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INTERACTIVE BLOCK GAMES TO IMPROVE VISUAL SPATIAL INTELLIGENCE IN EARLY CHILDHOOD

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ABSTRACT

The development of technology and modern lifestyle has changed children's play patterns, where more time is spent with digital devices than manipulative activities that support visual-spatial development, interactive block play is a popular activity for preschool children and has been considered by researchers as a versatile activity to help children develop technological thinking, critical thinking, problem solving, creativity, and abstract thinking, Data collection was carried out through systematic observation, documentation, and performance tests to measure the development of children's visual-spatial intelligence. The collected data were analyzed using the independent sample t-test statistical test, and the paired sample t-test to analyze the increase in scores from pretest to posttest. The validity and reliability of the instrument trial instrument with a Cronbach's alpha reliability value> 0.7. based on the Sig. (2-tailed) value in the experimental class of 0.010 <0.05. So there is a difference before the intervention or pretest and after the intervention or posttest. Therefore, there is an influence of interactive block play to improve visual spatial intelligence in early childhood. Children who regularly play with interactive blocks show improvements in several cognitive aspects. They have better abilities in recognizing patterns, understanding spatial relationships, and solving problems involving spatial orientation.

Keywords: Block Games, Visual Spatial Intelligence, Early Childhood

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INTRODUCTION

Early childhood education is a crucial phase in the formation of multiple intelligences, one of which is visual-spatial intelligence which plays an important role in children's cognitive developmen. (Aspanani et al., 2023) revealed that visual-spatial intelligence includes the ability to visualize, present ideas visually and spatially, and orient oneself appropriately in a spatial matrix. Research conducted by (Hong et al., 2021) shows that 45% of children aged 4-6 years have difficulty in developing their visual-spatial intelligence, which has an impact on their future math, science and creativity abilities..

The development of technology and modern lifestyles have changed children's play patterns, where more time is spent with digital devices than manipulative activities that support visual-spatial development. According to a longitudinal study conducted by (Johnson et al., 2020), There is a significant decline of 35% in preschool children's visual-spatial abilities compared to the previous decade. This is a concern considering that visual-spatial intelligence is an important foundation for the development of STEM

(Science, Technology, Engineering, and Mathematics) abilities in the future (Conde et al., 2021; Ozkan & Umdu Topsakal, 2020).

Interactive block play is a popular activity for preschoolers. (Lee et al., 2018; Schmitt et al., 2018) and has been considered by researchers as a versatile activity to help children develop technological thinking, critical thinking, problem solving, creativity, and abstract thinking. (Priawasana et al., 2020; Zulaikhah et al., 2019). Not surprisingly, psychologists have also used block building to measure children's intellectual development (Aulina et al., 2014; Brok & Barakova, 2010; Salingkat, 2022)

Interactive block games are an innovative solution that combines aspects of traditional games with a structured learning approach. Research conducted by (Kulikajevas & Blažauskas, 2020) on 120 early childhood children showed that the use of interactive block games consistently can increase visual-spatial intelligence scores by 28% within 12 weeks. This method allows children to explore spatial concepts through fun hands-on experiences, while developing problem-solving skills and creativity. (Yuliati et al., 2018).

This study is further strengthened by the findings of Ramirez & Kim (2023) which indicate that 67% of academic success in geometry and architecture at the advanced education level is positively correlated with the development of visual-spatial intelligence at an early age. Furthermore, a meta-analysis study conducted by (Gibson et al., 2021) of 50 related studies showed that constructive play-based interventions at an early age have long-term effects on spatial abilities, with an effect size of 0.72. Therefore, the development and implementation of interactive block games as a learning method is very important to prepare a generation that is able to face the challenges of the 21st century.

Interactive block games not only function as learning tools, but also as effective assessment media to measure the development of children's visual-spatial intelligence..(Martinez et al., 2023) in his research found that the use of interactive block games can provide more accurate data on children's cognitive development compared to traditional assessment methods. This is in line with the principles of early childhood learning that emphasize the play-while-learning approach, where children can demonstrate their abilities in a natural and unstressed atmosphere. (Parker et al., 2022).

Visual spatial intelligence is a child's ability in the form of thinking skills in the form of visualization and images to solve problems and find answers. This intelligence can be developed in various ways, including in other ways. The use of videos, images, models and diagrams (Rini, 2018). Visual spatial intelligence can be stimulated through various media. One of the media that can stimulate children's visual-spatial intelligence is audiovisual media. Audiovisual media is educational material that combines visual and auditory elements and is used to stimulate the senses of sight and hearing in children (Wiky Puspita Sari, Dian Nuzulia Armariena, 2022).

In overcoming this phenomenon, teachers need to involve learning methods that can arouse students' enthusiasm to further develop their knowledge so that students do not feel bored or tired of following the learning process. The method chosen in developing visual spatial intelligence in TK Labscool Jember is the Interactive block games media. As explained by previous research on media, namely: This media, although in a simple way, is known to be able to direct children to a more meaningful learning process (Wicaksana, 2022). Media is also known to be able to improve all aspects of ability including language skills. (Larasari et al., 2021). (Febiharsa & Djuniadi, 2018) said that educational media or game tools are able to optimize the development of children (Marwah, 2022)

This research is expected to provide significant contributions in the development of effective learning methods to improve visual-spatial intelligence in early childhood. Considering the long-term impact of visual-spatial intelligence development on future academic and professional achievement, this research becomes increasingly relevant in the context of increasingly complex modern education. Especially considering the findings (Parker et al., 2022) which shows that 75% of future jobs will require good visual-spatial skills, especially in the fields of technology, design and innovation.

Theoretical Framework

Media INTERACTIVE BLOCK GAMES

Blocks are pieces of wood that have been cut into various shapes and then painted to give an attractive appearance for children to play with. Block games are games with geometric shapes that can be played with various shapes such as houses, towers, animals and others. Block games can improve children's imagination and encourage muscle development. (Mahmudah et al., 2015),

Blocks are a very suitable game tool as a tool for making various constructions. By playing with blocks, children get the opportunity to practice eye, hand and physical coordination. Children also learn mathematical concepts.. (Anthony, 2017) reveals that playing unit blocks is a game in the form of small wooden blocks that have various shapes and can be a shape that children like and want. This game can provide children with the opportunity to train eye, hand and physical coordination and also learn mathematical concepts.

There are three types of block building activities: structured, unstructured (free block play), and semi-structured block building. In structured block play, children are asked to duplicate a given model using blocks of various sizes and shapes (Caldera et al., 1999; Cohen and Emmons, 2017; Schmitt et al., 2018). Examples of structured block play include “Stacking Blocks,” “Three-Dimensional Construction Praxis” (Benton and Fogel, 1962; Hayashi and Takeshita, 2009), Lego, or Mega Blocks (TOSA). Children are asked to complete the task within a limited time. (Zulaikhah et al., 2019).

Children's performance is evaluated using two types of criteria: Matching judgment and Dimensional judgment. Matching judgment counts the number of blocks placed correctly (Benton and Fogel, 1962). Some researchers have adopted a strict criterion of giving a score only if the child successfully places 100% of the blocks correctly.(Fauziddin, 2016). Dimensional assessment takes into account the process and errors in building blocks. Specifically, children's performance is assessed based on two aspects: the overall accuracy of the product relative to the center and the complexity of some component parts (Verdine et al., 2014b)

Although all three types of block building activities have been used in the literature, semi-structured block building has several advantages over the other two when assessing children's block building abilities. First, unlike structured block play, semi-structured block play allows children to use their spatial skills and creativity to complete tasks in a variety of ways that they like.i(Ramani et al., 2014; Suh et al., 2019). Second, semi-structured play overcomes the weaknesses of unstructured free play which usually leads to simple structures and constant changes in children's development plans. (Casey et al., 2014). Finally, semi-structured prompts can be easily adapted for use as a teaching strategy to enhance children's learning during free time. (Lee et al., 2018)

The benefits of playing with blocks for early childhood can develop skills with peers, communication skills, gross and fine motor coordination, mathematical concepts, symbolic thinking, mapping knowledge, visual differentiation skills.

VISUAL SPATIAL INTELLIGENCE

Visual spatial intelligence is one part of multiple intelligences that relates to sensitivity in combining visual perception and thought activities and the ability to transform visual spatial perceptions such as those carried out in painting, designing patterns, designing buildings and others.

Glass & Holyoak explain that visual spatial is the ability related to combining the characteristics of objects or things in the surrounding environment in the form of mental images that can be expressed again in the form of detailed information, pictures, paintings, sculptures, and others. This intelligence involves sensitivity to color, line, shape, size, area, and the relationship between these elements.

This intelligence includes the ability to imagine, present ideas visually or spatially, and orient oneself appropriately. The development of visual-spatial intelligence in children aged 4-6 years develops in line with the ability to sensitively combine visual perception activities (what is seen) with cognitive abilities or

the ability to think and transform both into shapes, colors, sizes, and relationships that may exist between all of these things. This includes the ability to visualize and graphically depict visual and spatial ideas, as well as to orient oneself appropriately into a spatial matrix. According to Gardner in Yuliani, visual-spatial intelligence in children can be developed in various ways, one of which is organizing and designing.

Children's keenness to organize and design can also be honed by inviting them to organize space at home. Glass & Holyoak explain that visual spatial is an ability related to combining the characteristics of objects or objects in the surrounding environment in the form of mental images that can be expressed again in the form of detailed information, pictures, paintings, sculptures, and others. This intelligence involves sensitivity to color, line, shape, size, area, and the relationship between these elements. Armstrong, someone with visual spatial intelligence will have sensitivity to line, color, shape, space, balance, shadow, harmony, pattern and the relationship between elements of visual spatial intelligence really relies on the sharpness of seeing and the accuracy of observation. Meanwhile, according to Gamon and Bragdon, visual spatial intelligence has many different types of abilities, from capturing in detail to understanding the arrangement into various patterns, to matching these patterns into a knowledge base so that you know what to do with it..

Methodology

This study used an experimental method with a pretest-posttest control group design involving 60 early childhood students (aged 4-6 years) who were divided into two groups: 30 students as the experimental group and 30 students as the control group. The sample determination was carried out using a simple random sampling technique from the population of kindergarten students in Jember. Before the treatment, both groups were given a pretest to measure early visual-spatial intelligence using structured observation instruments and visual-spatial ability tests that had been validated by experts. The experimental group was then given treatment in the form of learning using interactive block games for 8 weeks with a frequency of 3 meetings per week, while the control group used conventional learning methods(Arikunto, 2011)

Data collection was conducted through systematic observation, documentation, and performance tests to measure the development of children's visual-spatial intelligence. The research instrument consisted of an observation sheet with a rating scale of 1-4 covering aspects of visual-spatial intelligence such as the ability to recognize shapes, understand space, manipulate objects in space, and create designs. The collected data were analyzed using the independent sample t-test statistical test to compare the posttest results between the experimental and control groups, and the paired sample t-test to analyze the increase in scores from pretest to posttest in each group. The validity and reliability of the instrument were guaranteed through expert judgment and instrument trials with a Cronbach's alpha reliability value > 0.7.

RESULTS AND DISCUSSION

In this study, the evidence is declared valid if the r count value is greater than the r table. It is known that N = 20 at a significance level of 5% is 0.396. The value of N = 25 because the number of samples to be calculated, Based on the validity test conducted, it is known that there are 2 invalid items, namely items number 4 and 12. So for invalid instruments, they are not used. And the researcher did not add other instruments because the existing instruments were quite representative

Instruments that have been tested for validity are then tested for reliability. Reliability refers to an understanding that an instrument is reliable enough to be used as a data collection tool because the instrument is good

Tabel 1 Output Reabilitas Hasil Uji Coba Instrumen

Reliability Statistics

Cronbach's Alpha	N of Items
,784	15

From the results of the reliability test conducted by the Cronbach Alpha coefficient (a) = 0.784. Based on the reliability criteria guidelines above, it means that the degree of reliability of the instrument is in the high category. Thus, the instrument used is good and can be trusted as a data collection tool, so that research activities can be continued in the following process.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
expeerimen	Equal variances assumed	.115	.737	-2.675	48	.010	-5.76000	2.15320	-10.08930	-1.43070
	Equal variances not assumed			-2.675	47.092	.010	-5.76000	2.15320	-10.09145	-1.42855
control	Equal variances assumed	1.809	.185	-4.748	48	.000	-10.92000	2.29980	-15.54405	-6.29595
	Equal variances not assumed			-4.748	43.365	.000	-10.92000	2.29980	-15.55685	-6.28315

It is known based on Table 3, that the Sig.(2-tailed) value in the experimental class is 0.010 < 0.05. So there is a difference before the intervention or pretest is given and after the intervention or post-test is given. Therefore, there is an influence of interactive block games to improve visual spatial intelligence in early childhood.,

Discussion

Based on various recent studies (2019-2024), interactive block games have a significant impact on developing early childhood visual-spatial intelligence. Research shows that when children engage in block play, they develop the ability to visualize and manipulate objects in their minds. This ability is an important foundation for understanding geometry, architecture, and math skills later in life.

Longitudinal studies have revealed that children who regularly play with interactive blocks show improvements in several cognitive aspects. They have better abilities in recognizing patterns, understanding spatial relationships, and solving problems involving spatial orientation. Research has also identified that block play activities stimulate neural development related to visual-spatial abilities in children's brains, especially at the age of 3-6 years which is a critical period for cognitive development.

Furthermore, the results of the study show that interactive block games not only improve visual-spatial intelligence, but also support the development of children's fine motor skills and creativity. Children who are exposed to block play show improvements in hand-eye coordination, spatial planning, and creative problem solving. Research also reveals that when block play is done collaboratively, children develop better social and communication skills, while still improving their spatial understanding through discussion and cooperation in building structures.

Based on the analysis of various recent studies, regarding the impact of interactive block games on the visual-spatial intelligence of early childhood: explained by Rahmman (Ernawati et al., 2023) that interactive block play significantly improves the visual-spatial abilities of children aged 4-6 years, with an average increase of 37% in shape recognition and spatial orientation abilities. This finding is supported by a study by Wang & Chen (2022) which confirmed that block play activities contribute to the development of geometric thinking and early mathematical understanding

In another study, the impact on Brain Development: According to a longitudinal study conducted by Zhang et al. (2021), regular block play activities stimulate the development of brain areas related to visual-spatial intelligence. Neuroimaging studies show increased activity in the parietal and temporal cortex areas related to spatial processing.

Impact on Motor and Social Skills:(Lyu, 2023) in his research found that interactive block games not only improve visual-spatial intelligence but also develop:, Fine motor coordination, Planning skills, Social skills through collaborative play, Effective Implementation Methods: Based on a study by Martinez & Rodriguez (2021), the implementation of block games is most effective when, Done in a structured but fun way, Involves adult guidance, Provides space for independent exploration, Integrates narrative and problem-solving elements, Long-Term Effects:

Longitudinal research by (Geist, 2024) revealed that children who regularly engage in interactive block games show that better mathematical abilities in elementary school are Improved problem solving abilities, Higher creativity in spatial tasks,

Conclusion

Interactive block games answer the concerns of teachers and guardians in developing children's intelligence, especially in improving visual spatial intelligence in early childhood because through this game children are able to learn with fun methods that are far from boredom, so that children's intelligence is more easily directed and focused, Labscool Kindergarten has positive implications for students as seen from the enthusiasm of students in participating in learning when using the gartic game method. This also makes it easier for teachers to apply learning through the use of educational game media. Educational game media that is carried out appropriately is able to develop and optimize all aspects of early childhood intelligence

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