



The influence of brain gym on changes in the numerical ability of grade I elementary students



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ABSTRACT

Introduction: The child is one of the important human resources in building a nation with improved quality and quality of life. One of which is the issue of education. Education is a process of self-development potential to increase optimal knowledge. Therefore, using a brain gym to improve children's learning abilities is more optimal. This study is to determine the effect of brain gym on the change of numeracy skills in grade 1 elementary school children.

Methods: This research was pre-experimental with a one-group pretest-posttest approach with purposive sampling. The respondents were 19 samples that fulfilled the inclusion and exclusion criteria in public elementary school 1 Jatiwarna, Bekasi, Indonesia. Data were taken before and after the three weeks of brain training exercises using the 1st-grade end-of-year skills test. Analysis of univariate data used *Shapiro Wilk* and bivariate using paired sample *t*-test.

Results: From 20 respondents, the average counting ability before intervention was 65.20, and after intervention was 80.60. The results showed an effect of the Brain Gym intervention on the counting abilities of children with $p=0.000 < \alpha (0.05)$.

Conclusion: Based on these results, it can be concluded that exercise brain gym influenced the increase in children's numeracy skills at Public Elementary School 1 Jatiwarna Bekasi in 2018.

Keywords: brain gym, children, numeracy, numerical ability, students.

Cite This Article: Agustina, A., Ardhiani, R. 2023. The influence of brain gym on changes in the numerical ability of grade I elementary students. *Physical Therapy Journal of Indonesia* 4(2): 219-221. DOI: 10.51559/ptji.v4i2.145

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Received: 2023-06-01

Accepted: 2023-07-11

Published: 2023-08-20

INTRODUCTION

The development of elementary school-age children is included in the stage of the development of concrete operations. At this stage, the child can think logically about something. Elementary school students have distinct qualities that differ from one another.¹ The way children think logically about something will be different because every child is different. Both are interests, talents, abilities, personality, and environmental experiences. Children who experience disturbances during their development process can cause difficulties in learning.²

Students with learning difficulties experience difficulties in their general or specific learning tasks, which can be caused by neurological dysfunction, basic psychological processes, or other causes that can support a child's learning achievement to be low and the possibility of staying in class. Learning difficulties are divided into difficulty learning to read, difficulty learning to write, and difficulty

learning to count.³ The results of research conducted by the Third Mathematics and Science Study organized by the International Association for Evolution of Educational Achievement showed that Indonesia's mathematics ability was ranked 35th out of 45 countries.^{4,5}

According to 3,215 elementary school students in DKI Jakarta, there were 16.52% stated by teachers having learning difficulties. There were 5,887 students from 24 elementary schools in Pauh Padang District, and around 74.40% had difficulty learning to count.⁶ The data of these students indicate many problems in the academic field and require special education services. If children with learning difficulties do not get special services, we can imagine how many students will be threatened with leaving the class and may even be at risk of dropping out of school.⁷

Physiotherapy plays an essential role in providing training in physical activity. According to the Regulation of the Minister of Health number 65 of 2015 concerning

physiotherapy service standards, physiotherapy is a form of health service aimed at individuals or groups to develop, maintain and restore movement by using manual handling, increased movement, equipment (physical, electrotherapeutic and mechanical) function training, and communication.⁸ The intervention can be given as a brain gym to improve children's numeracy skills through the physiological effects they get.⁹ Brain exercise or Brain Gym is one of the entertaining exercises that kindergarten teachers can undertake to stimulate the child's brain.¹⁰

Brain gym is a series of simple motion exercises facilitating learning activities and adapting to daily demands. This movement is made to stimulate the left and right brain in the laterality dimension, relieve or relax the back of the brain (occipital & brainstem) and the front of the brain (frontal lobe) in the focusing extent, stimulate and relax the system associated with emotional feelings, namely the limbic system (midbrain) as well as the big brain on the dimension of concentration.¹¹ This

brain exercise can improve learning ability by using the whole brain. Brain Gym research that supports academic abilities has been carried out a lot, including research where the results show that the brain gym method affects improving numeracy skills in elementary school children.¹² Subsequent research indicates that the experimental group has a change in memory level.¹³ Therefore, this study aims to determine the effect of brain gym on the change of numeracy skills in grade 1 elementary school children.

METHODS

This type of research was pre-experimental. The research design used was one group pre and post-test. This design used one group of subjects by measuring before and after treatment. Then, the difference between the two treatment results was considered a treatment effect. As for determining the number of samples, this experimental research used purposive sampling, a sample selection technique by selecting the sample criteria to be studied. The sample size to be taken in this study used the Lemeshow formula.

$$n = \frac{\sigma^2 (Z_{1-\alpha} + Z_{1-\beta})^2}{(\mu_0 - \mu_a)^2}$$

$$n = \frac{6,0516(20 + 80)^2}{(11,7 - 12,67)^2}$$

$$n = 19$$

Information :

- n = sample size
- Z_{1-α} = confidence level 20
- Z_{1-β} = 80% test strength
- σ = standard deviation of the previous research population (2.46)
- σ² = variance of the previous study population (6.0516)
- μ₀ = average before the previous research intervention (11.7)
- μ_a = average after previous research intervention (12.67)

After calculating using the formula, the number of samples obtained was 19 people, and then 10% was added to anticipate the sample dropping out to 21 people and having met the criteria.

Table 1. Characteristic respondentst

Age	Frequency	Percentage
7	17	85
8	3	15
Amount	20	100
Means	Median	Min-Max
7.2	7.0	7-8
		SD
		0.366

Table 2. Shapiro-Wilk test

Time	P-value	Interpretation
Before Intervention	0.305	Normal
After Intervention	0.921	Normal

Table 3. Paired Sample T-Test

Means	SD	95% CI	t	p-value (2-tailed)
15.40	8.899	11.235 – 19.565	7.739	0.000

RESULTS

The research and tests carried out in this study showed that the average age of the respondents was 7.2, with a minimum age of 7 years and a maximum age of 8 years shown in Table 1. Table 2 stated that the normality test results conducted using the *Shapiro-Wilk* before the intervention were 0.305, and after the intervention was 0.921. Thus, it can be concluded that the *p*-value > (α=0.05), so the data is normally distributed. The results of the data normality test showed that the children's numeracy scores before and after the intervention had normal distribution data. Hence, the hypothesis test used is a parametric test, namely the paired sample *t*-test.

After 11 interventions, it was found that the parametric paired sample *t*-test results on the average value had a difference of 15.40 with a standard deviation of 8.899, shown in Table 3. Based on the test results, a *p*-value of 0.000 was obtained. If the *p*-value < (α = 0.005) means H₀ is rejected and H_a is accepted or brain gym affects increasing the numeracy skills of grade 1 students at Public Elementary School 1 Jatiwarna, Bekasi, Indonesia in 2018.

DISCUSSION

This follows the book, which states that children's intelligence develops rapidly at the age of 1-4 years, around 50%, and increases to 80% when they reach eight years of age and reaches 100% occurs during the 14 years later the brain will stagnate. So this can support that

optimizing education at an early age is very important because this period is important in developing a child's brain.¹⁴

Then, the most respondents based on gender found that 85% or 17 respondents were boys and 15% or three were girls. This is supported by a previous study that most respondents in the treatment group were male.¹⁵ This is also supported by research which states that there is an influence from the gender aspect on mathematical ability. Female students are superior to males in mathematical (verbal) communication skills and are more organized in learning.¹⁶

Based on the hypothesis test, it was concluded that brain exercise affected the ability to count in first-grade children at Jatiwarna Bekasi Public Elementary School I in 2018. According to research conducted by Wong, the same thing was found in Rochman 2015, brain exercises carried out for three weeks with a frequency of 3-6 times a week can improve numeracy skills in elementary school children. This exercise can help increase self-confidence and is influential in increasing focus, concentration, and memory and controlling children's emotions.¹⁷

In addition, according to research conducted by Lisnaini in 2012, four weeks with a frequency of 16 meetings can also improve cognitive function at a young age. This is because by moving, the brain will fulfill its needs for food and nutrients, which are supplied through blood circulation, oxygen, and energy to the brain so. If it is fulfilled properly, the brain can maintain its function, and plasticity occurs if damage occurs.¹⁸

In improving the development of this learning, various learning methods need to be done by teachers to improve student learning outcomes, one of which is brain gym. Brain gym movements are made to stimulate the left brain and right brain (lateral dimension), lighten or relax the back of the brain and the front of the brain (focusing dimension), stimulate systems associated with feelings or emotions, namely the midbrain (limbic) and cerebrum (concentration dimension). By doing brain gym, students will feel relaxed, the brain will be optimally integrated, and health can also improve to improve student learning outcomes.¹⁹

Sufficient stimulation can result in a bigger cortex, increased dendritic branching and synaptic growth, and optimal brain cell development. Cognitive stimulation of the brain can be used in a variety of settings. This indicates that various workouts can help youngsters improve their short-term memory since rhythm and brain activities drive the hippocampus to remember a lexicon of body motions. Brain stimulation has several favorable benefits on brain structure and function, such as increasing the number of 15 dendritic branches, synapses (connections between nerve cells), nerve support cells, and memory skills.^{20,21}

In this study, researchers experienced limitations. First, the difficulty of controlling factors affecting measurement results in children, such as nutritional factors, socioeconomic factors, and drugs or brain vitamins. Second, this study employed a one-group design with no control group. Future studies are planned to compare the effect size of brain gyms to other interventions in their research.

CONCLUSION

There was a significant influence on the provision of brain gym training on improving numeracy skills in first graders of Public Elementary School 1 Jatiwarna, Bekasi, Indonesia in 2018.

CONFLICT OF INTEREST

The author states there is no potential conflict of interest in connection with the research, authorship, and or publication of this article.

ETHICAL CONSIDERATION

Before reporting the condition, the authors obtained the patient's and parents' agreement and were given permission to write and publish the paper.

FUNDING

Any grant source did not fund this study.

AUTHOR CONTRIBUTIONS

AA prepares study designs, collects data, processes data, and writes manuscripts. RA is directing data collection and revising the manuscript.

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