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THE EFFECT OF FERRIS WHEEL GAMES ON MATHEMATICAL ABILITY IN EARLY CHILDHOOD: DEVELOPMENT OF COGNITIVE DIMENSIONS

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Abstract

Early mathematical abilities in early childhood are a means to develop intellectual potential, mathematical thinking, and cognitive dimensions. This research was conducted on children aged 5-6 years who have not recognized mathematical concepts well and have not used the right media in learning mathematics. This study aims to test and determine the mathematical ability of children aged 5-6 years to use Ferris wheel games. The method used in the study was (SSR) using the A-B-A design. Data collection techniques are tests and observations. Early mathematical abilities in early childhood are a means to develop intellectual potential, mathematical thinking, and cognitive dimensions. This research was conducted on children aged 5-6 years who have not recognized mathematical concepts well and have not used the right media in learning mathematics. This study aims to test and determine the mathematical ability of children aged 5-6 years to use Ferris wheel games. The method used in the study was (SSR) using the A-B-A design. Data collection techniques are tests and observations. The data obtained is a score percentage processed with descriptive statistical techniques, visual data analysis, and data analysis between conditions. The study's results showed an influence on the mathematical ability of children aged 5-6 years by being proven from the percentage scores of the two subjects who increased after being given the intervention. This study concludes that the Ferris wheel game can improve children's mathematical abilities aged 5-6 years. In a wider range of objects, this game can be developed to improve mathematical skills in children.

Keywords: Ferris wheel games; mathematical ability; early childhood; cognitive dimension; single subject research

Abstrak

Kemampuan matematika pada anak usia dini merupakan sarana untuk mengembangkan potensi intelektual, berpikir matematis, dan dimensi kognitif. Penelitian ini dilakukan pada anak usia 5-6 tahun yang belum mengenal konsep matematika dengan baik dan belum menggunakan media yang tepat dalam pembelajaran matematika. Penelitian ini bertujuan untuk menguji dan mengetahui kemampuan matematis anak usia 5-6 tahun dalam menggunakan permainan bianglala. Metode yang digunakan dalam penelitian adalah (SSR) dengan menggunakan desain A-B-A. Teknik pengumpulan data adalah tes dan observasi. Kemampuan matematika dini pada anak usia dini merupakan sarana untuk mengembangkan potensi intelektual, berpikir matematis, dan dimensi kognitif. Penelitian ini dilakukan pada anak usia 5-6 tahun yang belum mengenal konsep matematika dengan baik dan belum menggunakan media yang tepat dalam pembelajaran matematika. Penelitian ini bertujuan untuk menguji dan mengetahui kemampuan matematis anak usia 5-6 tahun dalam menggunakan permainan bianglala. Metode yang digunakan dalam penelitian adalah (SSR) dengan menggunakan desain A-B-A. Teknik pengumpulan data adalah tes dan observasi. Data yang diperoleh berupa skor persentase yang diolah dengan teknik statistik deskriptif, analisis data visual, dan analisis data antar kondisi. Hasil penelitian menunjukkan adanya pengaruh terhadap kemampuan matematika anak usia 5-6 tahun yang dibuktikan dari persentase skor kedua subjek yang meningkat setelah diberikan intervensi. Penelitian ini menyimpulkan bahwa permainan kincir ria dapat meningkatkan kemampuan matematika anak usia 5-6 tahun. Pada objek yang lebih luas, permainan ini dapat dikembangkan untuk meningkatkan kemampuan matematika pada anak.

***Kata Kunci**: Permainan kincir; kemampuan matematika; anak usia dini, dimensi kognitif; penelitian subjek tunggal.*

Introduction

Cognitive development is one aspect that can be stimulated in early childhood educational institutions as a form of preparation for the future. Cognitive development has several parts: visual, tactile, science, kinesthesis, and mathematical (Khodijah 2016). The development of mathematics, especially early mathematics skills, in early childhood is a tool that can be used to develop thinking skills and assist children in developing intellectual potential. Initial mathematical skills need to be given in the golden age that early childhood is experiencing to optimize mathematical skills in children and develop children's skills in everyday life. Early math skills provided early on can help children successfully understand mathematics for higher education levels. This ability also has a very close relationship with reading skills and achievements in learning mathematics in the future and can greatly influence a person's career and future (Milah & Mirawati 2018). Based on the theory of cognitive development described by Aunola, Entwisle et al. predict that early mathematical knowledge is related to subsequent achievements where the child's skills in recognizing numbers, symbols, and numbers can make it easier for children to gain mathematical skills in the future. This skill development framework rests on the idea that mathematics is a subject that has a sequence of levels in which the child must master concepts with simple procedures and also understand more difficult mathematics (Watts et al., 2018).

Awal Maulana (2017) said mathematics is a science that studies numbers and the method used in learning the improvements of the concept of numbers. Styo Utoyo (2017) Mathematics is the language of explanations conveyed through numbers, geometric shapes, and additions that will have meaning after the meaning is conveyed. Novitasari explained that learning that can improve ideal mathematical skills for children must meet several rules. These rules include the child's learning process from concrete to abstract thinking, initial understanding in children is obtained through experiences from concrete objects, initial understanding in children starts from the known to the unknown, and children's mathematics learning through simple knowledge towards complex knowledge (Novitasari 2016). The journal article by Camilla also corroborated the problem in this study, Marja et al., entitled research on early childhood mathematics teaching and learning, namely learning and learning mathematics in early childhood has different content and methods from normal learning. Therefore, this study shows lessons learned from interventions (media provision) in children's teaching and how to facilitate learning in optimizing mathematical development in Early childhood (Björklund, Heuvel, and Kullberg 2020). Children who understand mathematical concepts will provide convenience in learning and increase appropriate mathematical knowledge in early childhood. (Ratih Maryanti 2016).

Lev Vygotsky, a psychologist from Russia, argues that play activities can have a direct impact on the cognitive development of the child. Because early childhood has

an abstract understanding, concrete learning methods are needed. Therefore, learning methods carried out with play activities can help in the learning process in children. (Tedjasaputra 2005). Mathematics standards for early childhood are about understanding concepts. In Sri Hartanti (2019), NCTM (National Council of Teachers Of Mathematics) develops content standards and principles of mathematical ability in early childhood, namely numbers, algebra, geometry, and measurement.

The stage of formation of mathematical concepts in children that Bruner has described in J. Thombokan in Sofiah (2018) is that there is an enactive stage, which is the first stage in children learning concepts related to an object or object, which is the child experiences the event around his environment. The second iconic stage is where the child marks, changes, and stores an event experienced or object seen as an intellectual shadow. The last is the symbolic stage, according to Yulyandari (2019), which is the final stage where the child can convey an object or event that has been experienced and be able to explain it in his language. Lestari explained in Hartanti (2017) that the mathematical concept given to children aged 5-6 years is to introduce the concept of numbers to children and the arrangement of relationships and patterns.

According to several Feeney experts, NCTM et al., Mathematical skills in children are obtained from various concrete processes and then applied in the form of problem-solving activities such as classifying, matching, sorting, numbering, and comparing. (Sumardi 2017). According to the understanding according to several experts above, mathematical ability in children aged 5-6 years can be explained in several aspects, namely 1) Classification, namely the basic ability to group objects based on certain categories such as shape, color, and size and mastering the concept of numbers in children, 2) Ordering. Susan Smith (2005), the ability to sort or sequence, which is the child's ability to understand two or more objects into a certain order, 3) Matching, according to (Pearl and Agustin 2017), the ability to match in children is the child's skill in counting and matching the number of objects such as more and less, 4) Comparing (Comparing) and 5) Numbering (Spilling).

Anik Lestariningrum (2018) explained that Silva and Lunt argue that game tools are tools used to fulfill the impulse in play activities. Functional games in children are activities carried out repeatedly to provide children pleasure in playing with their environment (Wiwiek, 2017). Rita Kurnia (2018) argues that media is a tool that is given or taught by simulation, starting from the teaching content delivered in a descriptive or demonstration way, and has a function as a messenger and attracts children's interest in learning. According to Roggers and Parten in Sujiono (2013), there are six stages of play development in early childhood, namely not settling Unoccupied) is the stage where children play alone, Observer (onlooker) is the stage where children interact with other children but have not been able to engage in play activities together, Playing Alone (solitary independent) is the stage where children have started participating in play activities. However, there has been no involvement between children in the game, Parallel activity is the stage where children have used the media, playing with friends

(associative play) is the stage where children can interact, and cooperation in play (cooperative or organized supplementary play) is the stage where children can play with cooperation.

The results of observations obtained by researchers in the field in children aged 5-6 years include difficulties in recognizing numbers, writing numbers, and knowing geometric shapes and measurements, and there is an identification of problems that occur in the field, namely, mathematics learning in children aged 5-6 years only focus on worksheets so that children cannot explore in activities, introduction to the concept of numbers, geometric shapes, and colors that do not vary so that they can make children saturated, the limitations of APE used to develop mathematical skills and only use worksheet media, marbles, and surrounding objects and activities in schools do not accommodate mathematical abilities in children aged 5-6 years. This study aimed to determine the effect of Ferris wheel games on early childhood mathematical ability at the age of 5-6 years.

Methods

The research used is a type of quantitative research using the single subject research (SSR) experimental method to measure and test whether the Ferris wheel game can improve the mathematical ability of children aged 5-6 years. Takeuchi (2005) single subject research is an experimental research methodology used to evaluate an intervention performed on a subject or individual. Experimental research in this study is a method used to find the influence of certain treatments on others with the aim of how much influence the treatment is given repeatedly within a predetermined period. Najmatul (2015), Rosnow, and Resentthal in Sunanto explained that the focus of the single-subject research method is individual data as a research sample. The baseline condition measures the target behavior that has not been given any intervention and is then carried out in a natural state. And the experimental condition is a measurement that has been measured and given intervention.

Meanwhile, this study used data obtained from the scores of the research subjects, which included nine questions with a maximum score of 34. It used the A-B-A design research procedure in 9 sessions at baseline stage 1, intervention one, and baseline 2. Then the assessment that has been made and the score obtained will be converted into a percentage form from Takeuchi (2005) with the formula as follows:

$$Percentage = \frac{Skor\ Perolehan}{Skor\ Maksimal} \text{ x } 100\%$$

Information :
Percentage = Numbers obtained from the results of the percentage formula
Earned Score = Scores obtained by the subject
Maximum score = Highest Score

Results and Discussion

Based on the results of the research that has been carried out, the researcher will explain and explain the discussion related to the research results on the influence of the Ferris wheel game on the mathematical ability of children aged 5-6 years by using test questions that contain indicators of adaptation aspects of mathematical ability, namely in classifying, comparing, sorting, comparing and numbering. The summary of the results of the acquisition of MA and SA subject data during the study, namely starting from stages A1 (baseline), B1 (intervention), and A2 (baseline 2), are displayed in the form of the following tables and graphs:

Table 1.1 Summary of Mathematical Ability Data Acquisition

Sub	Score Gain in Percent (%)								
	A1 (*Baseline*)			B1 (Intervensi)			A2 (*Baseline*)		
	1	2	3	4	5	6	7	8	9
MA	66,67	69,44	69,44	94,44	97,22	100	100	100	100
SA	52,78	55,56	55,56	80,56	94,44	100	100	100	100

The data on the percentage of mathematical ability in both MA and SA research subjects at each stage is presented in the graphs in the figure below.

Figure 1.2 Recapitulation of Percentage Data Overall Conditions (A1-B-A2) Mathematical Ability of MA subjects

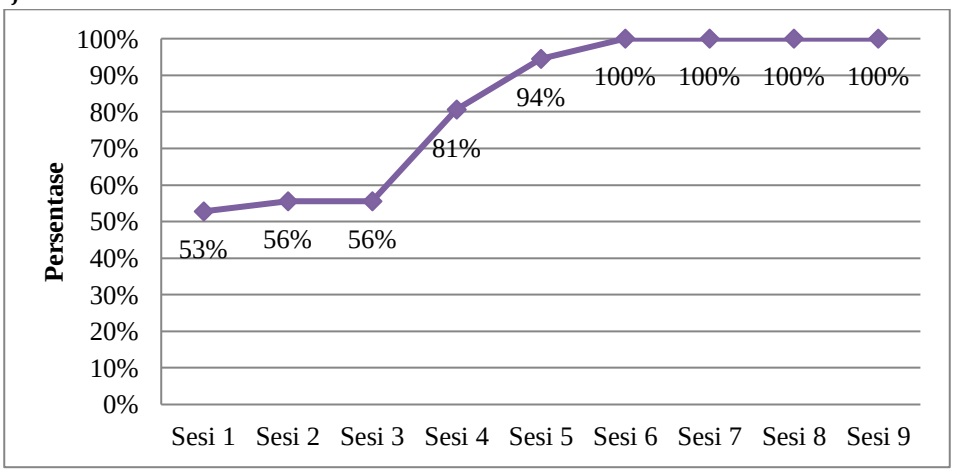
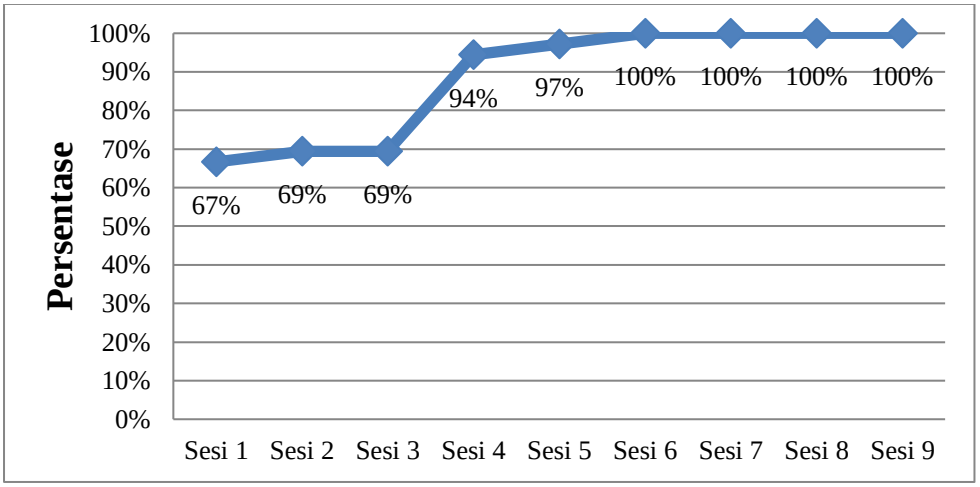


Figure 1.3 Recapitulation of Percentage Data Overall Conditions (A1-B-A2) Mathematical Ability of SA subjects



Based on the results of data analysis in this study, some findings reveal that the mathematical ability of the two research subjects has undergone great changes, namely by proving that the highest score on the questions answered by MA and SA subjects has a high percentage result of 100% at stage B1 (intervention). Then the percentage score persists stably without decreasing to stage A2 (baseline). It proves that in this study, there is a finding that the Ferris wheel games given to mathematics learning to MA and SA subjects have an influence that can improve the mathematical abilities of children aged 5-6 years.

The statement of the results of this research data can be strengthened by the results of research from Fina Sofiyatun, a bachelor of early childhood teacher education at the University of Semarang, namely improving initial mathematical skills through the game of arithmetic drawer blocks (numbers, colors, and geometric shapes), from the results of her research explained that there were significant improvements and differences in mathematical abilities possessed by early childhood in PAUD POS throughout Gunung Pati District after being given arithmetic drawer block game media on the application of its learning.

Mccluskey (2018) explains that young children can naturally express some of their mathematical ideas through games to provide valuable context for early childhood educators, teachers, and parents in responding in real terms to children's mathematical curiosities. Therefore, through mathematics learning activities with the concept of playing in early childhood, mathematical understanding can be interpreted as an embodied representation of their thinking and become an important factor in forming preverbal mathematical concepts. Henschen (2018) explained that to contribute to educational activities. Teachers must successfully describe the content of mathematics in children's activities and understand how children can benefit from their informal mathematical knowledge. Educators can also gain knowledge in finding or using appropriate play activities in mathematics learning that are appropriate to be given to children.

Sigurd et al. (2020) on learning taught in Norway, children participate in each other's activities taught by teachers in schools, thus aiming to make the child actively involved in the appropriation process in which the child learns in handling and solving mathematical problems with the available tools. These tools will make learning objects the focus and can build wider mathematics learning opportunities for children. Camila (2020) states that facilitating mathematics learning, one of which is by using a game tool in children, can affect the development, skills, and abilities of early mathematics in early childhood.

The data in the study can be strengthened by observational data given interventions and scores obtained on both research subjects while working on questions guided by the researcher. In this observation, it will make it easier for researchers to see the mathematical abilities of both subjects at each stage of baseline and intervention, it is known that both subjects have different ages and mathematical abilities, where MA subjects occupy kindergarten B class, and their mathematical abilities are still around knowing numbers 1-10, the concept of addition is still lacking and the ability to recognize geometric shapes that only know 1-2 shapes.

Meanwhile, the subject of SA is still in kindergarten A where his mathematical ability is still unable to sort large and small shapes. Hana knows the numbers 1-10 and only knows some geometric shapes. During the period of providing interventions where the two research subjects, namely MA and SA, learned mathematics using the Ferris wheel game, during the intervention the subjects of MA and SA were very enthusiastic about recognizing numbers, forms and summations, moreover both subjects felt that they were participating in play activities while learning this was proven by both subjects being able to explore knowledge about mathematics using the Ferris wheel game. At the baseline stage, when doing questions guided by MA and SA subjects, they can only count numbers 1-10. Then when using the Ferris wheel game in mathematics, learning MA and SA, they can calculate 1-12 and know the concepts of numbers and numbers.

In the study, there was a discovery in the MA subject where the MA mathematical ability was still lacking. It can be proven by the baseline stage test scores, which aim to know the initial mathematical ability at that stage. Before being given the intervention, MA was only able to count from 1-10, still needed to be assisted in adjusting the correct number and number, did not understand the order ranging from the largest to the smallest, had not been able to classify geometric shapes on a drawing object and MA had not been able to sum numbers correctly. However, this may change after being given intervention in mathematics learning. Ma's mathematical ability is increasing and surviving until the end of the research. Ma's behavior can prove she is increasingly enthusiastic about participating in mathematics learning activities during the intervention stage, so doing MA test questions is much easier than before being given intervention.

In the study, there was a discovery in the subject of SA, namely, the initial mathematical ability possessed by SA could only classify 1 to 2 geometric shapes on drawing objects. SA could not yet sort shapes ranging from large to small orders, and SA could only calculate 1-10 and could not add numbers correctly. However, after being given intervention, SA's ability has increased and stabilized with the evidence that the score obtained by SA reaches 100% starting from the intervention to the stage after being given the intervention, which means that SA can do test questions easily and it can be said that SA's mathematical ability has increased after participating in mathematics learning using the Ferris wheel game (Widodo Andi Promoto Agus 2020).

Conclusion

Based on the discussion and analysis results in this study, it can be concluded that the provision of Ferris wheel games in mathematics learning can have an effect in improving the mathematical abilities of children aged 5-6 years, which includes several aspects, the following are mathematical abilities in both MA and SA research subjects at the time before, during and after being given the Ferris wheel game obtained as follows: The mathematical ability possessed in the MA research subject at stage A1 (baseline) if used as an average percentage score is 68.51%, then for the average percentage score at stage B1 (intervention) is 97.38%, and the last stage the percentage score possessed by MA is 100%. In this case, it can be said that the ability of mathematics in classifying, sorting, matching, comparing, and numbering the MA research subjects increased because the MA was able to maintain a high percentage score of 100% in session 3 of the intervention stage stably until the final stage of baseline 2. The mathematical ability possessed by the SA research subjects at stage A1 (baseline), if used as an average percentage score, is 54.63%. The average percentage score at stage B1 (intervention) is 92.33%, and in the last stage, the percentage score possessed by SA is 100%. In this case, it can be said that the ability of mathematics to classify, sort, match, compare, and number in SA research subjects increased because SA was able to maintain a high percentage score of 100% in session three stages of intervention stably until the final stage of baseline.

Suggestions for teachers can improve and be able to develop mathematics learning with Ferris wheel games or interesting and educational media. For research institutions, the results of this study are expected to provide information in the PGPAUD study program education that mathematical abilities in children can be developed with the Ferris wheel media. Researchers can explore or conduct further research on games or educational media that can provide and improve mathematical skills in children.

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