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Development of G-MAG Media on the Ability to Recognize the Concepts of Triangle and Square in Children Aged 5–6 Years

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ABSTRACT

Limited learning media for geometry often hinders early childhood in understanding basic shapes such as triangles and squares. To address this issue, G-MAG (Geometry Imagination) media was developed to strengthen the recognition and classification skills of children aged 5–6 years. The research applied the Research and Development (R&D) approach with the ADDIE model, involving 15 children at TK Khadijah, Surabaya. Data were obtained through observation and questionnaires, while the effectiveness test used the Wilcoxon Match Pairs Test. The media, consisting of a 35 × 8 cm geometry tower, color dice, and shape dice, was validated by experts and judged highly feasible. Effectiveness results indicated a significant improvement (Asymp. Sig (2-tailed) = 0.001 < 0.05) between pretest and posttest scores. Children showed better abilities in recognizing and classifying geometric forms through repeated play-based activities. G-MAG provides an engaging, meaningful learning experience and has potential for broader application in early

childhood education.

Introduction

Childhood, especially early childhood, is a critical phase in human development that plays a significant role in shaping the foundation of cognitive, social, emotional, and other skills (Prawinda et al., 2023). Early childhood is often referred to as the golden age, where brain development is very rapid and requires various forms of appropriate stimulation (Zamzam et al., 2023). According to Law No. 20 of 2003 and Government Regulation of the Republic of Indonesia No. 1 of 2010, early childhood education aims to provide stimulation to support optimal development from birth to six years old. Children in this stage require learning approaches that suit their characteristics and developmental stages, including cognitive development, such as recognizing geometric shapes (Aisyah et al., 2023). The ability to recognize geometric shapes such as triangles and squares is an important aspect of cognitive skills that should be developed from an early age (Ulfa et al., 2020).

Previous research has shown that early childhood can recognize geometric shapes through visual approaches and play activities (Tegarinfisa & Hasibuan, 2018). Widayati et al. (2021) emphasized that cognitive development is closely related to the ability to think, analyze situations, and solve problems independently. Putri et al. (2023) also found that play activities can enhance children's imagination and creativity. On the other hand, the use of concrete learning media such as blocks or geometric shape cards is considered effective in helping

children understand abstract concepts (Dewi, 2019). Montessori-based media can help children learn independently and actively (Ummah, 2019), while the selection of appropriate media also supports successful learning processes (Suyadi & Selvi, 2019). Research by Ningrum and Chusna (2020) stated that learning media designed based on children's needs can increase their enthusiasm and activeness in learning activities.

However, preliminary observations at TK Khadijah Surabaya revealed that most children aged 5–6 years were not yet able to identify and name triangles and squares accurately. When shown a rectangle, only 2 out of 13 children could correctly identify it, while others gave incorrect answers or did not know. This demonstrates a gap between expected developmental standards and the actual conditions in the field. The lack of thematic learning media specifically designed to introduce types of triangles and squares, combined with the limited use of general construction play tools, may be the cause. Therefore, the development of G-MAG (Geometry Imagination) media is necessary as a solution to these limitations. This media is designed to provide engaging and meaningful learning experiences through play activities aligned with child development principles and Montessori theory, with the expectation of improving children's ability to recognize triangle and square concepts (Fairuzillah & Elfahmi, 2025). The novelty of this study lies in developing constructive play-based media that integrates elements of shape, color, and active play strategies to comprehensively

support children's cognitive development. Thus, G-MAG media is expected to become an innovative alternative in improving the effectiveness of geometry learning in early childhood education institutions.

Methods

This study used the Research and Development (R&D) method with the ADDIE development model (Analyze, Design, Development, Implementation, Evaluation) (Sugiyono, 2019). The research was conducted at TK Khadijah Surabaya with 15 children aged 5–6 years in group B as subjects. Data were collected through observation, questionnaires, and documentation. The product was validated by two material experts and two media experts using a Likert scale questionnaire. The trial design employed a one-group pretest-posttest to measure the effectiveness of G-MAG media on the ability to recognize triangles and squares. Feasibility analysis was conducted using descriptive quantitative methods, while effectiveness was tested using the Wilcoxon test (Slamet, 2022). The success of the media was determined based on the increase in children's scores after treatment using the media.

Result and Discussions

This research aimed to test the effectiveness of G-MAG (Geometry Imagination) media in improving the ability to recognize the concepts of triangles and squares in children aged 5–6 years. The stages of developing the G-MAG media in this study followed the ADDIE model.

At the analysis stage, a preliminary study was conducted at TK Khadijah Surabaya, particularly in the An-Nafi' class consisting of 15 children. Observations from August to November 2024 revealed that most children had not yet understood geometric shapes such as equilateral triangles, right triangles, squares, and rectangles. When the teacher displayed geometric shapes, many children gave incorrect answers. This occurred because there were no specific materials or media introducing these concepts. Children only recognized blocks as play tools without focusing on two-dimensional shapes. Therefore, G-MAG media was developed in accordance with the stages of early childhood cognitive development to help children recognize triangles and squares more effectively.

The purpose of developing this media was to enable children aged 5–6 years to recognize and classify equilateral triangles, right triangles, squares, and rectangles. This goal aligns with Ministry of Education and Culture Regulation No. 17 of 2022, which emphasizes the importance of recognizing patterns and shapes as part of cognitive development. Based on observations, children more easily understood material through interactive learning media, making the development of G-MAG relevant. School resources were still limited, as no special media were available to introduce geometric shapes. Observations and interviews with block center teachers showed that learning only used general blocks without in-depth concepts of two-dimensional shapes. Therefore, developing more concrete and engaging teaching materials

was considered essential.

The learning strategy applied through G-MAG was designed so that children could play actively while learning about shapes and colors. This strategy consisted of three stages: teacher preparation in understanding the media, implementation with active guidance, and follow-up activities in the form of reflection and evaluation of children's understanding. The learning plan included a pretest, treatment, and posttest. The pretest was conducted by asking about shapes from geometric picture cards shown by the teacher. Treatment was carried out three times using G-MAG media as an educational play tool. The posttest measured children's understanding after learning with G-MAG, using kokoru paper shapes and picture cards. Pretest and posttest results were compared to determine the effectiveness of the media in improving understanding of geometric shape concepts.

At the design stage, visual materials were adapted to children's ages and characteristics. The media was developed based on the early childhood curriculum, Montessori approach, and Piaget's theory. A storyboard was used to design the play sequence, while illustrations were made using Canva. The final objective was for children to be able to name and classify basic geometric shapes. Evaluation instruments in the form of pretest, posttest, and observations were prepared to assess the effectiveness of G-MAG in improving children's understanding of triangles and squares in an enjoyable and meaningful way.

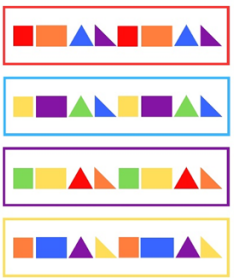
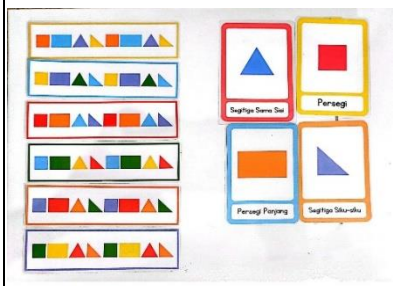
At the development stage, the previously designed media was

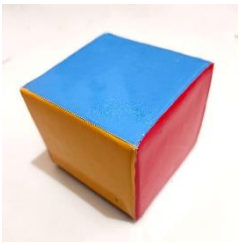
realized as a physical product, namely G-MAG (Geometry Imagination). The finished product was validated by media and material experts to ensure feasibility and conformity with learning objectives. Several revisions were made, such as adjustments to the colors of the geometry tower and additional blocks, which initially had uneven or unclear coloring (e.g., orange appearing too close to red, green being too dark). The geometric cards, whose colors did not match the blocks, were reprinted with improved coloring. The color dice were also revised for sharper tones, adjusted to the block colors. The detailed revisions are presented in the table below:

Table 1. Design of G-MAG (Geometry Imagination) Media after Revision

Description	**G-MAG Design before Revision**	**G-MAG Design after Revision**

Contained four shapes: equilateral triangle, right triangle, square, and rectangle. Each shape had six stacks in red, blue, yellow, orange, purple, and green. Tower size: 35 cm × 8 cm, thickness of each block: 1 cm.		

Consisted of four shapes: equilateral triangle, right triangle, square, and rectangle. Each shape had six stacks colored (red, blue, yellow, orange, purple, and green), similar to the geometry tower, with the same block dimensions.	 	

Made from duplex paper covered with sticker paper. Reprinted with sharper, clearer colors matching block shapes.		

After guidance and revisions, the improved G-MAG media was validated by material and media experts. Material validation was conducted by two experts which they are also lecturers of Early Childhood Education at Universitas Negeri Surabaya. They assessed aspects of learning objectives, materials, presentation, and quality. Their suggestions included revising the geometry cards from four to eight images with an *abcd-abcd* pattern to suit children's developmental stages. After revision, the results were excellent: Expert 1 gave a score of 55 out of 56 (98.21%), and Expert 2 gave 54 out of 56 (96.43%), yielding an average of 97.32%. These results indicate that the G-MAG material was excellent and feasible without further improvement.

Validation by media experts was also conducted by the same lecturers, assessing design, color selection, visuals, usability, and application in learning. They suggested improvements in color consistency between the geometry tower, dice, and cards. After revision, the validation results were also excellent: Media Expert 1 gave 47 out of 48 (97.92%), and Media Expert 2 gave 45 out of 48 (93.75%), with an average of 95.83%. This shows that G-MAG media met the

criteria of being very good and feasible for use.

Data collection was conducted through pretests and posttests given to 15 children in Group B at TK Khadijah, Surabaya. The data consisted of scores on two indicators: (1) naming shapes and (2) classifying geometric shapes. Pretest results showed that most children could only recognize one or two basic shapes, with a combined score of 64 points. After three treatments using G-MAG, the posttest score significantly increased to 111 points.

The improvement was evident in the comparison of average pretest and posttest results, as shown below:

Table 2. Comparison of Pretest and Posttest Scores

No.	Indicator	Pretest	Posttest	Difference
1	X1 (naming shapes)	32	54	22
2	X2 (classifying shapes)	32	57	25

To test the hypothesis, data were analyzed using the Wilcoxon Signed Rank Test with SPSS 22. Results showed Asymp. Sig (2-tailed) = 0.001, which is less than 0.05, meaning H_0 is rejected and H_1 accepted. Thus, there was a significant difference between pretest and posttest scores after using G-MAG.

Table 3. Wilcoxon Test Results

Test	Z	Asymp. Sig. (2-tailed)
Posttest – Pretest	–	0.001

These findings indicate that G-MAG media significantly improved children's ability to recognize the concepts of triangles and squares.

The results demonstrate that G-MAG effectively enhanced early childhood cognitive abilities in recognizing and classifying geometric shapes, particularly triangles and squares. This aligns with Piaget's cognitive development theory, which states that children aged 5–6 years are in the preoperational stage and learn more effectively through concrete experiences (Piaget in Lestari & Yuliani, 2021). G-MAG, consisting of a geometry tower, shape cards, and color dice, provided visual and motor stimulation that supported play-based learning.

This research also supports Fairuzillah & Elfahmi (2025), who found that interactive play-based learning increases motivation and comprehension in early childhood. G-MAG enabled enjoyable yet meaningful learning, as children actively participated in selecting, arranging, and grouping shapes.

Van Hiele's theory (in Sa'ida, 2021) further supports the effectiveness of this media, emphasizing that geometry learning should begin with visualization and proceed to recognition of properties and classification. G-MAG facilitated these stages by engaging children in visual exploration and concrete classification.

Moreover, the success of G-MAG was evident in the increase of children able to name all introduced shapes, from only 1 child in the pretest to 10 children in the posttest. This shows that the media played a vital role in broadening children's knowledge and symbolic thinking abilities (Ulfa et al., 2020). The media is also consistent with Montessori principles, where children learn through concrete tools and

independent repetition. G-MAG provided manipulative learning tools that nurtured initiative and creativity (Ummah, 2019).

Overall, the increase in posttest scores and Wilcoxon test results confirmed that G-MAG was effective in enhancing the ability of children aged 5–6 years to recognize geometric shapes. These findings contribute to the development of innovative, constructivist-based, and enjoyable early childhood learning media.

Conclusion

This research shows that the G-MAG (Geometry Imagination) learning media is highly feasible and effective for introducing the concepts of triangles and squares to children aged 5–6 years. Expert validation confirmed that this media is safe, engaging, and appropriate for the developmental stage of children. Its effectiveness was proven through a significant improvement between pretest and posttest results, indicating that children became more capable of recognizing, identifying, and classifying basic geometric shapes after using G-MAG. These findings support that a visual and imaginative approach in geometry learning can create enjoyable and meaningful learning experiences for early childhood. This media also has the potential to be further developed as a learning solution suited to the needs and characteristics of young children.

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