

Improving Short-Term Memory of School-Age Children through Brain Gym with the Chunking Technique Mnemonic Approach

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Abstract

Improving Children's Short-Term Memory through Brain Gym with Mnemonic Approach Chunking Technique. This study aims to determine the effect of brain gym with a mnemonic method approach to chunking techniques on short-term memory in 3rd and 4th grade students. The study used a pre-experimental design with a one-group pretest-posttest approach. The research subjects were 68 respondents selected using simple random sampling. Data collection was carried out using a questionnaire which was analyzed using the Wilcoxon test. The results of the analysis showed an increase in the average short-term memory score from 7.01 to 10.14 after the intervention. The Wilcoxon test results showed a p value = 0.000 ($p < 0.05$), which means there is a significant difference between memory before and after the intervention. Brain gym with chunking technique mnemonic method approach combines a series of simple stimulation movements and a method of remembering numbers that are broken down into smaller chunks to facilitate memory. This method can be applied as one of the strategies in improving student memory, both in the educational environment and in nursing practice in the process of child growth and development and the process of educating elementary school children in implementing daily learning activities.

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Introduction

School age is an excellent age for brain development, including memory (Canada et al, 2020). Children's intellectual development and academic performance have come under scrutiny because of their implications on future performance as well as individual quality of life and in social life. Academic performance, in addition to determining affective function, also depends on the child's intelligence function. Intelligence is the application of cognitive and metacognitive aspects to the learning and problem-solving process, while cognitive processes depend on brain functions such as short-term memory, long-term memory or better known as children's memory (Birman et al., 2022). The World Health Organization (WHO) reports that 5-25% of school-age children suffer from minor brain dysfunction, including fine motor developmental disorders (Safira, 2023). Indonesia has conducted a number of national and international learning assessments which show that many students across Indonesia are still struggling to master basic academic skills. At the elementary level, only 23% of students manage to reach the national minimum limit of math ability, and only 53% in reading ability (Kementerian Perencanaan Pembangunan Nasional (Bappenas) dan United Nations Children's Fund, 2017).

Child development problems currently tend to increase, both in developed and developing countries, including Indonesia. The incident in Indonesia is experiencing fine and gross motor development disorders, hearing loss, lack of intelligence and speech delay. Children who have learning difficulties in America reach 6-10%. Meanwhile, there are no exact figures on the number of children who have learning difficulties in Indonesia (Mokoginta et al., 2017).

Based on the results of interviews in the preliminary survey, it was found that many students have poor memory where some students often complain of forgetting when the teacher gives questions after the teacher explains the material. The results of the initial survey of 10 students in grades 3 & 4 using the Digit Forward assessment measuring tool with a series of numbers obtained results of 10% of children with poor short-term memory, 70% of children with sufficient short-term memory, and 20% of children with good short-term memory. Stimulation before learning at school has also not been widely applied, the learning method still uses conventional methods.

Short-term memory is always involved in daily activities, namely for mathematical operations, problem-solving and language comprehension, so short-term memory plays a very important role in daily life (Edi Priyanto, 2021). Poor short-term memory has a significant impact on physical, mental, and social health. In terms of physical health, this limited memory can lead to being hampered in carrying out basic routines, such as bathing, washing hands, or brushing teeth. This increases the risk of infection and various health problems. In terms of mental health, weak short-term memory has an impact on the ability to concentrate and process information (Guangzheng et al, 2022). Students become easily frustrated by failing to complete assignments, which leads to increased stress and decreased confidence. In the long run, this condition can hinder a child's cognitive development, including critical thinking skills, problem-solving, and good decision-making. The social impact cannot be ignored either. Students who have trouble remembering conversations, rules, or activities with peers may seem indifferent or less responsive. As a result, they are prone to social isolation, which has the potential to hinder the development of interpersonal and emotional skills (Hidayat et al., 2021).

Lack of short-term memory in students needs to be overcome immediately, Improving students' short-term memory can be stimulated and the application of innovative learning modes so that children are ready to get new material to be taught in class. This stimulation can be done by stimulating physical activity with brain gymnastics activities. A research conducted by Canada et al (2020), which states that brain gymnastics can improve short-term memory abilities in children with low socioeconomic status. Based on research conducted by (Suppawittaya & Yasri, 2020), Stating that the mnemonics of the chunking technique can improve short-term memory by breaking down the received information into smaller pieces to make it easy to remember and understand and reduce the amount of information that must be stored in working memory, by reducing the amount of information can increase the working memory capacity so that it can reduce cognitive load (Paas, & van Merriënboer, 2020). Brain gym is a gymnastic exercise that contains a series of simple movements that can stimulate the integration of the work of the right and left brain to produce harmonious coordination of brain functions, so that it can improve memory ability, body coordination ability, fine and gross motor skills (Pratama et al, 2022). Stimulation by doing brain gym can improve the function of the Reticular activating system which is the center of alertness in humans. The activation of RAS provides a stimulus to repair fibers in the corpus callosum that provide nerve impulses in both hemispheres of the brain, including the hippocampus and amygdala. Activation of hippocampus function improves the process of memory consolidation (Schapiro et al, 2020). Continuous stimulation to the brain through brain exercises can make the brain structure change significantly, the connections between neurons are more, and glia cells that support neuronal function increase, blood capillaries that supply blood and oxygen to the brain become more. Brain exercises have many positive effects on brain structure and function, including increasing the number of dendrite branches, increasing synapses (nerve cell connections), increasing the number of nerve support cells, and improving memory skills (Yuanika et al., 2023). In the mnemonic method, chunking technique, the information received is broken down into smaller pieces to make it easier to remember and understand. Reducing the amount of information that must be stored in working memory, by reducing the amount of information per section, can increase working memory capacity so that it can reduce cognitive load so that it can increase memory (Putri et al., 2021).

Brain Gym can be combined with the use of innovative learning methods, because brain gymnastics is not fixated on the use of learning methods, it will further increase students' readiness in learning which ultimately improves memory (Nafiah et al, 2025). Based on this, the researcher intends to combine these two interventions into a single intervention, which is expected to significantly improve students' memory. In addition, Brain gym with the mnemonic method approach of the chunking technique was chosen as a therapeutic medium because Brain gym is a simple physical activity stimulation that can be done at any time by involving simple physical movements that make students not easily tired which can stimulate the brain, increase blood flow, and prepare the brain to be more focused (Maheswari & Indu, 2023). Meanwhile, in Mnemonics, the chunking technique helps students to remember by grouping information into small units that are easier to understand, so that children are easier and less burdensome (Porumbescu et al, 2024). Referring to the advantages of this intervention and based on existing conditions, the study aims to demonstrate the effectiveness of brain gym with the mnemonic

method approach of the chunking technique on improving short-term memory in school-age children (Sukri & Purwanti, 2016).

Method

This study is a quantitative research using a pre-experimental design with a one-group pretest-posttest approach. The research subjects were selected using simple random sampling with as many as 68 respondents consisting of school-age children in grades 3 and 4 who were located at MI Unggulan Bakalan Pule. The variables in the study are short-term memory as a dependent variable and brain gym with a mnemonic approach of chunking technique as an independent variable. The study was carried out 3 interventions per week for 1 week. Intervention for 30 minutes with 3 interventions, after which short memory measurements were carried out again using a digit forward questionnaire. The data that has been collected is then analyzed by Wilcoxon.

Results and Discussion

Results

In this chapter, we will explain the findings of the research on the influence of brain gym with the mnemonic chunking technique that can affect short-term memory in students. Some of the things that will be explained include the characteristics of respondents in general and the results of the analysis of related variables. The data presented are based on both quantitative and qualitative analyses to ensure a comprehensive understanding of the observed effects. This chapter also explores patterns and relationships that emerged during the implementation of the intervention. Furthermore, interpretations of the results are discussed in relation to existing literature and relevant theoretical frameworks.

Table 1. Characteristics of Respondents

Variabel	Category	f	%
Age	8 years old	16	23,5
	9 years old	33	48,5
	10 years old	19	28,0
Gender	Male	37	54,4%
	Female	31	45,6%

Based on Table 1, the characteristics of the research respondents are presented in terms of age and gender distribution. The findings indicate that, out of 68 respondents, nearly half were 9 years old (48.5%), while a smaller proportion were 8 years old (23%). In terms of gender, the majority of respondents were male students, accounting for 54.4% of the total sample. These demographic characteristics provide important contextual information for interpreting the results of the intervention and understanding potential variations in short-term memory performance.

Table 2. Distribution of short-term memory frequencies pre and post intervention

Aspects assessed	Category	f	%
Pre-test Short-Term Memory Before Being Given Brain Gym with a Mnemonic Method Approach to the Chunking Technique. (Pre-test)	Good	19	27,9%
	Sufficient	34	50,0%
	Poor	15	22,1%
Short-Term Memory Before being given brain gym with the mnemonic method approach of the chunking technique. (Post-test)	Good	46	67,6%
	Sufficient	18	26,5%
	Poor	3	5,9%

The results of the study showed that before being given Brain Gym with the Mnemonic Method Approach of the Chunking Technique, the results were obtained that most students had sufficient short-term memory and after getting Brain Gym with the Mnemonic Method Approach of the Chunking Technique, the results were obtained that most of the students had good short-term memory. Based on Table 2, it can be seen that before the experiment, half of the students had short-term memory in the sufficient category. Meanwhile, after the experiment, most of the students had short-term memory in the good category. The results of this study indicate that the combination of brain gym and chunking mnemonic techniques can be an effective method in improving short-term memory in school-age children. By implementing this method routinely in learning activities, it is expected that students can more easily understand and remember the subject matter given.

Based on the normality test using the Kolmogorov-Smirnov test, the results of the normality test showed that the ρ value (pre-test) = 0.004 and ρ value (post-test) = 0.021, both of which have a significance value <0.05 . Therefore, it can be concluded that the data is not normally distributed. Therefore, it can be concluded that the data is not normally distributed so that the analysis test is carried out using the Wilcoxon statistical test.

Table 3. Results of Analysis Before and After Intervention

Short Term Memory	N	Mean $\pm$ SD	Min	Max	p value
<i>Pre-Test</i>	68	7.01 $\pm$ 2.091	3	12	0.000
<i>Post-Test</i>	68	10.14 $\pm$ 2.743	5	14	

Based on table 3 shows that the calculation results with the Wilcoxon statistical test obtained the results of short-term memory values with a significance level of 0.000 where ($p < 0.05$). That means there is a significant influence with the brain gym treatment with the chunking technique mnemonic method approach on short-term memory in school-age children. The results of this study show that there is a difference in the average value of the level of short-term memory ability before and after being given brain gymnastics with the chunking technique mnemonic method approach. It can be seen from the results of this study that student's short-term memory has increased by scores measuring short-term memory from an average of 7.01 ($\pm$ 2.091) to 10.14 ($\pm$ 2.743).

Discussion

This study showed that there were various variations in short-term memory in students before being given brain gym with the mnemonic method approach of the chunking technique.

Based on the findings, the data of short-term memory was obtained in the sufficient category before being given brain gym intervention with a combination of mnemonics and chunking techniques. According to Piaget theory, the children's cognitive development consists of several stages that are adjusted to the child's age. For the preoperational stage that children on 2-7 years old, children are able to use language and develop concepts simply. Meanwhile, the concrete operational stage which is children in to 7-11 years. In this study, the most common age is 9 years old, where at this age the sharpest memory in humans is approximately in childhood are 10-14 years. This finding is reinforced by Winarsih et al., 2021; Pakpahan & Saragih (2022) who stated that the child's memory span increases from about 2 digits at the age of 2 to 3 years and about 5 digits at the age of 7. Between the ages of 7-13 years the memory span increases by only about 1.5 digits.

Aside from the age factor, gender also affects short-term memory. In this study, the data obtained was dominated by male students thus supporting the finding that before the intervention short-term memory was not good enough. Winarsih (2021) revealed that there are differences in memory function between men and women, where men tend to have better spatial memory skills, while women tend to have better verbal memory skills and subject location. Boys' language development is slower than that of girls, this has an impact on their cognitive, social and emotional development (Agustin & Langin, 2020). In addition, environmental conditions can be affected. This causes an inevitable noise and make students are less able to concentrate during lesson hours which has an impact on students' memory which is influenced by environmental conditions (Winarsih, 2021).

Fortunately, after conducting brain gym with the chunking technique mnemonic approach, a significant increase in short-term memory was found. This can be proven from the change in the short-term memory category which was originally from a sufficient category to a good category. This significant increase was followed by an increase in the average value of short-term memory. Atmaja (2019) supports this finding that continuous stimulation to the brain through brain exercises can significantly change the structure of the brain, more connections between neurons, more glia cells that support neuronal function, blood capillaries that supply blood and oxygen to the brain become more. Brain exercises have many positive effects on brain structure and function, including increasing the number of dendrite branches, increasing synapses (nerve cell connections), increasing the number of nerve support cells, and improving memory skills. Canada et al (2020) reinforces the findings with the statement that repeated brain gym stimulation can improve brain function and relax the body.

During the intervention process, researchers collaborated with teachers who assisted students to ensure that the techniques taught were well understood. Alzuhra & Wahyuni (2024) stated that learning activities can be carried out more effectively if students are willing to listen to the explanation given by the educator. In addition, during the intervention research it was divided into 4 sessions to ensure that the research process runs optimally, in addition to the division of sessions the class became more conducive to the intervention process. Conducive classroom conditions have a positive impact on students' mood and concentration. Arianti, (2017) argues that the environment is one of the potentials that can be utilized as a source of learning and to fulfill human needs in living life in the world, which must be preserved. Characteristics of a good environment include classes that are able to stimulate and challenge

students to continue learning, and provide a sense of security and satisfaction in achieving learning goals.

Several related studies also show positive results regarding the effects of brain gym. The results of this study are supported by research conducted by Agustin & Langin (2020) which states that there is an influence of brain gymnastics on the memory of school-age children. Through brain gymnastics carried out with the right method or method will affect students' memory. The series of movements given are movements that have a focused function of increasing the memory of school-age children (Lukács et al 2024; Rahayu et al, 2022). This finding is supported by Atmaja (2019), who stated that the provision of brain gym on the first and second day did not show any difference, but on the third to sixth day showed a difference in scores before and after the intervention, which means that there was a difference in brain gym pretest and posttest scores after being given at least 2 repetitions of the treatment. Panzilion, (2021) A also supports this finding by explaining that in the same study before the brain gym therapy intervention. Brain gymnastics will activate the brain's integration mechanism. The movements are a bridge that forms a connection or relationship between the brain and the body (Basso et al, 2021). So that it can activate organs and systems in the human body, through the work of the nervous system by dividing movements into three dimensions, namely the lateral dimension, the focusing dimension and the centering dimension.

The evidence based on this research is the combination of mnemonic techniques with the chunking approach. The implementation of treatment in this study was carried out by dividing (Chunk) the number of stimulants divided into 3 numbers. By dividing the information to be remembered into two or three groups of data is believed to be more effective in improving memory than presenting it in one large group of simple information and has a clear structure easier to process and store in short-term memory (Suppawittaya & Yasri, 2020). Short-term verbal memory will improve when words can be broken down into smaller units. By breaking down information into simpler pieces, the recall process becomes more efficient, allowing individuals to store and recall more information in a shorter period of time (Gafar, et al., 2023; Norris & Kalm, 2021). Alzuhra & Wahyuni, (2024) argues that Memory can also be improved through a mnemonic strategy by encoding information so that it can be stored in memory and making the process of recalling information easier. Mnemonic strategies make a positive contribution to developing and improving students' memory skills. Mnemonics help recall large amounts of information involving three elements, namely encoding, maintenance, and recall. By applying some mnemonics techniques to remember information, the memory process will be easier because the mnemonics always use the principle of association or linking (Darusman & Herwina, 2018).

There are several techniques in the mnemonic method, one of which is the chunking technique. By using the technique the received information is broken down into smaller pieces to make it easy to remember and understand, Reducing the amount of information stored in working memory can increase the working memory capacity, thereby reducing cognitive load and ultimately improving memory (Putri et al., 2021). The chunking technique mnemonic can improve short-term memory by grouping information into two or three chunks, increasing the accuracy of recall compared to presenting it in one chunk (Suppawittaya & Yasri, 2020).

Conclusion

Brain gym with mnemonic method approach Chunking technique is proven to improve short-term memory of school-age children. Teachers are expected to continue to develop brain gym methods to improve learning optimization, especially in school-age children. The chunking mnemonic approach can be an alternative brain gym activity that emphasizes memorization skills training. The integrated of memorization skill training, which combines Brain Gym exercises with mnemonic methods and the chunking technique, has shown significant promise in enhancing cognitive functions and memory retention among school-aged children. Brain Gym activities stimulate physical movement and coordination, which in turn support neural activation and improved concentration. When these physical exercises are paired with mnemonic strategies methods that use associations, imagery, and repetition they create robust pathways for learning. The chunking technique, specifically, helps children break down complex information into smaller, manageable “chunks,” thereby reducing cognitive overload and facilitating easier recall. Future research would benefit from longitudinal studies examining the long-term academic and cognitive outcomes of such integrated training. Researchers may explore age-specific adaptations, the impact of digital integration, and neurocognitive measurements to precisely gauge how Brain Gym, mnemonic methods, and chunking collectively influence brain function.

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Authors' Note

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