Implementation Of Circuit Games To Improve Numbers' Symbol Recognition In Children Aged 3-4 Years At KB Bina Balita Ceria Tumpang

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Abstract— **Children during the golden age are at a developmental stage in all aspects, including cognitive development, in recognizing number symbols as the foundation for numeracy literacy. Initial observations indicate that most children experience difficulty recognizing number symbols, due to a lack of engaging methods appropriate to the characteristics of early childhood. This study aims to improve the ability of 3-4-year-old children to recognize number symbols through circuit games. This study used a Classroom Action Research (CAR) approach, implemented in two cycles. Each cycle consisted of planning, action implementation, observation, and reflection. The study subjects were 12 children at the Bina Balita Ceria Tumpang Kindergarten (KBB) in Malang Regency. The results showed a significant increase in the first cycle (41.7%), and a classical completion rate of 76.4% in the second cycle. The application of this method has proven effective in improving children's cognitive abilities in recognizing number symbols. The circuit game can improve children's ability to recognize numbers 1-5 in a fun and developmentally appropriate way.**

Keywords—Circuit games; number symbols; early childhood

I. INTRODUCTION

A child's world is full of play. Every activity they undertake is not just entertainment, but also a learning tool that hones cognitive, social, and emotional skills. One of the principles of early childhood learning is through play, selecting appropriate and varied methods and play tools, and utilizing learning resources available in the child's environment (Ester & Giamulia, 2021).

Play during early childhood is filled with activities that foster creativity, open-ended play, and foster imagination. Play activities in early childhood education (PAUD) focus on stimulating brain and physical development appropriate to the child's age. These activities impact all aspects of development.

Children aged 3-4 years are in the pre-concrete operational stage of cognitive development (Piaget, as cited in Sutisna, 2020). At this stage, children begin to represent their surroundings through words, pictures, and drawing. Children possess keen observational skills and a strong desire to learn. Exploring objects they encounter can be a highly effective and meaningful learning process for young children if consistently guided by parents and teachers.

One of the learning outcomes that early childhood children must possess in the foundation phase is cognitive maturity to engage in learning activities, such as basic literacy and numeracy, as well as a basic understanding of how the world works (Kemendikbudristek, 2024). These skills will help children prepare for the next level of school. One of the cognitive outcomes covered in the independent curriculum is mathematics. Mathematics in early childhood education encompasses the ability to express relationships between numbers in various ways (number awareness), identify patterns, recognize shapes and characteristics of objects that can be compared and measured, classify objects, develop an awareness of time through exploration, and develop direct experience with concrete objects in the environment (Kemendikbudristek, 2024).

Number awareness in early childhood includes counting objects, recognizing numbers, and understanding basic number concepts such as "one," "two," and "three." They begin to understand the concepts of "more" and "less," and are able to group objects by color or shape (Winda, 2014).

Early childhood mathematics learning is linked to literacy because there are many terms, symbols, and signs used to communicate mathematical ideas and find solutions (Kemdikbudristek, 2021). Everyday activities undertaken by early childhood lead to mathematical concepts. Activities carried out through play are not only fun; more importantly, the games themselves have educational values as a means of child development (Fadlillah, 2017). Play is a means to help children achieve optimal development.

Learning to recognize number symbols for children aged 3-4 years should be done in a fun way through play, so that children can learn joyfully and without feeling stressed. Through creative and interactive games, children can more easily associate numbers with real objects or situations, making number concepts easier to grasp. Activities such as counting objects, putting together number puzzles, or playing with props can stimulate their interest in learning through play, making the learning process a fun experience and fostering a strong sense of curiosity.

Initial observations of 16 children aged 3-4 at the Bina Balita Ceria Kindergarten (KBB) showed that 5 children were able to recognize number symbols, while 11 children still had difficulty recognizing the symbols for numbers 1-5 during the number-object matching activity. These children often mixed up the names of numbers, had difficulty distinguishing similar numbers, such as 3 and 5, and lacked enthusiasm when learning to recognize numbers was conducted using conventional methods such as books or worksheets.

These problems are caused by a lack of stimulation through play activities to introduce number symbols, a tendency for learning to focus on worksheets, and children's lack of active participation in activities. Children need activities that encourage active and exploratory learning.

Previous research by Rosanda et al. (2024) found that children's ability to sequence numbers and associate number symbols with the number of objects significantly increased, from 30% to 90% and from 31% to 92%, respectively. The results showed that learning through number stick games can create a fun and effective learning environment and improve children's cognitive skills in recognizing numbers in a concrete and enjoyable way.

Another study by (Cahyani, 2020) found that using number block games significantly improved early childhood's ability to recognize number symbols 1 through 10. Prior to implementing this method, only about 33% of children were able to pronounce the number symbols correctly. These results indicate that learning through play yields positive results.

Previous research has shown that introducing number symbols to early childhood occurs through active play. Children actively engage and explore in play.

Circuit Play

Circuit play is an activity aimed at enhancing all aspects of early childhood development and is designed to flow continuously from one activity to another using play equipment that is safe and engaging for children.

Circuit play is a learning method that organizes various activities into stations that children must pass through sequentially. Each station has a specific task or activity designed to achieve a specific learning objective. For example, in the case of number symbol recognition, each station in the circuit focuses on a different aspect of mathematics learning.

The circuit play design for recognizing number symbols consists of the following activity stations:

Post 1: Number Shape Recognition

Post 2: Matching Numbers to Sums

Post 3: Finding Numbers

Post 4: Guessing Numbers

The steps in the circuit game to improve number symbol recognition skills are shown in Table 1 below:

Post 1: Number Shape Recognition and Naming

a. Children recognize and name the numbers 1-5

b. Use large, colorful number cards

c. Children imitate the shape of the number with their fingers in the air

d. Duration: 5 minutes

Post 2: Matching Numbers to Quantities

a. Children match number cards to the corresponding number of objects.

b. Using concrete objects such as blocks, balls, or pictures.

c. Children count the objects and indicate the correct number.

d. Duration: 6 minutes

Station 3: Finding Numbers

a. Children find the numbers 1-5 in sequence.

b. Using number cards and number banners.

c. Children count while jumping to find the numbers in sequence.

d. Duration: 5 minutes.

Post 4: Guessing the Number Game

a. The teacher shows a picture of a number.

b. The child who is pointed at runs to find the number attached to a chair.

c. Using interactive and fun games.

d. Children sit on the chair where they have found the number to signify completion of the game.

e. Duration: 6 minutes.

Closing (5 minutes)

a. Brief reflection on the activity.

b. Ask the child whether the activity was enjoyable.

c. Share interesting experiences from each station.

d. Simple evaluation of the numbers learned.

II. METHOD

This study was designed using classroom action research (CAR). The research design was based on observations of children aged 3-4 years old who were studying number symbols at the Bina Balita Ceria Malangsuko Tumpang Kindergarten (KBB), Malang Regency, which would be improved.

The action research method used in this study refers to the Kemmis and MC Taggart models (Wijaya, 2023). The following is the implementation flow of the action research, which was carried out through iterative cycles:
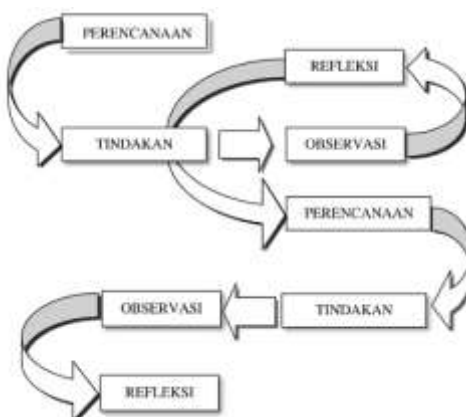

Figure 1. PTK flow of Kemmis and MC Taggart (Wijaya, 2023)

The subjects in this study were children aged 3-4 years who were registered at the Bina Balita Ceria Malangsuko Tumpang KB, Malang Regency, with a total of 12 children consisting of 5 boys and 7 girls.

Data Collection Techniques

The data collection technique for this classroom action research was direct observation, used to capture and assess the results of children's improvements in recognizing number symbols.

Performance assessments included activities such as naming number symbols, pointing to number symbols, and matching symbols with the number of objects. The researcher used documentation to document children's learning during the research, describing the steps in the game demonstrated/practiced by the teacher-collaborator during the circuit game activity.

The observation assessment criteria used were: BB (not yet developed = 1), MB (starting to develop = 2), BSH (developing as expected = 3), and BSB (developing very well = 4).

Data Analysis Techniques

Data analysis techniques are used to process data generated from individual children's improvements in shape recognition using formulas.

The percentage of all aspects can be calculated using the following formula:

$$x = \frac{\sum_x 1}{N}$$

Description:

x   = average value

$\sum\_x_1$ = percentage of each criterion

N   = number of components

Student learning outcomes data are analyzed using scores based on benchmark assessments. The scores obtained can be categorized as: very good, good, sufficient, poor, and very poor. Students are considered to have completed the learning process individually if they achieve a score of >70%, as stated by Arikunto (2006), who states that students with scores of >70% are considered to be in the good category.

III. RESULTS AND DISCUSSION

Cycle I

1. Planning

The teacher prepares the lesson plan (RPPH), prepares the circuit game arena, and supplies the necessary materials: large, colored number cards, concrete objects for counting (blocks, balls, dolls, bottles), a funnel, a flannel board, crayons, and paper. Number banners, number flags. Large, colored number cards, concrete objects for counting (blocks, balls, dolls, bottles), a funnel, a flannel board, crayons, and paper, number banners, and number flags.

2. Action

Circuit game activities involve children moving balls according to the numbers in the basket, finding numbers, jumping over numbers, and connecting numbers to objects.

3. Observation

Observations of the circuit game were conducted collaboratively between the teacher and the researcher.

Table 1. Results of Cycle I Assessment

No	Aspects	Percentage
1	Mention the number symbol	45,8%
2	Pointing to the number symbol	39,6%
3.	Matching a number symbol to an object	39,6%
	Average	**41,7 %**

The data in the table above shows that in cycle I, children's ability to name number symbols, point to number symbols, and match number symbols with objects reached an average of 41.7%. This percentage shows that children at the Bina Balita Ceria Tumpang Family Planning (KBB) in Malang Regency have not yet demonstrated completeness in cycle I because the percentage of results is still <75%.

4. Reflection

The circuit game pattern will be modified with activities that encourage children to actively participate. This will include activities such as jumping on numbers on banners and arranging pictures according to the numbers.

Cycle II

1. Planning

Preparing the RPPH (Lesson Planned Learning Activity Plan), arranging the circuit game pattern

2. Action

The circuit game differed from Cycle I. In Cycle II, the activities included jumping on number banners, setting up bottles according to the teacher's instructions, finding numbers on chairs with pictures of numbers, and arranging the pictures according to the numbers.

3. Observation

Observations of the circuit game were conducted collaboratively between the teacher and the researcher.

Table 2. Results of Cycle II Assessment

No	Aspects	Percentage
1	Mention the number symbol	70,8%
2	Pointing to the number symbol	75%
3.	Matching a number symbol to an object	83,3%
	Average	**76,4 %**

Based on the data in the table above, it can be seen that in Cycle II, children's ability to name number symbols, point to number symbols, and match number symbols to objects reached an average of 76.4%. This percentage indicates that children at the Bina Balita Ceria Tumpang Family Planning (KBB) in Malang Regency demonstrated mastery in Cycle II, as the percentage of results was >75%.

4. Reflection

The circuit game in Cycle II was more enjoyable for the children. The obstacles in the circuit game allowed the children to explore more about number symbols. Observations showed an increase in number symbol recognition ability from Cycle I to Cycle II, from 41.7% to 76.4%, demonstrating mastery.

The results of the first and second cycles demonstrated that learning to recognize numbers through circuit games was effective for children aged 3-4 years. The results showed a significant improvement in children's ability to recognize number symbols after implementing this game method. This study indicates that with the implementation of circuit games, children are more actively engaged in learning, which influences their ability to recognize number symbols.

The activities in circuit games encourage children to be active participants. The challenges presented in the game provide opportunities for children to understand and explore the concepts of counting and recognizing numbers. Learning that actively involves children through games provides opportunities to explore mathematical concepts in a fun and effective way. This is relevant to Julaiha's opinion in (Asmah & Syamsudin, 2025), which states that early childhood learning motivation is influenced by two factors: internal factors, such as interests and talents, and external factors, such as the learning environment and learning methods used.

The results of this study align with Arimbi's opinion (Khotimah & Agustini, 2023), which states that improving children's cognitive development can be achieved through activities such as matching objects in mind maps by color, differentiating sizes, sorting objects, recognizing colors, recalling newly seen objects, and introducing the concept of numbers.

This research is supported by Piaget's preoperational theory, which states that children aged 3-4 years begin to better understand number symbols through activities involving concrete objects, such as blocks or pictures (Sutisna, 2020). These activities allow

children to connect number symbols with real objects, in line with Piaget's theory, which emphasizes the importance of direct experience in early childhood learning.

Play is a highly effective tool in early childhood learning, particularly in the context of introducing mathematical concepts. This is supported by Susato's (2012) opinion that play-while-learning for early childhood is directed toward forms of play that stimulate brain and physical growth.

An active and interactive approach to teaching mathematics to early childhood should involve activities that spark children's interest and active participation. Activities such as matching numbers to concrete objects and finding numbers in sequence, as found in circuit games, help children understand number concepts in a more concrete and enjoyable way.

Games that involve physical activity, hands-on exploration with concrete objects, and active interaction between children and their environment help accelerate children's understanding of basic mathematical concepts. Furthermore, using fun games also helps children learn without pressure, increasing their motivation to learn.

IV. CONCLUSION

Circuit games can improve number symbol recognition skills in 3-4-year-old children at the Bina Balita Ceria Malangsuko Tumpang Kindergarten in Malang Regency. Circuit games are designed with activities that encourage children to actively learn concepts and numbers. Improvements are demonstrated by the completion rate in cycle I of 41.7% (not yet complete) and in cycle II of 76.4% (complete). Children need to be more actively involved in every activity, especially those involving educational games. Teachers are advised to continue integrating games that combine physical and cognitive activities into classroom learning.

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