Development of the DIY (Do-It-Yourself) Learning Model to Improve Problem-Solving Skills of Children Aged 5–6 Years

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ABSTRACT

Problem-solving skills are essential competencies that need to be developed during early childhood education. However, learning practices in many early childhood institutions are still teacher-centered, limiting children's opportunities to explore and solve problems independently. This study aimed to develop and examine the effectiveness of a DIY (Do-It-Yourself) learning model to improve problem-solving skills among children aged 5–6 years. The research employed a Research and Development (R&D) approach adapted from the ADDIE model consisting of analysis, design, development, implementation, and evaluation stages. The effectiveness of the model was tested using a pre-experimental design with a one-group pretest–posttest approach. The research participants consisted of 14 children from Group B at TK Negeri Parakanlima, Purwakarta. Data were collected using observation sheets measuring four indicators of problem-solving ability. The results showed a significant improvement in children's problem-solving skills, with the average score increasing from 52.43 in the pretest (developing category) to 80.36 in the posttest (very well-developed category). The N-Gain value of 0.65 indicated a moderate-to-high effectiveness level. The findings demonstrate that the DIY learning model can provide meaningful learning experiences through hands-on construction activities using recycled materials, encouraging children's independence, creativity, and critical thinking. Therefore, the DIY learning model can serve as an innovative pedagogical alternative to support the development of problem-solving skills in early childhood education.

Keywords: *DIY Learning Model, Problem-Solving Skills, Early Childhood Education, Recycled Materials, Experiential Learning*

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INTRODUCTION

Early childhood education plays a crucial role in developing fundamental competencies that shape children's future learning and development. One of the key competencies that should be fostered during early childhood is problem-solving ability. Problem-solving skills enable children to identify challenges, explore possible solutions, and make appropriate decisions when facing various situations in everyday life. These abilities support cognitive flexibility, critical thinking, and adaptive behavior that are essential for

children's academic success and social adjustment. Research indicates that children who develop strong problem-solving skills in early childhood tend to demonstrate better learning readiness and higher academic achievement in later educational stages (OECD, 2019; Pellegrino & Hilton, 2012).

Despite the importance of problem-solving development, learning practices in many early childhood institutions remain dominated by teacher-centered approaches. In such environments, teachers often provide direct instructions and predetermined solutions, limiting children's opportunities to explore ideas independently. As a result, children become passive recipients of information rather than active participants in the learning process. This condition may hinder the development of higher-order thinking skills, including problem-solving abilities, creativity, and decision-making skills (Hirsh-Pasek et al., 2015; Zosh et al., 2018).

Observations conducted at TK Negeri Parakanlima revealed similar conditions. Learning activities were primarily implemented through structured teacher instructions and repetitive tasks that offered limited opportunities for children to engage in independent exploration. During play activities, many children showed difficulty when encountering simple challenges. For example, when constructing towers using blocks, several children stopped their attempts when their structures collapsed rather than trying alternative strategies to solve the problem. Such behavior suggests that children's problem-solving abilities require further stimulation through more engaging and exploratory learning experiences (Berk, 2018).

To address this issue, innovative learning approaches that promote active participation and experiential learning are required. One potential approach is the DIY (Do-It-Yourself) learning model. DIY learning emphasizes hands-on activities in which children design, create, and build objects independently using simple materials. Through this process, children engage in exploration, experimentation, and reflection, which are essential elements in developing problem-solving skills. Hands-on construction activities also encourage children to think critically, test ideas, and evaluate the effectiveness of their solutions (Resnick & Rosenbaum, 2013; Sheridan et al., 2014).

Although DIY learning has gained increasing attention in the context of maker education and STEM-based learning, its application in early childhood education remains relatively limited. Most previous studies have focused on the use of maker activities or project-based learning to support creativity and engineering thinking, rather than systematically developing a structured DIY learning model specifically aimed at improving problem-solving skills among young children. This indicates a research gap in developing and testing instructional models that integrate DIY activities with structured learning strategies for early childhood education (Halverson & Sheridan, 2014; Peppler et al., 2016).

Therefore, this study aims to develop and examine the effectiveness of a DIY (Do-It-Yourself) learning model designed to improve problem-solving skills among children aged 5–6 years. The model is developed using the ADDIE instructional design framework to ensure systematic planning and implementation. The contribution of this research lies in the development of an innovative learning model that integrates hands-on construction

activities with structured problem-solving processes in early childhood learning contexts. The findings of this study are expected to provide both theoretical and practical contributions to the development of innovative learning strategies that support cognitive and problem-solving development in early childhood education.

METHOD
Research Design
This study employed a Research and Development (R&D) approach aimed at developing and evaluating the effectiveness of a learning model designed to improve children's problem-solving skills. The development process adopted the ADDIE instructional design framework, which consists of five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model was selected because it provides a structured procedure for designing, developing, and validating educational products through iterative stages of planning, testing, and refinement.

In the implementation stage, the effectiveness of the developed DIY learning model was tested using a pre-experimental research design, specifically a one-group pretest–posttest design. This design allowed the researcher to measure children's problem-solving abilities before and after the implementation of the learning model in order to identify potential improvements resulting from the intervention.

Subjects and Sample
The research was conducted at TK Negeri Parakanlima, Purwakarta, Indonesia, during the 2024 academic year. The participants consisted of 14 children aged 5–6 years from Group B, who were selected using a purposive sampling technique based on their participation in the learning activities implemented during the study.

These participants represented the target population of early childhood learners in the kindergarten level who were expected to develop problem-solving skills through structured learning experiences. The children participated in a series of DIY learning activities designed to stimulate exploration, creativity, and independent thinking.

Data Collection Procedure
Data were collected through several techniques aligned with the stages of the ADDIE development model. During the analysis stage, classroom observations and teacher interviews were conducted to identify existing learning problems and determine the need for innovative instructional approaches to support problem-solving development.
During the design and development stages, the DIY learning model and its supporting instructional materials were developed. These materials included a teacher guidebook, lesson plans, children's worksheets, and learning media constructed from recycled materials. The developed learning model was subsequently evaluated through expert validation, involving specialists in early childhood education and instructional design to assess the feasibility of the model.

In the implementation stage, the developed learning model was applied in classroom activities involving DIY-based construction tasks. Children's problem-solving abilities were assessed using structured observation sheets administered during both the pretest and posttest stages.

The observation instrument measured four key indicators of children's problem-solving ability:

1. Identifying problems
2. Generating possible solutions
3. Selecting appropriate solutions
4. Evaluating the outcomes of actions taken

Each indicator was assessed using a scoring rubric designed to capture the level of children's performance during learning activities.

Data Analysis

The collected data were analyzed using descriptive statistical analysis to examine the overall improvement in children's problem-solving abilities before and after the implementation of the DIY learning model. Mean scores from the pretest and posttest results were compared to identify changes in children's performance.

In addition, the effectiveness of the learning model was evaluated using the Normalized Gain (N-Gain) analysis, which measures the magnitude of improvement between pretest and posttest scores. The N-Gain values were interpreted according to standard criteria to determine whether the improvement fell within low, moderate, or high effectiveness categories.

The combination of descriptive statistics and N-Gain analysis allowed the researcher to evaluate both the magnitude and significance of the improvements in children's problem-solving skills following the implementation of the DIY learning model.

FINDING AND DISCUSSION
Research Results
Expert Validation Results

Expert validation was conducted to assess the feasibility of the developed DIY learning model before it was implemented in classroom learning activities. The validation process involved experts in early childhood education and instructional design who evaluated several aspects of the learning model, including learning material suitability, learning model design, learning media, and evaluation instruments. Table 1 presents the results of the expert validation of the DIY learning model.

Table 1. Expert Validation Results of the DIY Learning Model

No	Aspect Evaluated	Score (%)
1	Learning Material Suitability	95%
2	Learning Model Design	94%

3	Learning Media	96%
4	Evaluation Instrument	95%
	Average	95.00%

Source: Research Data

The validation results show that the average feasibility score of the DIY learning model reached 95.00%. The highest score was obtained in the learning media aspect (96%), while the learning model design aspect received a score of 94%.

Pretest and Posttest Results

Children's problem-solving abilities were measured before and after the implementation of the DIY learning model using observation-based assessment instruments. Table 2 presents the comparison between pretest and posttest results.

Table 2. Comparison of Pretest and Posttest Scores

Measurement	Average Score
Pretest	52.43
Posttest	80.36
Maximum Score	100

Source: Research Data

The data show that the average score of children's problem-solving ability increased from 52.43 in the pretest to 80.36 in the posttest after the implementation of the DIY learning model.

N-Gain Analysis Results

The effectiveness of the DIY learning model was analyzed using the Normalized Gain (N-Gain) formula to measure the level of improvement in children's problem-solving abilities. Table 3 presents the N-Gain analysis results.

Table 3. N-Gain Analysis of Problem-Solving Ability

Indicator	N-Gain Score	Category
Identifying Problems	0.60	Moderate
Generating Solutions	0.66	Moderate
Selecting Solutions	0.67	Moderate
Evaluating Results	0.68	Moderate
Average	0.65	Moderate–High

Source: Research Data

The results show that the overall N-Gain score reached 0.65, which falls into the moderate–high improvement category.

DISCUSSION

The findings of this study indicate that the implementation of the DIY learning model contributes to the improvement of children's problem-solving abilities. The increase in the average score from the pretest to the posttest demonstrates that learning activities based on hands-on exploration can provide meaningful learning experiences for children. Through DIY activities, children were encouraged to construct objects independently, experiment with different ideas, and evaluate the effectiveness of their solutions when encountering challenges.

The improvement in children's problem-solving abilities can be associated with the experiential learning processes embedded in the DIY learning model. During the learning activities, children were actively involved in exploring materials, testing ideas, and reflecting on their actions. Such experiences support cognitive development because children learn by interacting directly with their environment and constructing their own understanding through exploration and experimentation.

These findings are consistent with previous studies suggesting that hands-on learning and maker-based activities can enhance children's problem-solving skills and creative thinking. Research has shown that experiential learning approaches encourage children to develop critical thinking and independent learning behaviors (Halverson & Sheridan, 2014). Similarly, maker-centered learning environments provide opportunities for children to engage in iterative design processes that promote exploration, experimentation, and reflection (Peppler et al., 2016).

Despite the positive findings, several limitations should be considered. First, the number of research participants was relatively small, consisting of only 14 children from a single kindergarten. This condition may limit the generalizability of the research findings to broader educational contexts. Second, the duration of the implementation was relatively short, which may not fully capture the long-term effects of the learning model on children's problem-solving development.

Future research is recommended to involve larger participant groups and longer implementation periods in order to examine the long-term effectiveness and sustainability of the DIY learning model. Further studies may also explore the integration of DIY learning with other innovative approaches, such as STEM-based learning or project-based learning in early childhood education.

The findings of this study have practical implications for early childhood educators. The DIY learning model can serve as an alternative instructional strategy that encourages active participation, creativity, and independent thinking among children. By incorporating simple materials and hands-on activities, teachers can create learning environments that stimulate children's curiosity and support the development of problem-solving abilities in meaningful ways.

CONCLUSION

This study aimed to develop and examine the effectiveness of the DIY (Do-It-Yourself) learning model in improving problem-solving skills among children aged 5–6 years.

The results indicate that the implementation of the DIY learning model contributed to a significant improvement in children's problem-solving abilities, as reflected in the increase of the average score from the pretest to the posttest. The N-Gain analysis also showed a moderate-to-high level of improvement, indicating that the model was effective in supporting the development of children's problem-solving skills.

The findings suggest that learning activities based on hands-on exploration and creative construction can provide meaningful learning experiences for children. Through DIY activities, children are encouraged to identify problems, explore possible solutions, select appropriate strategies, and evaluate the results of their actions. These processes support the development of critical thinking, creativity, and independent learning behavior in early childhood.

However, this study has several limitations that should be considered. The research involved a relatively small number of participants from a single educational institution, which may limit the generalizability of the findings. In addition, the duration of the implementation was relatively short, which may not fully capture the long-term impact of the learning model.

Future research is recommended to involve larger samples and longer implementation periods in order to further examine the effectiveness and sustainability of the DIY learning model in different early childhood education contexts. Practically, the findings of this study provide useful insights for educators in designing innovative learning activities that promote children's problem-solving abilities through creative and exploratory learning experiences.

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