

Analysis of the Early Reading Learning Outcomes of Children Aged 5–6 Years Through a Computational Thinking-Based Problem-Based Learning Model

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ABSTRACT

Early reading skills are one of the essential aspects of early childhood language development that need to be developed as a foundation for entering the next level of education. This study aimed to analyze the early reading learning outcomes of children aged 5–6 years through a Computational Thinking-based Problem-Based Learning (PBL) model. The study employed a quantitative approach using a one-group pretest-posttest design. The research subjects consisted of 15 children in Group B at TK PGRI Tunas Harapan Keduyung, selected using a purposive sampling technique. Data were collected through observation using an instrument covering early reading indicators and were analyzed using descriptive statistics by calculating the mean scores, percentages, and developmental categories of children's learning outcomes. The results showed that the average early reading learning outcome at the pretest stage was 7 (43.75%), which was categorized as Beginning to Develop (BD). After the implementation of the

Computational Thinking-based Problem-Based Learning model, the average learning outcome increased to 12 (75%), which fell into the category of Developing as Expected (DE). The findings indicate that children's early reading learning outcomes through the Computational Thinking-based Problem-Based Learning model reached the Developing as Expected (DE) category. Therefore, the Computational Thinking-based Problem-Based Learning model can be used as an alternative instructional approach to support the achievement of early reading learning outcomes in early childhood.

Introduction

Law of the Republic of Indonesia Number 20 of 2003, Chapter I, Article 1, Point 14 concerning the National Education System states that "early childhood education is an educational effort aimed at children from birth to six years of age through the provision of educational stimulation to support their physical and spiritual growth and development so that they are prepared to enter further education" (Putra, 2020). This period is often referred to as the golden age, during which children experience rapid developmental growth that must be appropriately stimulated to enable them to develop optimally. This stage occurs very rapidly in a child's life (Syahbana et al., 2023). Such rapid development takes place across several developmental domains, one of which is language development.

Language development is the process through which children

acquire the ability to understand and use language as a means of communication. This development includes listening, speaking, reading, and writing skills (Isna, 2019). Language development is important because it enables children to understand the meanings of words and sentences and to develop an understanding of the relationship between spoken language and language presented in written form (Astuti & Istiarini, 2020). Furthermore, language development serves as an essential foundation for children's ability to communicate, comprehend information, and develop early reading skills.

According to Montessori, children aged 4–6 years are in a sensitive period for learning to read because they have developed reading readiness or an emerging interest in reading. Reading skills in early childhood are referred to as early reading skills. According to Fahmi (as cited in Ani & Fitria, 2019), the objective of early reading instruction is merely to introduce children to letters, syllables, and simple words. Likewise, Tarigan (as cited in Nasir, 2017) explains that early reading involves the ability to recognize letters, read syllables, and read simple words. Consistent with these views, Steinberg (as cited in Sunarni, 2014) states that early reading is a systematically planned reading activity introduced to preschool children through the gradual recognition of letters, syllables, and simple words using engaging learning activities. Based on these perspectives, it can be concluded that the primary

components of early reading are the abilities to recognize letters, syllables, and simple words.

The results of observations and interviews conducted in September indicated that the early reading skills of children aged 5–6 years at TK PGRI Tunas Harapan Keduyung still required improvement. Of the 15 children observed, 11 still experienced difficulties in early reading, particularly in reading syllables and simple words. These findings were further supported by the assessment results conducted by the teacher at the end of the early reading activities.

According to Rahim (as cited in Anjarwati, 2019), children's early reading skills are influenced by teaching methods, instructional procedures, and teachers' ability to manage the learning process. However, observations conducted at TK PGRI Tunas Harapan revealed that instruction was still implemented using a teacher-centered classical learning model, resulting in limited children's participation during learning activities. In addition, early reading activities were limited to the use of children's worksheets and reading books, so children were only exposed to the presented materials. These conditions caused children to become less enthusiastic and easily bored, resulting in suboptimal development of their early reading skills.

Rahayu and Wardhani (2023) argue that the most important issue in teaching early reading is the strategy employed to ensure that children perceive reading as an engaging and enjoyable activity through

the use of creative learning models. One of the effective instructional models for developing children's early reading skills is the Problem-Based Learning (PBL) model. Problem-Based Learning is a type of instructional model that encourages learners to actively participate in the learning process while helping them solve problems and enhance their critical thinking skills (F. et al., 2021).

To optimize the implementation of the PBL model, the Computational Thinking approach can be integrated into the learning process. In line with the demands of twenty-first-century education, children are expected not only to master fundamental academic competencies but also to develop thinking skills that support problem-solving abilities. One of the essential skills that should be cultivated from an early age is Computational Thinking (Fatonah et al., 2025). According to Wing (as cited in Ardiansyah et al., 2025), Computational Thinking is a thinking process required to formulate problems and develop systematic and logical solutions. This thinking process consists of four stages: decomposition, pattern recognition, abstraction, and algorithm design.

Several previous studies have demonstrated that the Problem-Based Learning (PBL) model has a positive effect on the early reading skills of young children. A study conducted by Putri, Parwoto, and Rusmayadi (2023) revealed that the implementation of the PBL model effectively and significantly improved children's early reading skills

through learning activities centered on problem-solving. Similarly, research conducted by Fajaryanti, Fitriawanati, and Rusmimawarti (2023) found that the use of the PBL model gradually enhanced children's early reading skills through their active involvement in the learning process.

In addition to studies on PBL, several previous studies have also examined the implementation of Computational Thinking in early childhood education. Kumala, Fathiyah, and Krisnani (2023) explained that Computational Thinking helps children develop logical, systematic, and structured thinking skills in solving problems. Likewise, the study conducted by Fatonah, Mulyana, and Sianturi (2025) demonstrated that learning activities based on Computational Thinking support the development of children's thinking abilities through innovative instructional activities. Furthermore, Muhith & Bahri (2025) emphasized that the Computational Thinking approach can foster children's abilities in decomposition, pattern recognition, abstraction, and algorithm design from an early age.

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Based on the foregoing discussion, this study is important because early reading skills serve as the foundation for children's literacy development at subsequent educational levels. Moreover, the integration of Problem-Based Learning and Computational Thinking in early reading instruction has rarely been investigated, particularly among children aged 5–6 years. Therefore, this study is expected to provide an overview of children's early reading learning outcomes through a Computational Thinking-based Problem-Based Learning model and to serve as a reference for teachers in designing learning activities that are more active, meaningful, and aligned with the demands of twenty-first-century skills. Based on this background, the objective of this study was to analyze the early reading learning outcomes of children aged 5–6 years through a Computational Thinking-based Problem-Based Learning instructional model.

Method

This study employed a quantitative approach using a pre-experimental design with a one-group pretest-posttest design.

According to Creswell and Creswell (2018), a one-group pretest-posttest design aims to determine changes in learning outcomes before and after the implementation of a treatment within a single research group. This design was used to examine the early reading learning outcomes of children aged 5–6 years before and after the implementation of a Computational Thinking-based Problem-Based Learning (PBL) model. In this design, the research sample was administered a pretest before the treatment and a posttest after the treatment, allowing changes in learning outcomes to be identified by comparing the scores obtained before and after the instructional intervention.

This research was conducted at TK PGRI Tunas Harapan, located in Keduyung Village, Laren District, Lamongan Regency. The research sample consisted of 15 children aged 5–6 years. The sample was selected using a purposive sampling technique, which is a type of non-probability sampling. According to Sugiyono (2019:85), purposive sampling is used when researchers intend to obtain relevant information from participants possessing specific characteristics that support the focus of the study. Similarly, Etikan, Musa, and Alkassim (2016) explain that purposive sampling is a non-probability sampling technique in which participants are selected based on particular characteristics that are consistent with the objectives of the research. Therefore, this study involved children aged 5–6 years at TK PGRI Tunas Harapan because children at this age have reached an

appropriate developmental stage to participate in early reading instruction.

The data in this study were collected through observation. The observation instrument was developed based on predetermined early reading indicators, including the ability to arrange letters to form correct syllables, read syllables, combine initial and final syllables to form correct words, and read simple words. Prior to its use, the observation instrument was validated by an expert with expertise in the field of early childhood education. The validation process assessed the suitability of the indicators with the research objectives, the clarity of each observation item, the appropriateness of the language used, and the feasibility of the instrument in measuring the early reading skills of children aged 5–6 years. Based on the validation results, the instrument was declared suitable for use after several revisions were made to the wording of the items according to the validator's recommendations. Subsequently, the instrument was revised based on these suggestions before being used for data collection.

The study began with the administration of a pretest to identify the children's initial early reading skills. Following the pretest, the researcher implemented the Computational Thinking-based Problem-Based Learning (PBL) model in early reading instruction over four learning sessions. The first and second sessions focused on introducing syllables through activities in which children arranged letters to form

syllables by applying the Problem-Based Learning syntax integrated with the stages of Computational Thinking, enabling children to identify, classify, and systematically organize letters into meaningful syllables. The third and fourth sessions focused on introducing simple words through activities in which children combined initial syllables with ending syllables to form complete and correct words by applying the Problem-Based Learning syntax integrated with the stages of Computational Thinking. Through these activities, children actively participated in solving problems, recognizing patterns in the relationships among syllables, and reading the words they had constructed as part of the development of their early reading skills. After all instructional sessions had been completed, the children were administered a posttest to determine their early reading learning outcomes after receiving the instructional treatment.

The data obtained were analyzed using descriptive statistics to describe children's early reading learning outcomes before and after the implementation of the Computational Thinking-based Problem-Based Learning (PBL) model. According to Field (2018), descriptive statistics are used to describe data characteristics through measures such as means and percentages, thereby facilitating the interpretation of research findings. The data analysis was conducted through several stages. First, the observation scores for each child in both the pretest and posttest were calculated based on the predetermined early reading

indicators. Second, the mean scores of the pretest and posttest were calculated to provide an overview of the children's learning outcomes. Third, the mean scores were converted into percentages to facilitate interpretation. The resulting percentages were then categorized into children's developmental levels, namely Not Yet Developed (NYD), Beginning to Develop (BD), Developing as Expected (DE), and Very Well Developed (VWD). These criteria provided an overview of the level of achievement of the children's learning outcomes. The assessment scale used in this study was adapted from Dimyati (2013:53), as presented in the following table.

Table 1
Categories of Children's Early Reading Skills

No	Percentage	Category
1	0%-25%	Not Yet Developed (NYD)
2	26%-50%	Beginning to Develop (BD)
3	51%-75%	Developing as Expected (DE)
4	76%-100%	Very Well Developed (VWD)

The results of the analysis were then presented in the form of tables and graphs to facilitate data interpretation and to compare children's early reading learning outcomes before and after the implementation of the Computational Thinking-based Problem-Based Learning (PBL) model.

Results and Discussion

This study aimed to analyze the early reading learning outcomes of children aged 5–6 years through a Computational Thinking-based Problem-Based Learning (PBL) model. The data were analyzed using descriptive statistics by calculating the mean learning outcomes, the percentage of achievement, and the children's developmental categories based on the results of the pretest and posttest.

The pretest results were used to determine the children's initial early reading abilities before participating in learning activities using the Computational Thinking-based PBL model. A summary of the pretest results is presented in the following table.

Table 2
Children’s Early Reading Learning Outcomes in the Pretest

Pretest			
Number of Children	Mean Score	Percentage	Category
15	7	43,75%	Beginning to Develop (BD)

Based on these results, the average early reading learning outcome before the implementation of the Computational Thinking-based PBL model was 7, with a percentage of 43.75%. These findings indicate that the children's initial early reading skills were still within the Beginning to Develop (BD) category. Most of the children still experienced difficulties in arranging letters to form syllables, reading syllables,

combining initial and final syllables to form correct words, and reading simple words. Therefore, the children's early reading skills at the pretest stage still required more optimal stimulation through active and meaningful learning activities.

The posttest results were then used to determine children's beginning reading skills after participating in learning using the Computational Thinking-based PBL model. A summary of the posttest results is presented in the following table:

Table 3
Children's Early Reading Learning Outcomes in the Posttest

Posttest			
Number of Children	Mean Score	Percentage	Category
15	12	75%	Developing as Expected (DE)

Based on these results, the average early reading learning outcome of the children was 12, with a percentage of 75%. These findings indicate an improvement in the children's early reading skills after participating in the learning activities. The children were better able to arrange letters to form syllables, read syllables, combine initial and final syllables to form correct words, and read simple words, although several children still required guidance in developing their early reading skills.

The results of the analysis indicate that the early reading learning outcomes of children aged 5–6 years at TK PGRI Tunas Harapan

improved after the implementation of the Computational Thinking-based Problem-Based Learning (PBL) model. This improvement can be seen from the comparison between the mean pretest and posttest scores of the children's early reading skills, as presented in the following table.

Table 4
Descriptive Statistical Analysis of the Pretest and Posttest on Early Reading

Measurement	Mean Score	Percentage	Category
Pretest	7	43,75%	Beginning to Develop (BD)
posttest	12	75%	Developing as Expected (DE)

Based on the data analysis, the average early reading learning outcome at the pretest stage was 7, equivalent to 43.75%, which falls within the Beginning to Develop (BD) category.

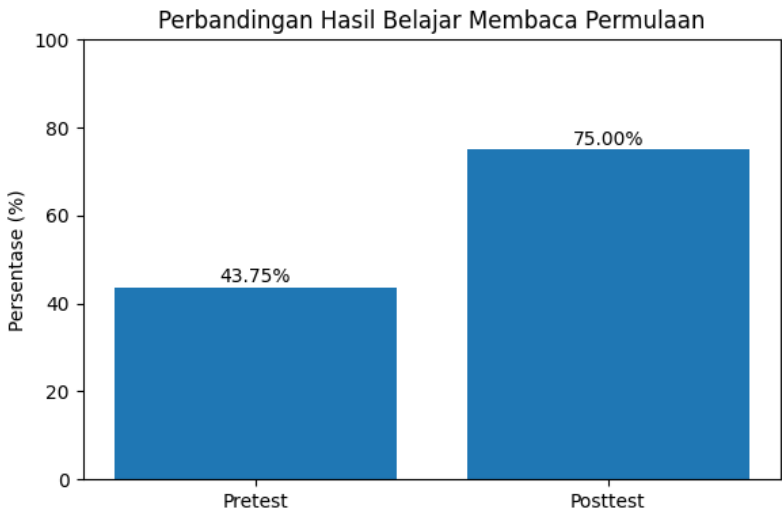


Figure 1. Comparison of Pretest and Posttest Results in Early Reading

After the implementation of the Computational Thinking-based Problem-Based Learning (PBL) model, the average posttest score increased to 12, equivalent to 75%, which falls within the Developing as Expected (DE) category. When compared, the children's early reading learning outcomes increased from 43.75% to 75%, representing an improvement of 31.25%. These findings indicate that learning through the Computational Thinking-based Problem-Based Learning (PBL) model effectively supports the development of early reading skills among children aged 5–6 years. To provide a clearer comparison of the children's early reading learning outcomes at the pretest and posttest stages, the data are presented in the following graph.

The findings of this study are consistent with those of Rauf et al. (2024), who reported that the implementation of the Problem-Based Learning (PBL) model improved children's early reading skills. In addition, the present findings are in line with the study conducted by Kumala et al. (2023), which demonstrated that the Computational Thinking approach helps children develop systematic and logical thinking skills that support the early reading process. Compared with previous studies, which generally investigated the effectiveness of Problem-Based Learning or Computational Thinking separately, this study demonstrates that integrating Problem-Based Learning and Computational Thinking can effectively support the early reading

learning outcomes of children aged 5–6 years. These findings contribute to the development of early childhood education, particularly in the language domain, by demonstrating that early reading instruction can be implemented through problem-solving activities integrated with a Computational Thinking approach. Therefore, the Computational Thinking-based Problem-Based Learning (PBL) model can serve as an innovative instructional alternative for supporting the development of early reading skills in young children.

Conclusion

Based on the findings of this study, it can be concluded that the early reading learning outcomes of children aged 5–6 years improved after participating in learning activities using the Computational Thinking-based Problem-Based Learning (PBL) model. This improvement is evidenced by the increase in the average learning outcome from 7 (43.75%), which was categorized as Beginning to Develop (BD), to 12 (75%), which was categorized as Developing as Expected (DE). The improvement of 31.25% indicates that the implementation of the Computational Thinking-based Problem-Based Learning (PBL) model effectively supports the development of children's early reading skills, particularly in recognizing letters, reading syllables, and reading simple words. These findings suggest that the integration of Problem-Based Learning (PBL) and

Computational Thinking can serve as an effective instructional alternative for supporting the development of early reading skills in early childhood education. Therefore, teachers may utilize the Computational Thinking-based Problem-Based Learning (PBL) model as an innovative instructional strategy to create reading activities that are more active, meaningful, and aligned with the developmental characteristics of young children.

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