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Experimenting with Sensorimotor Play to Enhance Learning Attention and Cognitive Function in Children at TK SPNF SKB Denpasar

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ABSTRACT

Introduction: Children need attention and education from their families, schools, and communities to support their development. Cognitive function, especially attention, is vital for their learning process. Previous studies have shown suboptimal cognitive function (average digit span test score of 4.31) and decreased attention during lessons, evidenced by frequent seat changes and talking. Enhancing these areas through sensorimotor play can create more engaging and enjoyable learning experiences for children.
Methods: This quasi-experimental study utilized consecutive sampling to determine a sample size of 30 children based on Pocock's formula. Two classes from TK SPNF SKB were randomly selected, and subjects were assessed for eligibility based on inclusion and exclusion criteria. The subjects were randomly divided into 15 children in the intervention group and 15 in the control group. The intervention group participated in sensorimotor play sessions three times a week for three weeks, totaling nine sessions, each lasting 30-35 minutes. The control group did not receive any intervention.
Results: Data analysis using paired sample t-tests demonstrated a significant improvement in the intervention group's learning attention (p = 0.001) and cognitive function (p = 0.001). Independent t-test results indicated an essential difference between the two groups post-intervention (p = 0.001).
Conclusion: Sensorimotor play effectively enhances attention and cognitive function in children.

Keywords: sensorimotor play, learning attention, cognitive function

INTRODUCTION

Children are often referred to as "little humans" who possess their unique characteristics and traits. Early childhood is a period of rapid and essential growth, serving as a critical foundation for their future development.[1] This period can be described as the "golden age" in a child's life, as it is the primary foundation for their growth and development. During this time, crucial aspects such as moral values, cognitive abilities, emotional regulation, motor skills, and language development are established.[2] Children require attention and education from their family environment, especially from their parents, as well as their school and community environments to help develop all aspects of their growth.[3]

Education is a crucial component that influences the development of a child's cognitive and social abilities. This process typically begins with the interaction between students and their learning environment.[4] Success in the learning process is not solely measured by the outcomes achieved; many factors influence it.[5] The factors influencing learning success are divided into internal and external factors. Internal factors originate within the child, such as the completeness of body parts and physical condition, and psychological factors like desire, motivation, seriousness, and the ability to concentrate. External factors come from the environment or external sources outside the individual.[6] These factors, including cognitive function, can also influence a child's development during the learning process.[5]

Cognitive function refers to conscious mental activities such as learning, remembering, thinking, and using language. Broadly, cognition encompasses an individual's ability to sustain attention, memory, reasoning, problem-solving, and executive functions (such as judgment, planning, and evaluation). These cognitive functions are closely related to quality of life and emerge and develop as one of the aspects of development during the ages of 24 to 71 months.[7] One component of cognitive function is attention, which is the ability to focus one's awareness.[8]

Individuals' ability to focus attention is defined as attention, while concentration is the effort to maintain attention over a certain period. Attention has three functions based on the brain's anatomy: Alerting, Orienting, and Executive Control. The Alerting function is related to one's readiness to respond to stimuli, the Orienting function involves selecting and allocating attention to stimuli, and the Executive Control function is associated with resolving conflicts. Attention plays a role in the learning process at school due to its influence on individuals' cognitive and emotional functions.

Cognitive function and attention can be trained to create more enjoyable and engaging learning experiences for children, notably through games.[9]

Incorporating games into the learning process is often encountered in education, especially during the early childhood years. One learning method involving games is through a sensorimotor play approach. This play method is part of sensory integration therapy, which combines sensory and motor coordination, involving functions of the eyes, ears, and muscles.[10] This play consists of tactile, visual, auditory, proprioceptive, vestibular, and kinesthetic developments.[11] Children often do not realize that they are actually learning something through sensorimotor play, as this approach is more enjoyable, active, and creative.[12]

Based on data from TK SPNF SKB (Non-Formal Unit Education Kindergarten Activity Studio) in Denpasar City, there are 165 children ranging in age from 3 to 6 years. There are three groups with different age ranges: the Play Group (PG) for ages 3-4, TK A for ages 4-5, and TK B for ages 5-6. According to the results of the preliminary study and brief interviews, it was found that some children experience attention disorders and cognitive function impairments, as evidenced by frequent seat changes, engaging in conversations with their peers, and joking around during the learning process.[9]

Based on the preliminary study at TK SPNF SKB in Denpasar City, a prevalence of cognitive function was obtained from 20 children aged 4-6 years, with an average score of around 4.31. The optimal value for cognitive function in children, as measured by the digit span test, is a score of 19. This result indicates a decline in mental function. Given the findings from the preliminary study on cognitive function and attention, it is necessary to provide stimulation to the children at TK SPNF SKB.

Therefore, stimulation must enhance children's learning attention and cognitive function at TK SPNF SKB in Denpasar City. Based on the above explanation, it is evident that there is a need for intervention to address the decline in learning attention and cognitive function in children at TK SPNF SKB in Denpasar City. This study was conducted to prove that sensorimotor play stimulation can improve learning attention and cognitive function in children at TK SPNF SKB in Denpasar City.

METHOD

This study employed a quasi-experimental research design using a pre-test and post-test control group design with consecutive sampling techniques conducted from May 2023 to June 2023. The research participants were required to meet several sample eligibility criteria. Inclusion criteria for the study included children aged 4-6 years enrolled in TK SPNF SKB Kota Denpasar, willing to participate, and having their parents or representatives fill out an informed consent form as approval. Exclusion criteria included uncooperative children refusing or engaging in additional academic or non-academic activities regularly during the research period, three times a week for a minimum duration of 30 minutes. This was controlled to minimize bias from learning attention and cognitive function improvements due to processes outside the research intervention. In this study, dropout criteria included children not attending the treatment at least three times or withdrawing from the study.

Using the Pocock formula with an additional 15% to prevent dropout, the sample size for this study was determined to be 30 children. From 6 available classes, two classes were randomly selected to fulfil the research quota. All children in both classes were then screened for inclusion and exclusion criteria before being divided into two groups. The sample was randomly divided into 15 children in the treatment group and 15 in the control group. The treatment or intervention group received sensorimotor play, while the other group received no treatment. The sample underwent pre-tests in both groups using the Five Point Test (5PT) and Digit Span Test (DST) conducted by a physiotherapist starting in the fourth week of May 2023.

The types of games used in this study were threading beads while listening to voice recordings and Lego games. Threading involves arranging or threading beads into various shapes. The shapes used in this study were round (bracelets) with varying difficulty levels at each meeting. Lego is a game consisting of blocks that can be assembled into various shapes. Each meeting created different shapes with different levels of difficulty as well.

Both games were conducted for three weeks, totaling nine sessions, each lasting 30-35 minutes. The research was conducted three times a week, carried out in the fifth week of May and the first, second, and third weeks of June 2023. The rooms used for both control groups were the same, with good lighting and attractive classroom designs but minimal distractions. The researcher organized all learning equipment, bags, and books and placed them away from the children.

The parameter used in assessing learning attention was the Five Point Test (5PT) with interrater reliability obtained from the Interclass correlation coefficients (ICC) of 0.999 and validity value of $r \geq 0.50$. Participants were given sheets of paper containing several boxes, each with five points arranged symmetrically. Participants were asked to create as many designs as possible by connecting two or more points with straight lines within two minutes. Assessment could be seen from unique designs (correct), repetitive designs (perseverative errors), and making designs with lines failing to connect the points (rule violations). The more accurate designs and the fewer errors and violations made, the better the child's attention. For accuracy scores (1 = correct, 0 = incorrect).

In assessing cognitive function, the Digit Span Test consisted of the Digit Span Test Forward and Digit Span Test Backward, with a validity value of K= 0.026 and a reliability value of Cronbach's alpha coefficient of 0.921. Children would perform the forward test by repeating the numbers spoken from the front in order, and vice versa for the backward test, where children would repeat the numbers spoken from the front but in reverse order. For each test item (Forward and Backward), children received 1 point for each correctly answered number sequence. Accuracy scores (1 = correct, 0 = incorrect). The maximum score that could be achieved was a total score of 15.

Data analysis will be conducted using IBM SPSS 27. Univariate analysis will determine the frequency distribution of age, gender, learning attention, and cognitive function. The normality test will be conducted using the

Shapiro-Wilk Test, and heterogeneity will be used with Levene's Test to determine the type of advanced statistical tests and see the magnitude of research data variance. If the data is normally distributed, then the Paired T-test will be conducted to assess the effectiveness of sensorimotor games on learning attention and cognitive function. An Independent T-test will be conducted to see the significance of differences between intervention and control group findings. The hypothesis in this study is that sensorimotor games are effective in improving learning attention and cognitive function in children at TK SPNF SKB Kota Denpasar. The Faculty of Medicine Ethics Committee, Udayana University, has reviewed the research procedures and granted research feasibility approval with number 1098/UN14.2.2.VII.14/LT/2023 on April 27, 2023.

RESULTS

This study was conducted from May to June 2023. The total population of TK SPNF SKB Kota Denpasar consisted of 117 children across six classes. Using the Pocock formula, the sample size was determined to be 30 after adding 15% for dropout criteria. Randomization was conducted on two classes in TK SPNF SKB Kota Denpasar to be included as research samples, totaling 39 children. Of the 39 children who met the inclusion criteria, 9 showed refusal and non-cooperation and had to be excluded. After obtaining the population of children who met the inclusion and exclusion criteria, a pre-test was conducted on the 30 children who would be the research subjects. Subsequently, they were randomly divided into two groups comprising 15 children, as outlined in Figure 1.

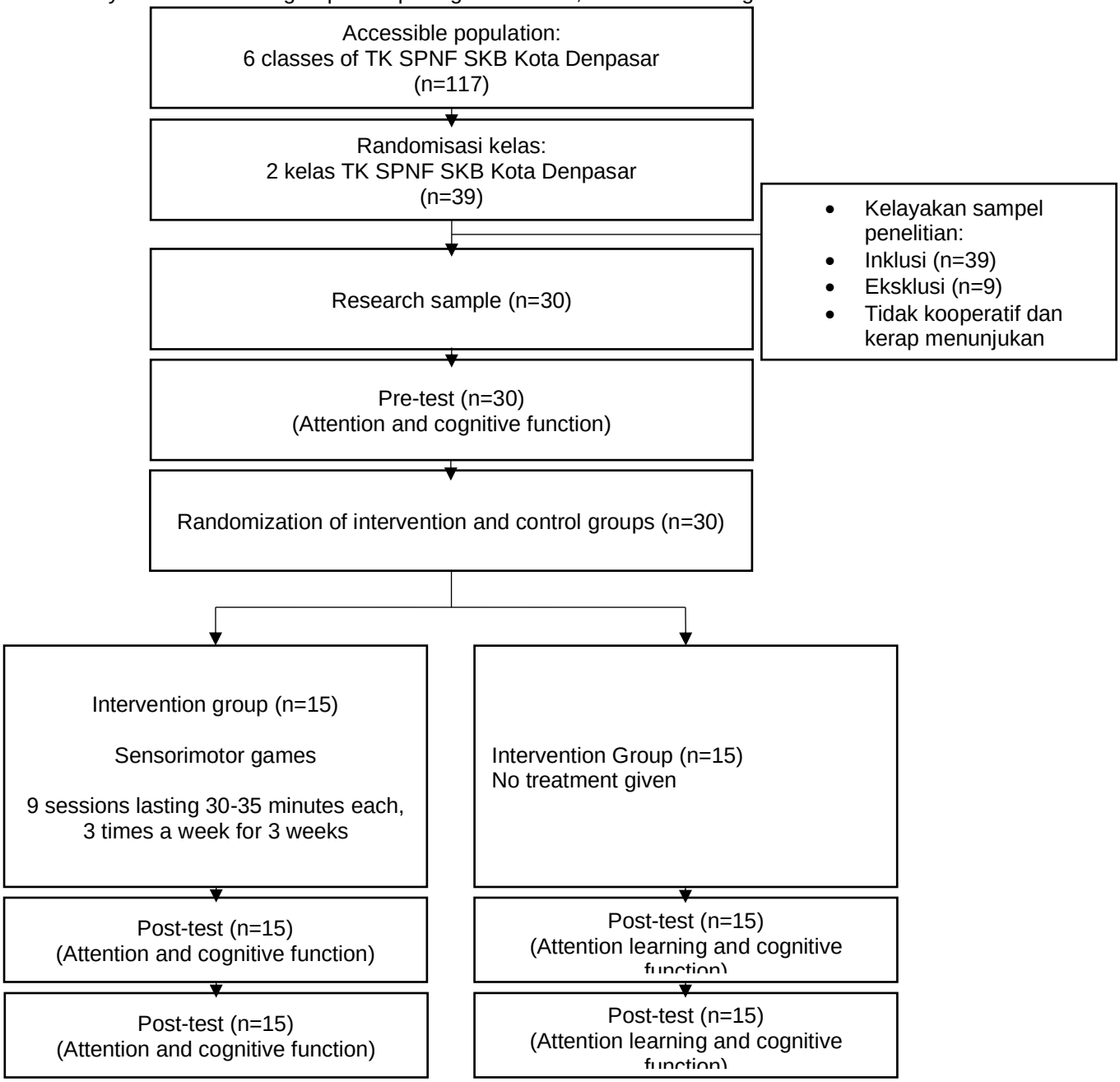

Figure 1. Research Flowchart

Next, the characteristics of the research subjects based on age and gender are outlined in the table below, as shown in Table 1.

Table 1. Subject Characteristics

Variable	Control Group (n=15)	Intervention Group (n=15)	p value
Gender			
Male	9	7	0.481[a]
Female	6	8	
Age (years)			
4	3	3	
5	9	11	0.541[a]
6	3	1	
Mean ± SD	5.0± 0.655	4.8±0.516	

[a]: Independent T-Test

Based on Table 1, 9 male and six female children were in the control group, while seven males and eight females were in the intervention group. The average age of children in the four-year-old control group was 3; in the intervention group, it was also 3. For children aged 5 in the control group, while there were 9 in the intervention group, there were 11. Lastly, for children aged 6 in the control group, while there were 3 in the intervention group, there was 1. The p-value for gender was p = 0.481 (p>0.05). For age, it was p = 0.541 (p>0.05), indicating no significant difference in the distribution of gender and age between the control and intervention groups. Pre-test measurements of Learning Attention using the Five Point Test (5PT) and Cognitive Function using the Digit Span Test (DST) in the Control and Intervention Groups are presented in Table 2.

Table 2. Pre-test learning Attention using the Five Point Test (5PT) and Cognitive Function using the Digit Span Test (DST) in the Control and Intervention Groups

Variable	N	Mean ± SD
Control Group		
Intervention Group	15	6.67 ± 1.496
Control Group		6.60 ± 1.595
Intervention Group		
Control Group	15	6.60 ± 1.502
Intervention Group		3.80 ± 1.014

Based on Table 2, the results of the pre-test measurements of Learning Attention using the Five Point Test (5PT) in the control group, comprising 15 children, showed an average pre-test score of 6.67 with a standard deviation of 1.496. In the intervention group, the average pre-test score was 6.60, with a standard deviation of 1.595. The pre-test measurements of Learning Attention using the Digit Span Test (DST) in the control group, comprising 15 children, showed an average pre-test score of 6.60 with a standard deviation of 1.502. In the intervention group, the average pre-test score was 3.80, with a standard deviation of 1.014. Table 3 presents the results of the Paired Sample T-test for 5PT and DST in the Control and Intervention Groups.

Table 3. Paired Sample T-test Results

Data Group	Pre-test	Post-test	Difference	p value
	Mean ± SD	Mean ± SD	Mean ± SD	
5PT				
Control	6.6±1.4	5.8±1.6	-0.8±1.6	0.060[a]
Intervention	6.6±1.5	9.0±2.2	2.4±1.4	0.001[a]*
DST				
Control	6.0±1.1	3.8±1.6	-0.2±1.5	0.061[a]
Intervention	3.8±1.6	6.4±1.1	2.6±1.4	0.001a[a]*

[a]: Paired Sample T-Test; *: (p<0.05)

Table 3 tests the mean improvement in learning attention and cognitive function before and after the intervention in the intervention and control groups using paired sample t-tests. In the intervention group, using 5PT and DST, the p-value was found to be 0.001 (p<0.05), indicating that sensorimotor play effectively enhances children's learning attention and cognitive function. In the control group, using 5PT, the p-value was 0.060 (p>0.05), and using DST, the p-value was 0.061 (p>0.05), demonstrating no improvement in attention and cognitive function due to the absence of intervention. The results of the Independent T-Test for Attention (5PT) and Cognitive Function (DST) are presented in Table 4.

Table 4. Independent T-Test for Attention (5PT) and Cognitive Function (DST)

Data Group	Control (Mean±SD)	Intervention (Mean±SD)	p-value
Pre-test (DST)	6.0±1.1	3.8±1.0	0.190a
Post-test (DST)	3.8±1.6	6.4±1.1	0.001a*
Difference in DST	-0.2±1.5	2.6±1.4	0.003a*
Percentage (%)	-0.2%	2.6%	

[a] : *Independent T-Test*; *: (p<0.05)

Continuation of Table 4. Independent T-Test for Attention (5PT) and Cognitive Function (DST)

Data Group	Control (Mean±SD)	Intervention (Mean±SD)	p-value
Pre-test (DST)	6.0±1.1	3.8±1.0	0.190a
Post-test (DST)	3.8±1.6	6.4±1.1	0.001a*
Difference in DST	-0.2±1.5	2.6±1.4	0.003a*
Percentage (%)	-0.2%	2.6%	

[a] : *Independent T-Test*; *: (p<0.05)

Based on Table 4, the pre-test data for the intervention and control groups were analyzed using an independent t-test on children's learning attention with the Five Point Test (5PT). The average scores for both the intervention and control groups were 6.6, with a p-value of 0.907 (p>0.05), indicating no significant difference between the pre-test results of the intervention and control groups. However, the post-test data showed that the average score for the intervention group was 9.0. In contrast, the control group scored 5.8, with a p-value of 0.001 (p<0.05), indicating a significant difference in post-test scores between the intervention and control groups.

Similarly, the pre-test data for the intervention and control groups were analyzed using an independent t-test on children's cognitive function with the Digit Span Test (DST). The average scores were 3.8 for the intervention group and 6.0 for the control group, with a p-value of 0.190 (p>0.05), indicating no significant difference between the pre-test results of the intervention and control groups. For the post-test data, the average score for the intervention group was 6.4. In contrast, the control group scored 5.8, with a p-value of 0.001 (p<0.05), indicating a significant difference in post-test scores between the intervention and control groups.

The difference between the control group's pre-test and post-test scores for 5PT was -0.8, with a percentage change of -0.8%. In contrast, the intervention group's difference was 2.4, with a percentage change of 2.4%. For the DST, the control group's pre-test and post-test difference was -0.2, with a percentage change of -0.2%, while the intervention group's difference was 2.6, with a percentage change of 2.6%.

DISCUSSION

Subject Characteristics

The study was conducted from May to June 2023. The total population of TK SPNF SKB Kota Denpasar was 117 children across six classes. Through randomization of 2 courses for the study, 39 children met the inclusion criteria, with nine excluded due to lack of cooperation. This left 30 children, randomized into intervention and control groups with 15 children each.

Based on Table 1, 20 of the 30 research subjects aged 4-6 were five years old. This age period is crucial as it forms the foundational basis of a child's personality. Children's potential develops rapidly during this period, often called the "Golden Age." Development during this time includes cognitive, physical, creative, emotional, language, and communication functions that children in early childhood pass through gradually.[13]

Based on Table 1, nine male children were in the control group and 7 in the intervention group. Meanwhile, in the control group, there were six female children, and in the intervention group, there were 8. Analysis of subject characteristics indicates that this study had different numbers of subjects in both groups, but this did not affect the research outcomes.

The Effect of Sensorimotor Games on Attention

A paired sample t-test was employed to test the hypothesis in this study. In the intervention group, using the Five Point Test (5PT) tool, a p-value of 0.001 (p < 0.05) was obtained, demonstrating that providing Sensorimotor Games is effective in enhancing children's learning attention. Meanwhile, the independent t-test conducted on the post-test using the Five Point Test (5PT) yielded a p-value of 0.001 (p < 0.05), indicating a difference between the two groups.

These results align with the findings of Setyaningsih (2017) regarding the impact of sensorimotor stimulation on children's attention and concentration levels, which state that sensorimotor stimulation leads to significant improvements in attention. Using this game method correlates positively with enhancing children's concentration and learning attention, making it suitable for implementation in schools and at home.[12]

Based on the research by Maemunah (2020) regarding the jump rope game and its effect on attention improvement, it is stated that the jump rope game influences enhancing children's attention abilities. Not only the game of jump rope but also other types of games, such as Lego, puzzles, riddles, building blocks or beads, and so on, can be performed regularly according to the rules, further stimulating children's attention abilities.[14]

Based on the study conducted by Rohmah F et al. (2021), the research findings suggest that concentration and attention can be trained through sensorimotor games. Teachers utilise proprioceptive sensorimotor games based on Lego and bombing games, often played in a safe corner after children finish their tasks and duties. Implementing these sensorimotor games results in students being more focused, paying more attention to the content offered by the teacher, and being able to complete tasks better. Children who previously had difficulty focusing can now answer the teacher's questions confidently, whereas before, they often felt hesitant and unable to do so.[15]

In line with the study by Mualli C et al. (2022) at RA Nurus Salam regarding efforts to improve concentration and learning attention, observed from the enthusiasm and spirit of children in using sensorimotor learning, it is stated that these games are effective in enhancing children's attention and focus on the knowledge taught by teachers. The method designed by the educators at RA Nurus Salam involves the use of audiovisual strategies, educational gaming tools, and playing in nature.[16]

The study conducted by Dewi et al. (2023) regarding the effectiveness of sensorimotor games in improving concentration and physical fitness shows that sensorimotor games can enhance concentration, coordination, and balance in children aged 7-12 years old. Utilizing sensory pathways, these games can be applied to children experiencing decreased learning concentration and serve as an alternative physical exercise.[17]

Based on several studies above utilizing sensorimotor games, it is evident that these games effectively enhance children's attention and focus. However, the techniques employed in these previous studies differ from the approach adopted in this research.

Attention plays a crucial role in maintaining memory, language, and executive functions, thus holding significance in learning and intelligence. Response speed and information processing accuracy are vital components of intelligence, and intelligence is associated with nerve conduction speed. Attention always plays a pivotal role, as individuals must focus on a stimulus before reacting. Attention is shaped by specific systems distinguished based on brain anatomy regions and consists of three subfunctions: alerting networks, orienting networks, and executive control networks.[9]

The Influence of Sensorimotor Games on Cognitive Function

Bivariate analysis or hypothesis testing in both groups was conducted using paired sample t-tests. With a value of $p=0.001$ ($p<0.05$) in the intervention group using the Digit Span Test (DST) as the measurement tool, it indicates that the implementation of Sensorimotor Games is effective in enhancing cognitive function in children. Meanwhile, the independent t-test yielded a p-value of 0.001 ($p<0.05$) in the post-test using the Digit Span Test (DST), indicating a difference between the two groups in this study.

Krisna et al. (2018), in their research on using natural materials-assisted beading activities to enhance cognitive abilities in early childhood, yielded results consistent with this study. Their findings suggested that beading activities can improve children's mental function by involving tasks such as sorting and classifying colours, shapes, and sizes of beads, guided by recognizing patterns and forms.[18]

Based on the research conducted by Syafrina and Adiningsih (2020), cognitive enhancement in children's symbolic thinking can be achieved effectively through playing with Lego. Through observation, there was an increase in children's cognitive development scores after the intervention. This indicates that Lego play is quite effective in enhancing their cognitive function.[19]

Another study supporting the findings of this research is conducted by Aristi et al. (2021). The study examined the cognitive abilities of preschool children and their improvement after being exposed to constructive Lego play stimulation. Lego play stimulates the suitable brain activity of children in shaping forms. Significant cognitive function development was found in the group that received the intervention in that study.[20]

Research conducted by Puslika and Kurniah (2021) found that children could identify patterns and shapes, count colours, and add beads to a string after being treated with the stringing game method. Data analysis showed a significant improvement in cognitive scores in the experimental group compared to the control group.[21]

The research findings from Suyoto and Indarini (2021) regarding the cognitive improvement of early childhood further reinforce the study's results. There was an enhancement in children's mental abilities when engaged in activities focused on colour and geometric pattern recognition using stringing activities.[22] In line with Arman's research (2023) on efforts to enhance children's cognitive abilities through stringing activities, it was stated that cognitive skills, such as pattern recognition through stringing activities, improved with each session.[23]

The research findings by Effendi et al. (2023) indicate that audio-visual media impacts children's cognitive development. This was demonstrated through an increase in post-test scores after the intervention. In their study, audio-visual media was applied by allowing children to watch and listen to videos displayed, followed by questions about the colours, shapes, and sizes of geometrical figures shown in the videos. Additionally, children were asked to arrange and match geometric shapes according to the displayed videos.[24]

From several studies on children's cognitive function, the conclusion is that sensorimotor play effectively enhances children's mental abilities. Cognitive function involves memory, attention, executive function, language, perception, and psychomotor skills. Each aspect involves complex processes such as encoding, storing, and retrieving information to form short-term, long-term, and working memory.[8]

If cognitive function in children deteriorates, it is associated with an increased risk of various cardiovascular diseases, mental disorders such as depression, and several types of cancer. About 50% of a child's cognitive ability develops in early childhood, around 4. This percentage will peak at 80% of the total intelligence achievable during adolescence when the child is around eight. Cognitive function needs to be optimized and prioritized from toddlerhood as it can lead to health issues in the future.[7]

Penelitian ini menegaskan hubungan antara pemberian permainan sensoris dengan peningkatan atensi belajar dan fungsi kognitif anak di TK SPNF SKB Kota Denpasar. Implikasi praktis dari temuan ini adalah bahwa hasil penelitian dapat membantu TK SPNF SKB Kota Denpasar dalam merancang program intervensi khusus untuk anak-anak yang mengalami kesulitan dalam atensi belajar atau fungsi kognitif. Program-program ini dapat mencakup berbagai aktivitas sensorimotor yang dirancang untuk meningkatkan keterampilan yang dibutuhkan atau menggunakan metode serupa seperti yang digunakan dalam penelitian ini (meronce dan membuat lego). Selain itu, penilaian rutin terkait atensi belajar dengan Five Point Test (5PT) dan fungsi kognitif dengan Digit Span Test (DST) juga perlu dipertimbangkan untuk dilakukan sebagai bahan evaluasi terkait dengan kurikulum pembelajaran dan perkembangan hasil belajar anak-anak di TK SPNF SKB Kota Denpasar.

This study confirms the relationship between providing sensorimotor games and enhancing children's attention and cognitive function at TK SPNF SKB Kota Denpasar. The practical implications of these findings are that they can assist TK SPNF SKB Kota Denpasar in designing specific intervention programs for children experiencing difficulties in

learning attention or cognitive function. These programs may include various sensorimotor activities intended to enhance the required skills or employ similar methods to those used in this study (such as threading beads and building with Lego). Additionally, regular assessments related to learning attention using the Five Point Test (5PT) and cognitive function using the Digit Span Test (DST) should be considered for implementation as part of the evaluation process regarding curriculum learning and children's learning outcomes at TK SPNF SKB Kota Denpasar.

This study employed consecutive sampling, which has the limitation of not being able to consider the subjects as representative of the entire population, and this technique was conducted by selecting subjects encountered or suggested, potentially leading to biased results. The researchers suggest that other researchers use probability sampling techniques to enhance the accuracy of generalizing the findings. Generalizing the findings to healthy populations or other populations may not be suitable, given the specific criteria set at the beginning of this study. However, as found in this study, these findings can still be applied to populations with similar characteristics, such as children aged 4-6 years with average 5PT and DST scores around 6.

Controlled variables such as nutritional intake can also be added. In this study, nutritional intake was not controlled because each child has a different dietary intake depending on their family's social and economic conditions. This study did not investigate physical activity as each child has different physical activities depending on the type, intensity, and duration of physical activities they engage in outside of school. This study did not examine parental education to avoid offending parents with low or high education levels.

CONCLUSION

The provision of sensorimotor games to the intervention group has been shown to improve children's learning attention compared to those not receiving treatment, with a value of $p = 0.001$. Additionally, providing sensorimotor games to the intervention group has been proven to enhance children's cognitive function compared to those not receiving treatment, with a value of $p = 0.001$.

Implications of this research include the importance of schools paying more attention to attention and cognitive function, especially short-term memory, to prevent declines in children. One way to address this is by incorporating sensorimotor play activities such as Lego and threading beads into the TK SPNF SKB Kota Denpasar curriculum. Furthermore, regular assessments of learning attention using the Five Point Test (5PT) and cognitive function using the Digit Span Test (DST) should also be considered as part of the school's learning evaluation.

Future researchers should conduct further research on the effectiveness of other sensorimotor games or techniques in improving attention and cognitive function, especially short-term memory. It is also suggested to include and control variables such as nutritional intake, physical activity, and parental education level to provide a more in-depth explanation of the related variables and minimize bias. Researchers are also advised to use other sampling techniques, such as probability sampling, to enhance the accuracy of generalizing the findings.

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