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IMPROVING VISUAL-SPATIAL ABILITY IN MATHEMATICS THROUGH MATCHING SHAPES

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ABSTRACT

This study aims to detect Matching Shape that can improve visual spatial math skills in Natural Academy early childhood. This type of research is classroom action research. This research was carried out with a cycle model. The subject of this research is early childhood at Natural Academy. The data collection techniques used in this research are picture matching tests, and observation of teacher and student activities to analyze the quality of the application of learning with matching shapes. The data in this study were analyzed by descriptive analysis. The results of this study showed an increase in visual spatial ability through matching shapes. This is evidenced by the initial ability reaching an average value of 55.5, in cycle I reaching an average value of 70 and cycle II reaching an average value of 89.1. Meanwhile, the initial observation of the quality of teacher activities was 39.6% and students were 20%, cycle I reached 59% of teacher activities while students were 56%. Then in cycle II it reached 89% of teacher activities and 90% of student activities.

Keywords: *spatial visual ability, mathematics, and matching shapes*

INTRODUCTION

Education is a long-term investment, and achieving high-quality education requires effort (Tamu & Atte, 2024). Quality education can be achieved if the learning process is carried out effectively, namely if learning takes place smoothly, in a focused manner and in accordance with learning objectives (Puspitarini & Hanif, 2019). Learning mathematics is an important effort in advancing education because it provides a strong foundation for the development of critical, logical, and systematic thinking skills. Not only is

mathematics taught at all levels of education, but it is also one of the subjects that has more class hours compared to other subjects (Harahap et al., 2021). This shows that mathematics education is considered fundamental in shaping students' mindset and analytical skills. In addition, research shows that effective mathematics learning can improve students' problem-solving ability, which is an important skill in everyday life (Harahap et al., 2021; Silalahi, 2022). And Image shape recognition in early childhood is an important aspect of their cognitive and motor development. In early childhood, children are in a developmental phase known as the “golden age,” where they are very sensitive to learning stimuli that can improve their cognitive and psychomotor abilities (Setiawan et al., 2018). The introduction of shapes through drawings can assist children in understanding basic concepts related to geometry, which in turn contributes to their mathematical and logical thinking abilities (Maulidini, 2023).

Matching shapes is a fundamental activity that significantly enhances visual-spatial abilities in early childhood. This skill is crucial as it lays the groundwork for various cognitive processes, including problem-solving, mathematics, and even language development. Research indicates that engaging in shape matching activities helps children develop their ability to recognize and manipulate shapes, which is essential for understanding spatial relationships and object recognition.

One of the key benefits of matching shapes is its role in object recognition. Augustine et al. highlight that young children can recognize common categories of objects even with sparse representations, suggesting that their developing cognitive systems are capable of processing shape similarities effectively (Augustine et al., 2011). This ability to discern shapes is foundational for later cognitive skills, as it allows children to categorize and relate different objects based on their visual characteristics. Furthermore, the correlation between children's performance on shape recognition tasks indicates that as they engage with these activities, their understanding of spatial relations improves (Augustine et al., 2013).

Moreover, traditional games that incorporate shape matching, such as puzzles, are shown to enhance visual-spatial skills. For instance, the game "cengkling" encourages children to jump and navigate through various spatial configurations, thereby reinforcing their understanding of spatial concepts (Saputra & Ekawati, 2021). The integration of play with educational activities not only makes learning enjoyable but also fosters critical thinking and spatial reasoning abilities.

Additionally, the development of spatial language during activities like block play further supports the enhancement of visual-spatial skills. Yang and Pan found that engaging in block play allows children to use spatial language, which is crucial for articulating their understanding of spatial relationships (Yang & Pan, 2021). This verbalization of spatial concepts aids in solidifying their cognitive grasp of shapes and their arrangements in space.

The relationship between visual-spatial skills and other cognitive domains is also evident in studies linking these skills to early mathematical understanding. Newcombe and Frick emphasize that spatial skills are closely tied to children's learning of object names and recognition, which are critical for mathematical reasoning (Newcombe & Frick, 2010).

Natural Academy is an institution that usually focuses on education, training, or skill development in various fields related to nature, desire, or holistic health. In its activities, it trains early childhood where there are obstacles when teaching math to improve visual spatial abilities. From this problem, a class action research was conducted using mathing shapes.

Mathing Shapes is a visual math learning tool designed specifically for early childhood (Elia et al., 2023). Matching Shapes consists of geometric shapes that children can print, cut and arrange (CAKIROGLU et al., 2022). Through this activity of arranging geometric shapes, children can train their visual spatial abilities (Wardhani et al., 2023). This is also reinforced by Adhalia & Susianna (2021); The use of visual learning media has been proven to improve students' ability to solve problems, think creatively, and mathematical reasoning.

METHODS

This type of research is classroom action research. This research was carried out using a cyclical model with steps in each cycle including; action planning, implementation, observation, and reflection stages, then if the research target has not been achieved in the first cycle, the research will continue to the next cycle, followed by re-planning the cycle (Arikunto, 2019). An overview of the research design of the Kemmis and Taggart model can be seen in Figure 1.

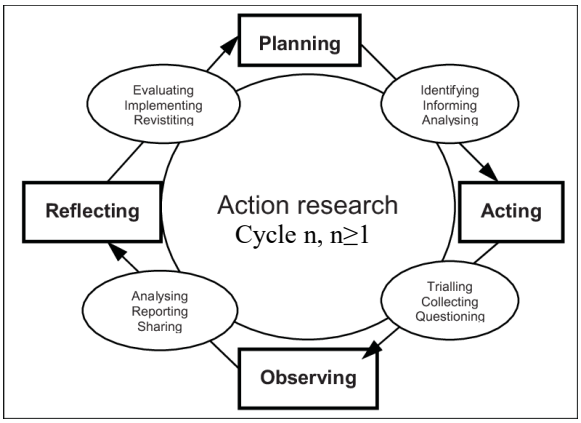

Figure 1. the research design of the Kemmis and Taggart model

The subjects of this research are natural academy students. The object of this research is the improvement of visual spatial ability. The data collection techniques used in this research are observation, tests in the form of story problems to hone students' reasoning skills in solving space building problems, questionnaires to determine students' self-confidence and documentation. The data collection techniques used in this research are picture matching tests, and observation of teacher and student activities to analyze the quality of the application of learning with matching shapes. The indicator of research success is 80% of students reach KKM>80.

RESULTS AND DISCUSSION

Classroom action research on the application of matching shapes to improve students' visual spatial math skills begins with the pre-cycle stage or the assessment stage before the action using the media. The results of the assessment at the pre-cycle stage are presented in Table 1, and Table 2

Table 1. Learning Activity

Activity	**Activity**
Teacher	39.6%
Student	20%

Table 1. above states that teacher activities dominate over student activities in learning so that students are not actively involved in developing their abilities. This requires that students must be actively involved in learning so that when students are involved in interesting and challenging activities, students tend to be more motivated to learn (Agung et al., 2023; Marwati et al., 2023).

Table 2. Visual-Spatial Ability in Mathematics

Indicator (Ema Lestari et al., 2023)	**Average Student Score**
sensitive to shapes and events	40
able to record these forms in their memory	70
Communicating shapes into words	56
describe shapes based on clear and detailed sequences	42
Average	55.5

After knowing the achievement of reasoning ability results and student learning problems, the research continued in the implementation of cycle I which was adjusted to the research design that had been prepared. The results are presented in Table 3 and Table 4.

Table 3. Learning Activity in Cycle 1

Activity	**Activity**
Teacher	59%
Student	56%

Table 4. Visual-Spatial Ability in Mathematics in Cycle 1

Indicator (Ema Lestari et al., 2023)	Average Student Score
sensitive to shapes and events	70
able to record these forms in their memory	70
Communicating shapes into words	70
describe shapes based on clear and detailed sequences	70
Average	70

From the results of the analysis of cycle 1, it is necessary to improve the activities of teachers and students. It is natural that in cycle 1 the classroom action research is still not optimal because it is still adapting to something new, especially learning that has never been done before. (Machost & Stains, 2023). So that this has an impact on the results of low visual spatial abilities (Mo & Liu, 2022).

From the reflection of cycle 1, then continued to cycle 2. These results state that the learning activities have received very good scores and the expected visual spatial abilities are in accordance with the expected target values so that this class action research stops at cycle 2.

Table 5. Learning Activity in Cycle 2

Activity	Activity
Teacher	89%
Student	90%

Table 6. Visual-Spatial Ability in Mathematics in Cycle 2

Indicator (Ema Lestari et al., 2023)	Average student score
sensitive to shapes and events	95
able to record these forms in their memory	91
Communicating shapes into words	91
describe shapes based on clear and detailed sequences	83
Average	89,1

CONCLUSION

The conclusion of this study is that there is an increase in the visual spatial abilities of natural academy students in mathematics. Research findings regarding the use of mathching shapes can improve the spatial visual abilities of natural academy students in mathematics. This approach is carried out through the stages of visualizing (Children learn to imagine shapes in their minds and how the shapes can be rotated, flipped, or combined), Spatial

reasoning (children develop an understanding of spatial relationships between objects, such as above, below, beside, inside, and outside), problem solving (children arrange shapes to create certain patterns or images train problem solving skills and logical thinking), and increase creativity (children create their own designs and patterns).(Prasetyo & Abidin, 2021).

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