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Implementation of Scaffolding Techniques in Early Childhood Learning to Improve Numerical Skills

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Abstract This research is motivated by the low numerical skills of early childhood who still often have difficulty in recognizing numbers, counting concrete objects, and understanding the concept of simple quantities. Numerical skills are important for children to master early because they are the basis for learning mathematics at the next level. Therefore, appropriate learning strategies are needed and according to the stage of Child Development. This study aims to describe the implementation of Scaffoding techniques in mathematics learning in order to improve the numerical skills of children in KB Miftahul Huda. The research method used is Class Action Research (PTK) with two cycles. The study subjects consisted of 15 children of Group B aged 5-6 years. Scaffolding techniques are applied through gradual assistance in the form of teacher directions, lighter questions, demonstrations with concrete media, and slowly reducing assistance according to the child's ability. Data were collected through observation, interviews, and documentation, and then analyzed qualitatively and quantitatively. The results showed a significant improvement in children's numerical skills. In the pre cycle only 33% of children were able to count objects and match numbers with numbers. After the application of scaffolding in the first cycle increased to 46%, and in the second cycle reached 86%. It is proved that scaffolding technique is effective in improving early childhood numerical skills. This strategy is not only relevant to the theory of child development, but also makes a real contribution to the practice of learning in early childhood, especially in building a concrete and gradual understanding of numbers.

Keywords: Scaffolding, Numerical Skills, Mathematics, Early Childhood

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Introduction

Early Childhood Education (ECD) is a very important stage of education because it is the initial foundation for the further development of children. At an early age, children are in the golden phase (golden age) where the right stimulation will greatly affect the development of cognitive, social-emotional, language, and motor. One of the cognitive aspects that really needs attention is numerical skills, which are the basis for mastering mathematical concepts at the next level of Education.

Early childhood numerical skills are not only limited to the ability to recognize number symbols, but also include the skills of counting objects, matching numbers to numbers, grouping, and understanding simple concepts such as more, less, and equal. However, the reality is that there are still many children who have difficulty mastering numerical skills because math learning is often done in the abstract without associating with concrete experiences that correspond to the child's world.

According to Piaget, early childhood is at a preoperational stage where they still need concrete experience in learning (Piaget, 1952). This is confirmed by Vygotsky

through the concept of the Zone of Proximal Development (ZPD), that children can learn more optimally with the gradual help of adults or peers (Vygotsky, 1978). Bruner also asserted that scaffolding as a form of temporary support in the learning process is essential to help children achieve more complex understanding (Bruner, 1986).1 the gradual help provided is then slowly reduced as the child begins to be independent. Through scaffolding, teachers can provide directions, clues, and lighter questions that help children find answers and understand mathematical concepts more meaningfully.

In addition, recent research has shown that early numerical stimulation is positively correlated with academic achievement at the next level. Jordan et al. (2023) states that rich counting experience from preschool age is able to improve long-term numeracy skills.2 this reinforces the urgency of implementing Scaffoding strategies in early childhood numerical learning.

National policies also support Child Development-based learning approaches. Permendikbud No. 137 of 2014 on PAUD national standards affirms the importance of learning that is appropriate for the developmental stage, contextual, and based on real experiences.3 thus, the application of scaffolding techniques is in line with National Education Regulations

In KB Miftahul Huda, previous mathematics learning is still mostly done by conventional methods, namely introducing numbers and counting without using concrete media and gradual assistance. This causes some children have not been able to master numerical skills in accordance with the stage of development. Therefore, this study is important to know how the implementation of Scaffoding techniques in early childhood mathematics learning and its impact on children's numerical skills.

Based on the above, this study was conducted to describe the implementation of Scaffoding techniques in early childhood mathematics learning in KB Miftahul Huda, identify the forms of gradual assistance provided by teachers, and analyze the improvement of children's numerical skills after the application of these techniques.

Numerical skills are one of the basic cognitive abilities that are important to develop from an early age. These skills include not only recognition of number symbols, but also the ability to count, Group, compare, as well as understanding simple quantity concepts such as “more”, “less”, or “equal to”. According to the National Council of Teachers of Mathematics (NCTM), early childhood numerical skills need to be cultivated through concrete experiences, games, and daily activities. Children usually learn numerical activities through counting real objects, arranging blocks, comparing numbers, to playing with Number cards. Thus, numerical skills become an important foundation for successful mathematics learning at the next level (NCTM in Rinaldi, 2019).

Jean Piaget (1952) explained that children aged 2-7 years are in the preoperational stage, that is, the phase in which they understand concepts more easily through concrete experiences than abstract explanations. Therefore, mathematical concepts should be introduced through real objects, visual media, and play activities. This is in line with the finding that hands-on experiential learning is more meaningful than just memorizing numbers.

Furthermore, Lev Vygotsky (1978) emphasized the importance of social interaction in the cognitive development of children. He introduced the concept of Zone of Proximal Development (ZPD), which is the distance between a child's ability that can be achieved independently with the ability that can be achieved through the help of adults or peers. Thus, effective learning for Early Childhood needs to present support according to their ZPD.

In line with this, Bruner (1986) proposed the concept of Scaffoding, which is a learning strategy by providing gradual temporary assistance to help children achieve more complex understanding. The form of scaffolding can be a lighter question, an example, a demonstration, or the use of concrete media. As the child's understanding develops, this help is reduced until the child can complete the task independently.

Previous research has also supported the effectiveness of scaffolding in numerical learning. Bodrova & Leong (2007) showed that Scaffoding in counting activities can improve the numerical skills of preschoolers. Research in Indonesia by Rinaldi (2019) found that the use of game-based Scaffoding proved effective in helping children aged 5-6 years recognize numbers and simple counting. This is in line with the opinion of Wood, Bruner, & Ross (1976) who asserted that gradual guidance (tutoring) can encourage children to solve problems better.

Thus, previous theories and research have shown that early childhood numerical skills develop optimally when given concrete experience, social interaction, and gradual assistance that is slowly reduced. Scaffoding strategy becomes very relevant to be applied in early childhood learning because it is in accordance with the child's developmental stage and is able to foster learning independence

Methodology

This study uses the approach of classroom Action Research (PTK) conducted collaboratively between researchers and teachers in KB Miftahul Huda. According to Arikunto (2013), Class Action Research is a reflection of learning activities in the form of actions that are deliberately raised and occur in a class together. Meanwhile, according to Kemmis & McTaggart (1988), PTK is a form of reflective research conducted by action actors (teachers) to improve the rationality and fairness of their own learning practices, their understanding of the practice, as well as the situation in which the practice is carried out. PTK was chosen because it is in accordance with the objectives of the study, which is to improve learning practices in the classroom and improve children's numerical skills through the application of techniques. PTK also allows teachers to reflect directly on the learning practices implemented (Arikunto, 2013; Kunandar, 2011).

The subjects were 15 children of Group B aged 5-6 years, consisting of 8 boys and 7 girls. Location selection in KB Miftahul Huda is based on the problem of low numerical skills of children and the need to implement learning strategies that are more appropriate to the stage of Child Development.The research was carried out for two months, namely from July to August 2025. The process is carried out in two cycles, where each cycle consists of the stages of planning, execution, observation and reflection. Spiral PTK Model used refers to the framework Kemmis and McTaggart (Sugiyono, 2015).

The procedure of this study follows a spiral model consisting of four main stages, namely planning, implementation, observation, and reflection. In the planning phase, the researcher and the teacher develop a daily learning implementation plan (RPPH) that focuses on numerical activities based on scaffolding techniques. To support learning activities, concrete media such as Number cards, counting blocks, and other real objects relevant to the learning theme are prepared. In addition, researchers also compiled observation sheets of children's numerical skills that will be used to monitor the development of their abilities.

The next stage is the implementation (acting), where the teacher applies scaffolding techniques in the learning process. Help is provided gradually through exemplification, lighter questions, and demonstrations of media use. As the child's

understanding increases, the teacher begins to slowly reduce the help so that the child is encouraged to complete the task more independently.

In the observation phase, the researchers observed the children's activities during the learning process. The focus of observation was directed at the level of children's participation, interaction with teachers, and numerical skills based on established indicators, namely the ability to recognize number symbols, count concrete objects, match numbers with numbers, and compare concepts of more and less.

The last stage is reflection (reflecting). At this stage, the researcher and the teacher analyze the data from the observations to assess the success rate of the actions that have been implemented. An analysis is also carried out to identify obstacles that arise during the learning process and formulate improvements that will be applied in the next cycle.

The technique of data collection in this study consists of three ways, namely observation, interview, and documentation. Observation is used to assess the numerical skills of children based on predetermined indicators. Interviews were conducted with classroom teachers to obtain additional information about the initial condition of the children as well as their responses to the application of scaffolding. Meanwhile, documentation in the form of photos of activities, anecdotal records, and children's work is used as a complement to the data.

The research instrument is a numerical skill observation sheet, which contains numerical mastery indicators such as recognition of number symbols, the ability to count concrete objects, match numbers with numbers, and compare the concept of quantity.

The collected Data were analyzed by two approaches. Qualitative analysis is carried out by describing the learning process, children's responses, and the form of scaffolding assistance provided by teachers. Meanwhile, quantitative analysis was done by calculating the percentage of achievement of children's numerical skills in pre-cycle, cycle I, and Cycle II. The results of both analyzes were compared to determine the extent of improvement in children's numerical skills after the application of scaffolding.

With this systematic PTK design, the study is expected not only to show an increase in the numerical ability of children, but also can be a model of learning practices that are applicable to other early childhood teachers.

Result and Discussion

This class action research was conducted in two cycles with a focus on improving children's numerical skills through Scaffoding techniques. Children's numerical skills were observed based on indicators: (1) recognizing number symbols, (2) counting concrete objects, (3) matching numbers to quantities, and (4) comparing the concepts of more and less.

Indicators of numerical skills in this study include the introduction of number symbols, counting concrete objects, matching numbers with quantities, and comparing the concept of simple quantities. This indicator is set by researchers based on the reference theory of cognitive development (Piaget, 1952; Vygotsky, 1978; Bruner, 1986) and early childhood numerical learning recommendations from NCTM (in Rinaldi, 2019).1.

Based on the results of preliminary observations at the pre-cycle stage, it is known that most children still have difficulties in recognizing numbers and counting concrete objects. Of the 15 children, only 5 children (33%) have achieved the expected development, while the other 10 children (67%) still need intensive teacher assistance. This condition shows that children's numerical skills still need to be improved through more targeted learning strategies.

Furthermore, in the first cycle, the researcher and the teacher compiled the RPPH with the theme “knowing numbers and numbers”. Various learning media such as counting blocks, number cards, and objects around are prepared to make it easier for children to understand the concept of numbers. Achievement indicators are focused on the ability to recognize numbers 1-5, count concrete objects, and match numbers with numbers. The teacher also prepares simple lighter questions, for example “what is the number of these blocks?” , to stimulate the involvement of children.

. The learning activity begins with an opening, where the teacher greets the Children, invites them to sing counting songs, and explains the activities to be carried out. In the core activities, children are invited to count concrete objects with the help of the teacher, match number cards with the number of objects, and answer the questions asked. The teacher provides directions and examples in stages using the scaffolding approach. After that, the activity was closed with simple reflection, positive reinforcement, and prayer together.

In the first cycle, learning activities are carried out with gradual assistance in the form of teacher directions, the use of concrete media (counting blocks, number cards, surrounding objects), and lighter questions. The results of the first cycle showed an increase in the development of children's numerical skills even though they have not achieved maximum results. Of the 15 children, 7 (46%) had demonstrated numerical skills as expected, 5 (33%) were developing, while 3 (21%) still needed intensive help from teachers. These findings form the basis for making improvements in the next cycle.

Furthermore, in the second cycle, the researcher and the teacher compiled a rpph themed “number comparison". In this plan, teachers prepare various additional media in the form of color buttons and fruit images to support learning activities. The established indicators include the child's ability to count up to the number 10, compare the number of objects with the concepts of more and less, and perform calculations independently. For this reason, game-based learning activities are designed to be more fun and easy for children to understand.

The implementation of the activity began with the opening, the teacher greeted the children and did ice breaking through a simple counting game. The core activity is carried out by actively involving children, where children count real objects that have been prepared, then compare two groups of objects, and match numbers with numbers through small competition activities. During this process, the teacher provides lighter questions to stimulate the child's thinking while gradually reducing the help, so that the child is more independent in counting.

At the closing stage, the teacher together with the children reflect on the activities that have been carried out. Children are invited back to mention the numbers that have been learned, then the teacher gives a symbolic award as a form of appreciation for the efforts and participation of children. Thus, the activities in the second cycle took place more interactive, fun, and encourage children to be more independent in developing numerical skills.

Implementation of learning in the second cycle showed an increase in children's numerical skills compared to the previous cycle. Children look more enthusiastic and active following the activities, especially when using the media color buttons and fruit images that attract their attention. When asked to count concrete objects, most children are already able to name numbers up to 10 fluently.

In addition, the ability to compare two groups of objects with the concepts of more and less has also increased. Children are faster in determining groups that number more or less without having to always wait for the teacher's guidance. In the activity of matching

numbers with the number of objects, most children can already do it independently through a small race game prepared.

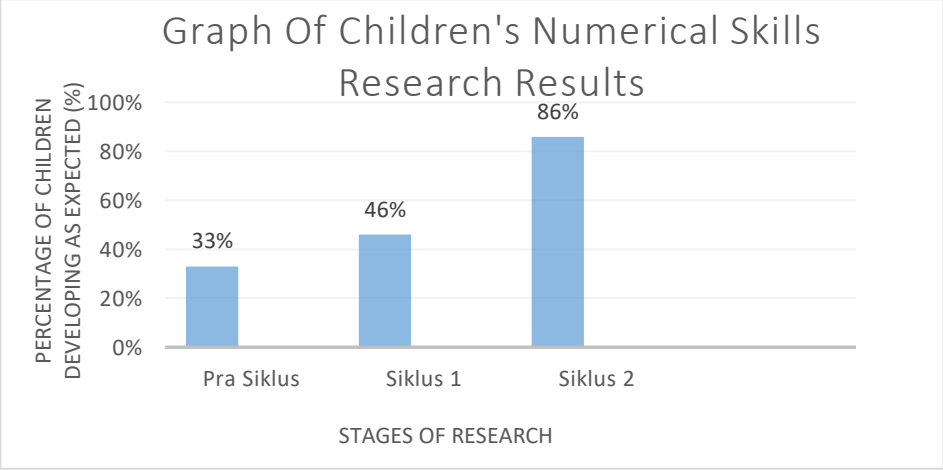
Reflection at the end of the activity shows that the child is able to recall the learned numbers. Symbolic rewards given by teachers also motivate children to participate more actively. Overall, the indicators set in the II cycle are well achieved. The child's numerical skills improve, independence in counting develops, and the learning atmosphere becomes more fun.

In the second cycle, the teacher applies scaffolding with more structured, such as giving examples of counting using real objects, asking again the results of the count of children, then reducing assistance when children are independent. The results are more optimal: 13 children (86%) have achieved progress as expected, while 2 children (14%) still need further guidance.

Table I
Indicators Of Achievement Of Children's Numerical Skills

Indicators	Pra Siklus	Siklus I	Siklus II
Recognize number symbols	33%	46%	86%
Counting concrete objects	33%	46%	86%
Matching numbers with numbers	33%	46%	86%
Comparing more /less	33%	46%	86%

Graphics I
Children's Numerical Skills Research Results



The results of the second cycle showed a significant improvement, namely 86% of children developed as expected.

The application of scaffolding techniques is proven to improve early childhood numerical skills. In the first cycle, children are introduced to simple counting activities with media counting blocks and number cards. Teachers provide intensive help through direct examples, verbal instructions, and lighter questions. Although the results are not yet maximum, the child shows enthusiasm and begins to understand the concept of numbers.

In the second cycle, activities are more varied and game-based. The child is invited to compare the number of buttons or pictures of fruits, and then try to count independently. Teachers consistently reduce help, so children are encouraged to find answers on their own. As a result, the majority of children managed to achieve indicators of numerical skills.

Learning activities in both cycles show that scaffolding helps children move from dependence on teacher assistance to independence. This is in accordance with Vygotsky's theory of ZPD, and is supported by research by Bodrova & Leong (2007) and Rinaldi (2019) which confirms the effectiveness of scaffolding in improving numerical ability. Thus, this strategy is relevant to be applied in early childhood education because it is appropriate for the stage of development, fun, and based on concrete experiences.

The results showed that the application of scaffolding techniques can improve the numerical skills of early childhood in KB Miftahul Huda. In the initial condition, children still have difficulty in recognizing numbers and counting, this is because the previous learning was done more conventionally and abstractly.

In the first cycle, when the teacher began to implement scaffolding, children showed higher enthusiasm in following the activities. However, some children still have difficulties because the assistance provided is not fully in accordance with their individual ability levels. This is in line with Vygotsky's theory that effective learning should take place in the Zone of Proximal Development (ZPD), where assistance is provided according to the needs of the child.

In the second cycle, the teacher adjusts the scaffolding by providing more concrete and gradual assistance, for example by using real objects to calculate, asking again the results of the count of children, and giving children the opportunity to try independently. As a result, most children are able to recognize numbers, count, match numbers to numbers, and distinguish more and less.

The increase from 33% in pre-cycle to 86% in Cycle II proves that scaffolding techniques are effective in helping children understand numerical concepts. This supports the results of previous research by Bodrova & Leong (2007) and Rinaldi (2019) which states that it can improve children's math skills through gradual help.

Thus, scaffolding techniques can be used as an alternative to math learning strategies in early childhood because it is in accordance with the stage of Early Childhood Development, provides concrete experiences, and fosters learning independence.

Conclution

Based on the results of class action research that has been carried out through two cycles, it can be concluded that the application of scaffolding techniques in mathematics learning in KB Miftahul Huda is able to have a positive impact on improving early childhood numerical skills. The scaffolding implementation process is carried out through the provision of structured phased assistance. Teachers provide clear directions, deliver lighter questions to stimulate children's thinking, utilize concrete media such as color buttons and fruit pictures, and slowly reduce assistance as children's understanding increases. Such measures help children more confident in learning to count and train them to be independent.

Scaffolding forms that have proven effective in improving Numerical Ability include the provision of examples of counting using real objects, the use of Number cards to match numbers with the number of objects, as well as teacher guidance in comparing the concept of more and less. Through this strategy, children can learn more actively, easily understand basic math concepts, and be able to connect number symbols with concrete numbers around them.

Thus, it can be affirmed that the application of scaffolding techniques is one of the appropriate alternative learning strategies to improve early childhood numerical skills. This strategy not only effectively supports cognitive development, but also aligns with the

characteristics of early childhood learning that require real experience, gradual guidance, and a fun learning atmosphere

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