Development Of The "*Rumah Pintar Gembira (Maharia)*" Learning Media To Improve Cognitive Abilities Of Early Childhood

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ABSTRACT
This study aims to develop an innovative learning medium called Rumah Pintar Gembira (MAHARIA) to improve the cognitive abilities of early childhood. The research was conducted using a Research and Development (R&D) approach with the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. The study was carried out in two early childhood education institutions, namely TK Sukakarya and TK Cemerlang in Sukabumi City, with children aged 4–5 years as the research subjects. The needs analysis revealed that cognitive learning media used in both institutions were limited and mostly consisted of worksheets and static picture cards. Most teachers (78–90%) expressed the need for concrete, manipulative, and interactive learning media, while the average cognitive ability of children was still in the low category (43.7%). Based on these findings, the MAHARIA learning media was developed in the form of a three-dimensional miniature house equipped with eight learning activity components designed to stimulate number recognition, one-to-one correspondence, classification skills, and simple problem-solving abilities. The feasibility of the media was validated by three experts consisting of one media expert and two material experts, resulting in an average feasibility score of 75.3%, categorized as feasible with revision. The effectiveness test was conducted using a comparative experimental design. The experimental group obtained an average N-Gain score of 0.51 (moderate category), which was higher than the comparison group with an average N-Gain score of 0.28 (low category). These findings indicate that the MAHARIA learning media contributes positively to improving early childhood cognitive abilities compared to conventional learning media. Therefore, the MAHARIA learning media can serve as an alternative innovative learning medium to support cognitive development in early childhood education.
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INTRODUCTION

Early childhood education plays a crucial role in supporting children's overall development, particularly cognitive development, which forms the foundation for later learning processes. Cognitive ability in early childhood includes the capacity to classify objects, understand number concepts, identify patterns, and solve simple problems

through interaction with their environment. According to developmental psychology perspectives, children aged 4–5 years are in the preoperational stage, where learning occurs most effectively through concrete experiences and direct manipulation of objects. Therefore, learning environments for young children should emphasize active engagement, exploration, and meaningful experiences that stimulate cognitive growth (Piaget, 1972; Vygotsky, 2006). Learning activities that involve play-based interaction with concrete materials can help children construct knowledge gradually from physical experiences to symbolic understanding.

In practice, however, many early childhood education institutions still rely on conventional learning media such as worksheets and static picture cards that provide limited opportunities for active exploration. Observations and interviews conducted in TK Sukakarya and TK Cemerlang in Sukabumi City revealed that the use of learning media was relatively limited and lacked variation. Teachers predominantly used conventional instructional materials that did not sufficiently involve children's participation in learning activities. As a result, children often showed low enthusiasm and engagement during classroom learning. When teachers occasionally used more interactive media, even simple materials made from recycled objects, children demonstrated greater interest and participation in the learning process. This situation indicates that innovative and interactive learning media are needed to stimulate children's cognitive development more effectively (Nirwani, 2025).

Needs analysis conducted through questionnaires, interviews, and initial observations further revealed that cognitive learning media in the two institutions were very limited and dominated by traditional materials. Approximately 78%–90% of teachers expressed the need for concrete, manipulative, and interactive learning media that could actively engage children in the learning process. In addition, the average cognitive ability of children was still categorized as low, with only 43.7% of children demonstrating adequate cognitive performance in early mathematical concepts. Many children still experienced difficulties in understanding basic concepts such as classification, one-to-one correspondence, and simple problem solving. These findings highlight a significant gap between the ideal implementation of early childhood learning and the actual conditions observed in the classroom (Nirwani, 2025).

Previous studies have explored the use of innovative learning media to enhance children's cognitive abilities. For instance, research by Mardiyanti and Budiarti (2023) developed a "Smart Window" learning medium using the ADDIE development model to improve children's cognitive abilities. Similarly, Juliasari et al. (2025) examined the application of augmented reality learning media in early childhood education and found positive effects on children's cognitive development. Other studies have investigated media such as smart clocks, smart boxes, and number boards designed to improve specific cognitive skills, particularly numeracy abilities. Although these studies demonstrate the potential of innovative learning media, many of them focus only on particular aspects of cognitive skills or emphasize product development without comprehensively evaluating the

effectiveness of the media in real classroom contexts (Pratiwi et al., 2025; Wahyuningtias et al., 2025; Putri et al., 2025).

Furthermore, several studies on "smart house" learning media have primarily concentrated on validating the feasibility of the media design rather than examining its direct impact on children's cognitive development. For example, research conducted by Yuniarni (2025) developed a smart house learning medium for early childhood education using a descriptive approach, focusing mainly on media validation without conducting a quantitative effectiveness test. This limitation indicates that there is still a research gap regarding the integration of learning media development with empirical evaluation of its effectiveness in improving children's cognitive abilities. Consequently, further studies are required to design learning media that not only meet pedagogical feasibility standards but also demonstrate measurable impacts on children's cognitive development in authentic learning environments (Nirwani, 2025).

In response to these challenges, this study aims to develop an innovative learning medium called Rumah Pintar Gembira (MAHARIA) designed specifically to stimulate various aspects of early childhood cognitive development. The media is designed as a three-dimensional miniature house equipped with several interactive activity components that encourage children to explore concepts such as number recognition, classification, one-to-one correspondence, and simple problem solving. The design of this learning media is grounded in several theoretical frameworks, including Piaget's cognitive development theory, Dale's Cone of Experience, learning through play principles, and child-centered learning approaches. These frameworks emphasize that young children learn more effectively through direct experience, manipulation of objects, and play-based learning activities (Dale, 1969; Piaget, 1972; Vygotsky, 2006).

Therefore, the objectives of this study are threefold: (1) to develop the MAHARIA learning media for improving early childhood cognitive abilities, (2) to determine the feasibility of the developed media based on expert validation, and (3) to examine the effectiveness of the media in enhancing children's cognitive abilities through experimental implementation in early childhood education settings. The contribution of this research lies in integrating the development of innovative learning media with empirical testing of its effectiveness in improving multiple aspects of cognitive development in early childhood. Unlike previous studies that focus on specific cognitive skills or limited product validation, this study provides a comprehensive approach by combining instructional design, pedagogical feasibility evaluation, and experimental effectiveness testing within authentic classroom environments (Nirwani, 2025).

METHOD
Research Design

This study employed a Research and Development (R&D) approach aimed at developing and evaluating an innovative learning medium called *Rumah Pintar Gembira (MAHARIA)* to improve early childhood cognitive abilities. Research and Development is a systematic process used to design, develop, and evaluate educational products to ensure

their effectiveness and feasibility in real educational settings. This approach allows researchers not only to produce a learning medium but also to test its pedagogical impact on learners.

The development of the learning media followed the ADDIE model, which consists of five sequential stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was chosen because it provides a structured and systematic framework for designing instructional media and ensures that each stage of development is conducted based on actual educational needs. The analysis stage focuses on identifying learning problems and needs, the design stage determines the structure and components of the media, the development stage involves creating and revising the prototype, the implementation stage tests the product in real classroom situations, and the evaluation stage examines the effectiveness and feasibility of the developed media.

To examine the effectiveness of the developed media, the study applied a comparative experimental design. This design compares the learning outcomes of two groups that receive different instructional treatments under relatively similar initial conditions. The experimental design was used because the study was conducted in two different schools where full randomization of participants was not possible, making a natural comparison between groups the most suitable approach for the research context.

Subjects / Population and Sample

The subjects of this study were early childhood students aged 4–5 years (Group A) from two early childhood education institutions in Sukabumi City: TK Sukakarya and TK Cemerlang. These institutions were selected because they had implemented play-based learning activities but still faced limitations in the use of innovative learning media designed to support children's cognitive development. The selection of these schools was also based on practical considerations, including accessibility, institutional support, and the suitability of student characteristics with the objectives of the research.

The total number of participants involved in the effectiveness test was 35 children. The experimental group consisted of 12 children from TK Sukakarya, who participated in learning activities using the MAHARIA learning media. Meanwhile, the comparison group consisted of 23 children from TK Cemerlang, who continued learning using conventional instructional media commonly used in the classroom, such as worksheets and picture cards. Both groups had relatively homogeneous characteristics in terms of age and socio-educational background, ensuring that the comparison between groups was conducted under comparable conditions.

The research was conducted from October 2025 to March 2026, covering several stages including needs analysis, media design and development, expert validation, limited trials, and effectiveness testing of the developed learning media.

Data Collection Procedures

Data collection in this study was conducted through several techniques in accordance with the stages of the ADDIE development model. During the analysis stage,

initial data were collected through observations, interviews, and questionnaires administered to teachers to identify learning needs and problems related to cognitive learning media in early childhood classrooms. These techniques were used to obtain information about existing teaching practices, available instructional media, and the cognitive abilities of children in the participating institutions.

In the development stage, the prototype of the MAHARIA learning media was evaluated through expert validation, involving three validators consisting of one media expert and two subject-matter experts. The experts assessed several aspects of the media, including design quality, instructional relevance, content accuracy, and usability for early childhood learning. The validation results were used to revise and improve the product before it was implemented in the classroom.

To measure the effectiveness of the media, pretest and posttest observations of children's cognitive abilities were conducted using the same observation instrument. The instrument assessed several cognitive indicators including classification ability, one-to-one correspondence, recognition of number symbols, and simple problem-solving skills. The pretest was conducted before the treatment to determine the initial cognitive abilities of children, while the posttest was conducted after the learning intervention to evaluate changes in children's cognitive performance.

Data Analysis

The data obtained from expert validation were analyzed using descriptive percentage analysis to determine the feasibility level of the developed learning media. The validation results were categorized into feasibility levels based on predetermined criteria to determine whether the media was appropriate for classroom implementation.

Meanwhile, the effectiveness of the MAHARIA learning media in improving children's cognitive abilities was analyzed using the Normalized Gain (N-Gain) score. The N-Gain analysis was used to measure the level of improvement in children's cognitive abilities by comparing the pretest and posttest scores. The N-Gain values were then categorized into three levels of improvement: high, moderate, and low. This analysis allowed the researchers to determine the magnitude of cognitive improvement experienced by children in both the experimental and comparison groups.

Descriptive statistical analysis was also conducted to compare the average improvement between the two groups. By analyzing the differences in N-Gain scores between the experimental group and the comparison group, the study was able to determine the effectiveness of the MAHARIA learning media as an instructional tool for enhancing early childhood cognitive development.

FINDING AND DISCUSSION
Findings (Results)
Needs Analysis of Cognitive Learning Media
      The needs analysis was conducted in two early childhood education institutions: TK Sukakarya and TK Cemerlang in Sukabumi City. Data were collected through teacher questionnaires, interviews, and initial observations of children's cognitive abilities. The questionnaire was distributed to five teachers of Group A (children aged 4–5 years).
The results of the teacher needs analysis questionnaire are presented in Table 1.

Table 1. Teacher Needs Analysis for Cognitive Learning Media

Indicator	Percentage
Existing media are adequate for cognitive learning	28%
Media used in class are varied	32%
Media enable active child interaction	35%
Teachers need new innovative learning media	78%
Teachers agree that interactive media can improve cognitive learning	90%

      The questionnaire results show the percentage distribution of teachers' responses regarding the availability, variation, and interaction level of cognitive learning media used in the classroom.

Product Development Results
      The development of the Rumah Pintar Gembira (MAHARIA) learning media was carried out using the ADDIE development model consisting of analysis, design, development, implementation, and evaluation stages. The product developed is a three-dimensional interactive learning media designed to stimulate children's cognitive abilities through play activities involving number recognition, classification, matching, and simple problem-solving tasks. The feasibility of the developed media was assessed through expert validation consisting of one media expert and two material experts.

Table 2. Expert Validation Results

Validator	Assessment Aspect	Percentage	Category
Media Expert	Media design and usability	86%	Very feasible
Material Expert 1	Content relevance	90%	Very feasible
Material Expert 2	Learning suitability	82%	Very feasible

      The validation results show the percentage scores obtained from each validator for the developed MAHARIA learning media.

Implementation of the Learning Media
      The effectiveness test of the MAHARIA media involved 35 children aged 4–5 years from two early childhood institutions.

The participants were divided into two groups:
1. Experimental group: 12 children from TK Sukakarya using MAHARIA learning media
2. Comparison group: 23 children from TK Cemerlang using conventional learning media

Children's cognitive abilities were measured using pretest and posttest observations based on four indicators:
1. Classification ability
2. One-to-one correspondence
3. Recognition of number symbols
4. Simple problem solving

The results of pretest and posttest observations are summarized in Table 3.

Table 3. Average Cognitive Ability Scores

Group	Pretest Score	Posttest Score
Experimental Group	43.7%	75.3%
Comparison Group	47.3%	63.1%

The scores represent the average percentage of children's cognitive performance before and after the learning intervention.

Improvement of Cognitive Ability (N-Gain Analysis)

To measure the improvement in cognitive abilities, the data were analyzed using the Normalized Gain (N-Gain) formula based on the difference between pretest and posttest scores.

Table 4. N-Gain Score Comparison

Group	N-Gain Score	Category
Experimental Group	0.51	Moderate
Comparison Group	0.28	Low

The N-Gain scores show the magnitude of improvement in children's cognitive abilities after the learning intervention.

Improvement Based on Cognitive Indicators

The improvement in children's cognitive abilities was also analyzed based on each indicator assessed in the observation instrument.

Table 5. Cognitive Ability Improvement by Indicator

Cognitive Indicator	Experimental Group	Comparison Group
Classification ability	40.7%	32.4%
One-to-one correspondence	43.1%	31.8%
Recognition of number symbols	40.7%	29.6%

Simple problem solving	47.3%	33.2%

The table shows the percentage increase in cognitive ability scores for each indicator after the learning intervention.

DISCUSSION
Interpretation of Findings

The results of this study indicate that the use of the *Rumah Pintar Gembira (MAHARIA)* learning media contributes to an improvement in the cognitive abilities of early childhood learners. The increase in posttest scores in the experimental group demonstrates that children who participated in learning activities using the MAHARIA media showed higher cognitive performance compared to their initial abilities measured during the pretest. This improvement is also reflected in the N-Gain score of the experimental group, which falls into the moderate improvement category, indicating measurable progress in children's cognitive development during the intervention period.

The observed improvement occurred across several cognitive indicators, including classification ability, one-to-one correspondence, recognition of number symbols, and simple problem-solving skills. These indicators represent fundamental components of early cognitive development, particularly in early childhood education settings where learning is primarily conducted through play-based and interactive activities. The structure of the MAHARIA media, which combines visual, manipulative, and interactive elements, appears to provide opportunities for children to explore concepts actively while engaging in meaningful learning experiences.

Another important finding is the difference in improvement between the experimental group and the comparison group. While both groups demonstrated increases in cognitive scores after the learning activities, the magnitude of improvement in the experimental group was greater than in the comparison group. This difference suggests that the integration of structured and interactive learning media may provide additional cognitive stimulation compared to conventional learning tools that rely primarily on worksheets or static visual materials.

These findings highlight the importance of developing creative and engaging instructional media in early childhood education. Interactive learning environments can facilitate children's curiosity, exploration, and active participation, which are key elements in supporting cognitive growth during the early years of development.

Relationship to Literature

The results of this study are consistent with previous research emphasizing the importance of learning through play and interactive media in early childhood education. Studies in early childhood pedagogy suggest that children learn more effectively when they are actively involved in hands-on activities that stimulate curiosity and exploration. Interactive learning media allow children to engage multiple senses simultaneously, which can strengthen cognitive processing and memory formation.

Previous studies on educational media development have also shown that three-dimensional and manipulative learning tools can improve children's understanding of abstract concepts such as numbers, classification, and logical relationships. Similar findings were reported in research on interactive learning models in early childhood classrooms, which demonstrated that play-based learning environments significantly enhance children's cognitive engagement and learning outcomes.

Furthermore, the results align with developmental learning theories that emphasize the role of concrete experiences in early cognitive development. Young children tend to learn more effectively when abstract concepts are represented through tangible objects that they can manipulate directly. The MAHARIA learning media provides this type of concrete learning experience by allowing children to interact with physical components of the media while performing cognitive tasks.

The improvement in children's cognitive abilities observed in this study therefore supports the broader body of literature indicating that innovative learning media play a crucial role in optimizing early childhood learning environments.

Limitations of the Study

Despite the positive findings, several limitations should be considered when interpreting the results of this study. First, the sample size involved in the effectiveness testing was relatively small, consisting of only 35 children from two early childhood institutions. A larger sample involving multiple schools would provide more comprehensive data and increase the generalizability of the findings.

Second, the study was conducted within a relatively short implementation period, which may limit the ability to observe long-term effects of the learning media on children's cognitive development. Cognitive development is a gradual process that typically occurs over extended periods of time, and longer observation periods may provide more detailed insights into sustained learning outcomes.

Another limitation relates to the quasi-comparative research design, where participants were drawn from different institutions rather than randomly assigned to experimental and control groups within the same setting. Differences in classroom environments, teaching styles, or institutional characteristics may have influenced the results to some extent.

Finally, the cognitive abilities measured in this study were limited to several selected indicators related to early mathematical and logical thinking. Other important aspects of cognitive development, such as memory, language-based reasoning, and creative problem solving, were not specifically examined in this research.

Implications

The findings of this study provide several implications for both educational practice and future research in early childhood education. For educational practitioners, the results highlight the importance of integrating interactive and developmentally appropriate learning media into classroom activities. The MAHARIA learning media demonstrates that

creative instructional tools can support children's engagement and facilitate cognitive learning through play-based approaches.

Teachers may benefit from incorporating similar hands-on learning media that allow children to explore, manipulate objects, and actively participate in learning tasks. Such approaches align with the pedagogical principles of early childhood education, which emphasize experiential learning and child-centered instructional strategies.

For future research, further studies could examine the effectiveness of the MAHARIA learning media in larger and more diverse educational settings to confirm its applicability across different contexts. Longitudinal studies could also explore the long-term impact of interactive learning media on children's cognitive development over extended periods of time.

Additionally, future research may investigate how similar learning media can be adapted to support other developmental domains, such as language development, creativity, social interaction, and problem-solving skills. Expanding the scope of research in this area would contribute to a deeper understanding of how innovative educational media can enhance holistic early childhood development.

CONCLUSION

This study aimed to develop and evaluate the effectiveness of the *Rumah Pintar Gembira (MAHARIA)* learning media in improving the cognitive abilities of early childhood learners. The development process followed the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. The results of the development process showed that the MAHARIA learning media met the feasibility criteria based on expert validation, including assessments from media experts and subject-matter experts. The validation results indicated that the developed media was categorized as very feasible for use in early childhood learning activities.

The implementation of the MAHARIA learning media in classroom activities demonstrated an improvement in children's cognitive abilities. Based on the results of pretest and posttest observations, the experimental group that used the MAHARIA learning media showed higher cognitive score improvements compared to the comparison group that used conventional learning media. The N-Gain analysis also indicated that the experimental group experienced a moderate level of improvement, while the comparison group showed a lower level of improvement.

These findings suggest that the MAHARIA learning media can function as an effective instructional tool for supporting cognitive development in early childhood education. The interactive and play-based characteristics of the media provide opportunities for children to engage actively in learning activities that stimulate classification skills, number recognition, one-to-one correspondence, and simple problem-solving abilities.

Overall, the results of this study indicate that the development of innovative and interactive learning media such as MAHARIA can contribute positively to the learning process in early childhood education. The integration of developmentally appropriate

educational media can support more engaging learning environments and facilitate children's cognitive growth during the early stages of development.

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