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The difference in the effects of brain gym and proprioceptive activity methods on gross motor skill improvement in children aged 4-6 years

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Abstrak
Background: Gross motor development in children aged 4-6 years is an important aspect that influences physical, social, and cognitive abilities. Gross motor disorders can hinder daily activities and child development. Brain Gym and Proprioceptive activity are two methods believed to improve gross motor skills, but their effectiveness has not been directly compared. Objective: This study aims to determine the differences in the effects of Brain Gym and Proprioceptive activity on the improvement of gross motor skills in children aged 4–6 years. Method: This study used a quasi-experimental design with a two-group pretest-posttest design. The sample consisted of 34 children aged 4–6 years at TK ABA Karangasem, Sleman, divided into the Brain Gym and Proprioceptive activity groups. Gross motor skills were measured using the Test of Gross Motor Development-2 (TGMD-2) before and after the intervention. The sampling technique used in this study was purposive sampling. Data analysis was performed using SPSS version 25. Data were analysed using paired sample t-tests and independent sample t-tests. Results: The results showed that Brain Gym significantly improved gross motor skills (p=0.000). Proprioceptive activity also had a significant effect (p=0.000). There was no significant difference between the two methods (p=0.140). Conclusion: Brain Gym and Proprioceptive activity effectively improve gross motor skills in children aged 4-6 years, but there is no significant difference between the two. Both methods can be used as alternative interventions to support the development of gross motor skills in children.
Keywords: Brain Gym, Proprioceptive activity, Gross Motor Skills, Early Childhood, TGMD-2.

INTRODUCTION

Early childhood is a golden age. During this period, children's brains undergo the most rapid development in their entire lives. This occurs from when the child is in the womb until early childhood, i.e., from birth to six years. During this period, the child's brain undergoes extremely rapid growth. Law Number 20 of 2003 on the National Education System, Article 1, Point 14, states that early childhood education (PAUD) is an effort aimed at children from birth until the age of six, conducted through the provision of educational stimuli to assist in the physical and mental growth and development of children, enabling them to be prepared for further education. Children aged 4–6 years have not yet experienced sensorimotor maturation, which affects concentration, posture, balance, and daily behavior, as demonstrated by children's habits when sitting, such as constantly moving or shaking their feet on the floor, chewing their fingers – their fingers, biting their nails, chewing pens, pencils, clothing collars, arms, or inedible objects, frequently falling while playing, and difficulty sitting still for long periods.

Gross motor development in early childhood is significant for children. Children can train their large muscles and coordinate their eyes, hands, and feet through gross motor movements. With good coordination between eyes, hands, and feet, children can perform gross motor activities such as jumping, running, lifting, throwing, balancing, strengthening, and agility. Every child must receive proper stimulation to achieve optimal gross motor development.

According to UNICEF data from 2019, 27.5% or 3 million children experience disorders, particularly motor development disorders. Data from the World Health Organisation (WHO) shows that

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many countries experience various child development problems, including gross motor delay, with incidence rates in the United States ranging from 12-16%, Thailand 24%, Argentina 22%, and Indonesia 13–18% (Hidayat, 2018). National data from the Indonesian Ministry of Health indicates that in 2018, 11% of infants in Indonesia experienced growth and development disorders. Gross motor skill disorders in children aged 4–6 years can lead to various problems in daily activities. This can limit their participation in physical play and social activities with peers, potentially hindering their social and emotional development.

Additionally, delays in gross motor development can affect a child's self-confidence. Inability to participate in age-appropriate physical activities may make children feel different or less competent compared to their peers. Therefore, parents and educators must provide appropriate stimulation, such as encouraging children to play outdoors or participate in appropriate physical activities, to support their gross motor development.

Brain Gym is a series of simple, fun movements designed to improve learning abilities using the whole brain (Madyastuti *et al*., 2018). Brain Gym aims to connect/unify the mind and body. The Brain Gym method facilitates relaxation and focus in children, improving their ability to absorb information and communicate. Brain Gym can restore brain function after stressful activities, improve concentration, and enhance the ability to understand and reason.

Proprioceptive activity utilises our proprioceptive system, which is located in the muscles and joints. This proprioceptive system is responsible for body awareness—knowing where our body is in space. This is important for controlling strength and pressure, and proprioceptive ability improves performance, increases muscle endurance, and prevents injury (Nili et al., 2015). The more information children obtain through this system, the better they understand what their bodies are doing and how it relates to everything else. This is crucial for the brain, as it plays a significant role in self-regulation, coordination, posture, body awareness, language skills, and the ability to focus.

The measurement tool used to assess gross motor skills in children is the Test of Gross Motor Development-2 (TGMD-2). (TGMD-2) It is one of the most widely used assessment tools for assessing children's gross motor skills development. The TGMD-2 is a standardised test based on norms and criteria measuring gross motor skills in children aged 3–10. The test consists of 12 motor skills divided into two subtests: locomotor [Run (running), Gallop (horse steps), Hop (jumping), Leap (jumping), Horizontal Jump (horizontal jumping), Slide (sliding)] and object control [Striking a Stationary Ball (hitting a stationary ball), Stationary Dribble (dribbling/bouncing a ball in place), Catch (catching), Kick (kicking), Overhand Throw (overhand throw), Underhand Roll (rolling a ball underhand)].

Brain Gym can provide effective stimulation to improve eye-hand coordination, improving gross motor development in children aged 4-6 years. Brain gym improves balance and body coordination and strengthens the neural connections that support gross motor control. Proprioceptive activity plays an important role in improving gross motor skills in children. This stimulation helps children coordinate movements involving large muscles, such as running, jumping, and climbing. Children may have difficulty coordinating movements without proper proprioceptive function, which can affect their gross motor skills.

METHOD

The researcher focuses on the field of pediatric physiotherapy. The research method used is the experimental method. An experimental method systematically establishes a causal-effect relationship between phenomena (Sukardi, 2015). The research design used is a "Two Groups Pretest-Posttest Design," which involves administering a pretest before treatment and a posttest after treatment. The research subjects were divided into two groups, where one group received treatment using the Brain Gym method, while the other group received treatment using the proprioceptive activity method. The population in this study were students at the 'Aisyiyah Bustanul Athfal Karangasem kindergarten aged 4-6 years in Klurakbaru, Bokoharjo, Prambanan, Sleman, totalling 34 people. The sampling technique used in this study employed purposive sampling. The reason for selecting samples using purposive sampling is that not all samples meet the criteria set by the researcher. Therefore, the samples were deliberately selected based on specific criteria determined by the researcher to obtain representative samples (Sugiyono, 2017). To determine the number of samples taken in this study, the Slovin formula (Oscar & Sumirah, 2020) was used, and the result obtained was 34, so the total sample in this study was 34 students. The 34 students sampled in this study were randomly divided into two groups through a

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lottery system. The first group consisted of 17 students who were given Brain Gym exercises, while the second group also consisted of 17 students who were given Proprioceptive activity exercises.
The research design can be described as follows:

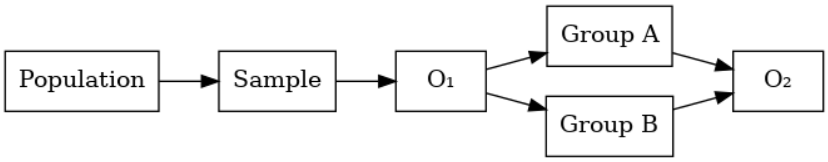

Figure 1. Research Design

Explanation:

O1 : Pre-test

O2 : Post-test

Group A : Treatment, using the brain gym exercise model

Group B : Treatment, using the proprioceptive activity exercise model

Data analysis is an important stage in research that aims to answer research questions based on data processing results. The data analysis techniques used in this study included descriptive statistical tests conducted to determine the distribution of respondent characteristics. Descriptive statistical tests were used to determine the distribution of respondent characteristics based on age, gender, height, and weight. Prerequisite tests for analysis, consisting of normality tests using the Shapiro-Wilk test to determine whether the data distribution in a group of variables is normally distributed or not (Fahmeyzan et al., 2018) and homogeneity tests using the Levene Test to ensure whether some population variances are the same or not (Usmadi, 2020), as well as hypothesis testing, which was conducted using the Paired Sample t-test and Independent Sample t-test. Decisions were made based on the significance value (p-value), where if the probability value (p) is > 0.05, H_0 is accepted and H_a is rejected, indicating that there is no difference in the effect of Brain Gym and Proprioceptive activity on the gross motor skills of 4–6-year-old children at the ABA Karangasem Kindergarten. Conversely, suppose the probability value (p) is < 0.05. In that case, H_a is accepted and H_0 is rejected, indicating a difference in the effect of Brain Gym and Proprioceptive activity on improving gross motor skills in children aged 4–6 years.

RESULTS AND DISCUSSION

Results

This study began with the initial measurement of children's gross motor skills using the Test of Gross Motor Development-2 (TGMD-2) as a baseline evaluation before the treatment was conducted, to support achieving the established objectives. Before the treatment, all participants underwent *a* pretest to measure their initial gross motor skills using the TGMD-2. After the intervention was administered according to the scheduled timeline, *a posttest* was conducted to assess the improvements resulting from the intervention, followed by brain gym exercises and proprioceptive activities. The data were analysed using descriptive statistical tests, paired sample t-tests, and independent sample t-tests using SPSS version 25.0. The research results are presented in the table below.

Table 1. Results of Descriptive Statistical Tests

	N			**Mean ± SD**
Age	17	Group I		5.12 ± 0.781
	17	Group II		5.18 ± 0.809
TGMD-2	17	Brain Gym	Pre	7.71 ± 1.572
			Post	9.12 ± 0.993
	17	Proprioceptive activity	Pre	7.71 ± 1.213
			Post	10.29 ± 1.160
Pre-post Difference	17	Brain Gym		1.41 ± 0.712

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	17	Proprioceptive activity		2.59 ± 1.873

Based on the results of descriptive statistical tests, it was found that there were 17 respondents in each Group, with mean values and standard deviations obtained. The sample distribution based on age in Group I yielded a value of 5.12 ± 0.781, while in Group II, a value of 5.18 ± 0.809 was obtained. The distribution of samples based on TGMD-2 results in Group I, with Brain Gym treatment obtained a pretest value of 7.71 ± 1.572 and a posttest value of 9.12 ± 0.993. Meanwhile, in Group II with Proprioceptive activity treatment, the pretest score was 7.71 ± 1.213 and the posttest score was 10.29 ± 1.160. The difference between the pretest and posttest scores indicated an increase of 1.41 ± 0.712 in Group I *(*Brain Gym*)*, while in Group II (Proprioceptive activity*)*, the increase was 2.59 ± 1.873.

Analysis Results

Normality Test

Based on the analysis of the normality test, the following data were obtained:

Table 2. Results of the Normality Test

	Shapiro-Wilk			**Description**
	Statistic	**df**	**Sig**	
Pre-test Brain Gym	0.964	17	0.703	Normal
Pre-test Proprioceptive activity	0.920	17	0.147	Normal
Post-test Brain Gym	0.921	17	0.153	Normal
Posttest Proprioceptive activity	0.925	17	0.183	Normal
Combined Pretest Brain Gym & Proprioceptive activity	0.949	17	0.114	Normal
Combined Posttest Brain Gym & Proprioceptive activity	0.938	17	0.503	Normal

From the normality test results on the pretest data, the significance value for the Brain Gym group was 0.703, and for the Proprioceptive activity group was 0.147. Thus, both groups showed pretest data that was normally distributed ($p > 0.05$). Meanwhile, the normality test results on the posttest data showed a significance value of 0.153 for the Brain Gym group and 0.183 for the Proprioceptive activity group, indicating that the data were normally distributed. The normality test results on the combined pretest data between the Brain Gym and Proprioceptive activity groups showed a significance value of 0.114. In contrast, the combined posttest data showed a value of 0.503. Since all significance values were > 0.05, it can be concluded that all data, both pretest and posttest, met the normality assumption.

Homogeneity Test

Based on the analysis of the homogeneity test for pretest and posttest, the following data were obtained:

Table 3. Results of Homogeneity Test

	Levene's Statistic	**df1**	**df2**	**Sig**	**Description**
Pretest	0.801	1	32	0.377	Homogeneous
Posttest	0.778	1	32	0.384	Homogeneous

From the table of homogeneity test results, the significance value obtained was 0.377 for the pretest and 0.384 for the posttest. The research results are declared homogeneous since all significance values are > 0.05.

Data Hypothesis Test

In this study, data analysis was conducted using hypothesis testing in the form of a paired and independent t-test. The decision-making criteria were based on the probability value, where if the probability value of H_0 (null hypothesis) is greater than 0.05, then H_0 is rejected. Conversely, if the probability value of H_a (alternative hypothesis) is less than 0.05, then H_a is accepted. The results of the hypothesis testing in this study show the following findings:

Paired T-Test

The results of the paired sample t-test analysis can be observed in the table below:

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Table 4. Results of the Paired T-Test

		Sig. (2-tailed)	Conclusion
Pair 1	Brain Gym	0.000	Significant
Pair 2	Proprioceptive activity	0.000	Significant

Based on the results of the Paired T-Test, a significance value (Sig. 2-tailed) of 0.000 was obtained in the group given the Brain Gym treatment, which means that the value is less than the significance level of 0.05. Thus, there is a significant difference between the pretest and posttest results in the Brain Gym group. Similarly, in the group that received Proprioceptive activity treatment, a significance value of 0.000 was obtained, which is also less than 0.05. These results indicate a significant difference between the pretest and posttest results in the Proprioceptive activity group. Thus, both the Brain Gym and Proprioceptive activity treatments significantly improve gross motor skills in 4–6-year-old children at TK ABA Karangasem.

Independent T-Test

The results of the independent sample t-test analysis can be observed in the table below:

Table 5. Results of the Independent T-Test

	Group	Sig	f	t	Sig (2-tailed)	Mean Difference
Pair 1	Combination of Brain Gym & Proprioceptive activity	0.375	0.798	-1.493	0.140	-0.588

Based on the Independent Sample T-Test results in Table 5, a sig value (2-tailed) of 0.140 was obtained. Since the p-value is greater than 0.05 ($p > 0.05$), it can be concluded that H_0 is accepted and H_a is rejected. Thus, there is no significant difference between Brain Gym and Proprioceptive activity in improving gross motor skills in children aged 4–6.

DISCUSSION

This study aimed to determine the difference in the effects of Brain Gym and Proprioceptive activity methods on improving gross motor skills in children aged 4–6. The data could answer the hypothesis formulated previously based on the results obtained. Further discussion of the research results can be described as follows:

The Effect of Brain Gym on the Improvement of Gross Motor Skills in Children Aged 4–6 Years

Based on the results of Hypothesis Test I using a paired sample t-test, the results showed *a* p-value less than 0.05 ($p < 0.05$), $p = 0.000$. Therefore, the alternative hypothesis (Ha) was accepted, and the null hypothesis (Ho) was rejected. It can be concluded that brain gyms improve gross motor skills in children aged 4–6.

This finding is supported by previous research findings (Madyastuti et al., 2018) stating that brain gyms can effectively stimulate eye-hand coordination and gross motor skill development in children aged 4 to 6. Additionally, (Safrudin et al., 2024) noted that the Brain Gym method facilitates relaxation and focus in children, enhancing their ability to absorb information and engage in communication. Brain Gym also positively impacts children's focus, body control, and learning readiness.

The Effect of Proprioceptive Activity on the Improvement of Gross Motor Skills in Children Aged 4-6 Years

Based on the hypothesis test II results using a paired sample t-test, the results showed a p-value less than 0.05 ($p < 0.05$), $p = 0.000$. Therefore, the alternative hypothesis (Ha) was accepted, and the null hypothesis (Ho) was rejected. Thus, proprioceptive activity influences the improvement of gross motor skills in children aged 4-6 years.

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These results are consistent with research from Frontiers in Rehabilitation Sciences, which found that active proprioceptive training significantly improves proprioceptive function and motor skills in children (Winter et al., 2022). This indicates that exercises promoting body awareness through repetitive movements and sensory stimulation can significantly impact children's development of gross motor skills.

Differences in the Effects of Brain Gym and Proprioceptive Activity on the Improvement of Gross Motor Skills in Children Aged 4–6 Years

Based on the results of Hypothesis Test III, using an independent sample t-test, the probability value (p) was 0.140 and the t-value was -1.493. This value indicates that the probability is greater than 0.05 ($p > 0.05$), meaning that the null hypothesis (Ho) is accepted and the alternative hypothesis (Ha) is rejected. Therefore, it can be concluded that there is no significant difference between the effects of Brain Gym and Proprioceptive activity on the improvement of gross motor skills in children aged 4–6 years.

The above statement shows that Brain Gym and Proprioceptive activity positively affect gross motor skills in children aged 4–6. However, their levels of effectiveness are not significantly different from one another. Based on the study's findings, it is evident that both types of interventions, Brain Gym and Proprioceptive activity, can be integrated or applied alternately as part of a gross motor stimulation program for children. This approach aims to provide variety in movement forms and sensory-motor stimulation, yet both contribute equally to improving gross motor skills in young children.

CONCLUSION

Based on the results of the study conducted on the differences in the effects of Brain Gym and Proprioceptive activity methods on the improvement of gross motor skills in children aged 4–6 years at TK ABA Karangasem, the following conclusions can be drawn: 1) There is an effect of Brain Gym on the improvement of gross motor skills in children aged 4–6 years. 2) There is an effect of Proprioceptive activity on the improvement of gross motor skills in children aged 4–6 years, and 3) There is no significant difference between the effects of Brain Gym and Proprioceptive activity on the improvement of gross motor skills in children aged 4–6 years.

These findings indicate that both Brain Gym and Proprioceptive activities can be applied as alternative methods to support the development of gross motor skills in early childhood education settings. Educators and therapists may consider integrating these activities into daily learning or therapy sessions to enhance children’s motor development. In addition, future studies could explore long-term effects, different age groups, or combinations of both methods to maximize developmental outcomes.

REFERENCES

Adzani, N. A., Awanis, A., & Ariyanti, L. (2024). Effectiveness of Providing Brain Gym on Gross Motor Development in Preschool Children. *FISIO MU: Physiotherapy Evidences*, *5*(1), 33-41.

Aye, T., Kuramoto-Ahuja, T., Sato, T., Sadakiyo, K., Watanabe, M., & Maruyama, H. (2018). Gross motor skill development of kindergarten children in Japan. *Journal of physical therapy science*, *30*(5), 711-715.

Darmawati, N. B., & Widyasari, C. (2022). Permainan tradisional engklek dalam meningkatkan motorik kasar anak usia dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *6*(6), 6827-6836

Fatmawati, V., Khotimah, S., & Imania, D. R. (2015). Perbedaan Pengaruh Brain Gym dan Latihan Kinestetik terhadap Propioceptive Pada Anak Usia 4-6 Tahun di TPA Al Mustaqim. *Sport and Fitness Journal Volume*, *3*, 1-12.

Fauziddin, M., & Mufarizuddin, M. (2018). Useful of clap hand games for optimalize cogtivite aspects in early childhood education. *Jurnal obsesi: jurnal pendidikan anak usia dini*, *2*(2), 162.

Fitriani, R. (2019). Model Pembelajaran Kooperatif dengan Permainan Estafet untuk Motorik Kasar Anak Usia Dini. *Jurnal Pelita PAUD*, *4*(1), 1-13.

Gümüsdag, H. (2019). Effects of Pre-School Play on Motor Development in Children. *Universal Journal of Educational Research*, *7*(2), 580-587.

ISSN 0216-4493 (print), ISSN 2597-6109 (online)

Jenni, O. G., Chaouch, A., Caflisch, J., & Rousson, V. (2013). Correlations between motor and intellectual functions in normally developing children between 7 and 18 years. *Developmental neuropsychology*, *38*(2), 98-113.

Kaoci, W., Taib, B., & Ummah, D. M. (2021). Perkembangan Fisik Motorik Kasar Anak Melalui Permainan Tradisional "Jalan Tempurung". *Jurnal Ilmiah Cahaya Paud*, *3*(1), 11-22.

Madyastuti, L., Twistiandayani, R., & Rahayu, A. W. (2018). Pengaruh Senam Otak Terhadap Peningkatan Motorik Kasar Pada Anak Usia 4-6 Tahun. *Wiraraja Medika: Jurnal Kesehatan*, *8*(2), 8-13

Safrudin, E. L., Ayuningrum, L. D., & Wijayanti, I. (2024). The Effect of Brain Gym on Psychomotor Development in Preschool Children. *Jurnal Smart Paud*, *7*(2), 129-137.

Usmadi, U. (2020). Pengujian persyaratan analisis (Uji homogenitas dan uji normalitas). *Inovasi Pendidikan*, *7*(1).

Waruwu, M. (2023). Pendekatan Penelitian Pendidikan: Metode Penelitian Kualitatif, Metode Penelitian Kuantitatif dan Metode Penelitian Kombinasi (Mixed Method). *Jurnal Pendidikan Tambusai*, *7*(1), 2896–2910.

Wiryanthini, I. A. (2016). Perbedaan Efektivitas Proprioceptive Exercise Dan Zig-zag Run Exercise Terhadap Peningkatan Kelincahan Pada Anak Usia 9-11 Tahun Di Sekolah Dasar Negeri 4 Sanur. *Majalah Ilmiah Fisioterapi Indonesia*, *3*(1).

Winter, L., Huang, Q., Sertic, J. V., & Konczak, J. (2022). The effectiveness of proprioceptive training for improving motor performance and motor dysfunction: a systematic review. *Frontiers in rehabilitation sciences*, *3*, 83016

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