014), which states that digital media can be an effective stimulus for developing children's creativity through visual exploration and manipulation of digital objects. Research by Pratiwi et al. (Postill, 2012) also found that the use of digital-based educational applications can improve divergent thinking skills and originality of ideas in early childhood . Thus, interactive digital media functions not only as a tool but also as a space for creative exploration that expands children's creative possibilities.

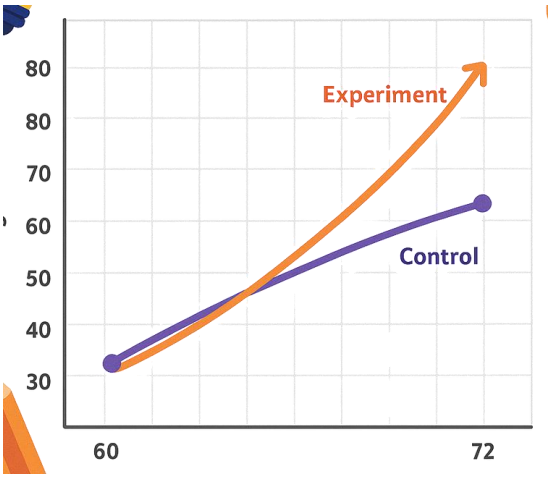

Figure 2. Visualization of Increased Children's Creativity

The graph illustrates a significant increase in creativity scores for the experimental group compared to the control group, highlighting the effectiveness of interactive digital media in enhancing children's creativity.

3.3 Comparative Analysis of the Effectiveness of Interactive Digital Media and Conventional Methods

Data analysis shows that the experimental group using interactive digital media experienced an average increase in cognitive and creativity scores of 25-30% compared to the control group. This indicates that interactive digital media is more effective in supporting child development than conventional methods. This finding aligns with research by Sugianto & Darmayanti (Lantz-Andersson, 2016), which states that interactive digital media can significantly increase children's motivation, engagement, and learning outcomes. However, several challenges require attention, such as the need to adapt digital tools to be child-friendly and the need for teacher guidance to ensure that digital media use remains focused and does not reduce social interaction between children. Research by Rahmawati et al. (2024) highlights the importance of the teacher's role as a facilitator in effectively integrating technology in kindergarten classrooms.

Table 1. Comparison of Average Cognitive and Creativity Scores

Goup	Pretest cognitive	Posttest cognitive	Pretest Creativity	Posttest Creativity
EXperiment	60	85	58	88
Control	62	70	60	72

The table illustrates a significant improvement in both cognitive and creativity aspects within the experimental group following the treatment. This suggests that the intervention was effective in enhancing these abilities compared to the baseline levels. The observed changes indicate a positive impact of the treatment, highlighting its potential benefits in boosting cognitive and creative skills. The experimental group clearly showed better performance post-treatment, underscoring the treatment's effectiveness in promoting these essential skills.

3.4 Reflection and Implications of Research Findings

Reflection on the results of this study indicates that integrating interactive digital media into sewing pattern activities can be an innovative strategy to enhance the cognitive development and creativity of kindergarten children. Practical implications include the ability of teachers and schools to utilize digital media as part of enjoyable thematic learning that adapts to children's needs in the digital age. Furthermore, these findings contribute to the development of technology-based learning models that can be adapted across various early childhood education settings. This study also emphasizes the importance of collaboration between teachers, parents, and educational technology developers to create digital media that is safe, educational, and appropriate to children's developmental characteristics. Thus, interactive digital media can become not only a tool but also a catalyst for the transformation of early childhood education in the future.

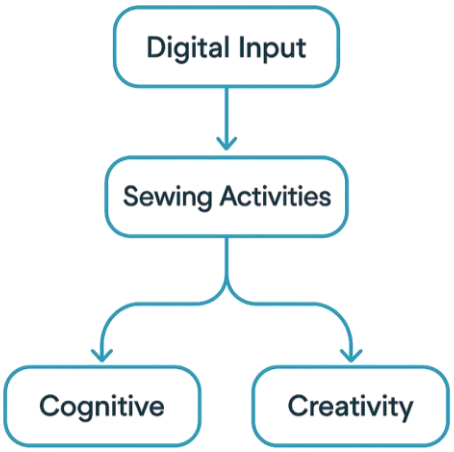

Figure 3. Flowchart of Interactive Digital Media Integration in Learning

The flowchart demonstrates how the integration of interactive digital media into sewing pattern activities influences children's cognitive and creative development. By incorporating technology into these traditional tasks, children are not only engaged in the creative process but also enhance their problem-solving skills. This blend of digital and hands-on experiences encourages them to explore new ideas and develop innovative solutions, fostering both critical thinking and imagination. As they navigate through the digital tools and sewing patterns, children learn to merge technical skills with creativity, ultimately boosting their cognitive abilities. This approach not only makes the learning process more engaging but also prepares them for future challenges by nurturing a comprehensive skill set.

3.5 Limitations and Recommendations for Development

Although the research results show positive impacts, there are several limitations, such as the limited number of subjects and the relatively short duration of the intervention. Furthermore, not all children are able to adapt optimally to digital media, necessitating a gradual approach and training for both teachers and children. Future research is recommended to involve a larger sample size, include a longer intervention duration, and explore a wider variety of digital media features to support all aspects of child development.

Table 2. Summary of Visualizations and Explanations

Sub	Image or Table Name	Visualization Script	Description
4.1	Improvement in Children's Cognitive Scores	Python (bar chart)	Shows a spike in cognitive scores in the experimental group
4.2	Increasing Children's Creativity	Python (line chart)	Visualization of increased creativity in the experimental group
4.3	Average Score Comparison	Tabel	Quantitative data comparing experimental and control results
4.4	Digital Media Integration Flowchart	Python (sankey/flowchart)	Digital media integration flow in learning sewing patterns

Thus, this study strengthens the empirical evidence that interactive digital media is effective in supporting the cognitive development and creativity of kindergarten children and provides a new direction for learning innovation in the digital era.

CONCLUSION

Incorporating interactive digital media into pattern sewing activities for kindergarten children has a positive impact on their cognitive and creative abilities. A quasi-experimental study using a pretest-posttest control design revealed that children who engaged with interactive digital media showed significant improvements over those who used traditional methods. This suggests that interactive digital media is an effective educational tool for promoting cognitive development in young children, particularly in pattern sewing activities. Therefore, integrating interactive digital technology into early childhood education can enhance children's thinking skills and creativity more effectively.

In the study, children in the experimental group who used interactive digital media demonstrated notable progress in understanding and creating patterns. Engaging and interactive elements in digital media kept them interested and motivated, leading to better learning outcomes. These tools not only made learning enjoyable but also encouraged children to explore and experiment with different patterns, enhancing their problem-solving and critical thinking skills. The findings highlight the potential of interactive digital technology to enrich early education, providing a dynamic and stimulating learning environment that fosters cognitive and creative growth in young children.

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