



The Effect of Brain Exercise on Improving the Coordination Ability of Mild Graphic Improvement

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ABSTRACT

A pre-experimental study was conducted under a purposive sampling frame from November to December of 2023 by utilizing primary data from mild intellectual disability in Campus B Universitas Negeri Jakarta. The association between variables was analyzed using a dependent T-test. Based on the research findings presented in Chapter 4, it can be concluded that brain gymnastics exercises have a significant influence on improving hand-eye coordination in individuals with mild intellectual disabilities. This conclusion is derived from the above-mentioned research results, where the calculated t-value is 10.46, surpassing the critical t-value of 2.131. Consequently, the observed difference is statistically significant.

ARTICLE HISTORY

Received: 2024/01/14

Accepted: 2024/01/20

Published: 2024/02/21

KEYWORDS

Coordination;
Brain Gym;
Exercise
Mentally disabled.

AUTHORS' CONTRIBUTION

A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

Cites this Article : Pratiwi, Gusdiana Danu; Setiakarnawijaya, Yasep; Hartono, Fajar Vidya; Prabowo, Eko. (2024). *The Effect of Brain Exercise on Improving the Coordination Ability of Mild Graphic Improvement*. **Competitor: Jurnal Pendidikan Keolahragaan**. 16 (1), pp.47-55

INTRODUCTION

Humans are considered the epitome of divine creation when compared to other beings. They are characterized as both individualistic and social entities. Endowed with intellect, emotions, and cognition, humans are expected to exhibit responsibility for their actions. As social beings, humans possess the capacity for communication and interaction. Nevertheless, the distribution of abilities among humans is not uniform, with some individuals being born with limitations commonly referred to as disabilities.

Individuals with disabilities are categorized into those with physical, intellectual, mental, and sensory disabilities. According to the International Labour Organization, approximately 82% of people with disabilities come from developing countries. Data from the Social Ministry of Indonesia's PUSDATIN in 2010 revealed that out of 11,580,117



individuals with disabilities, 1,389,614 had mental disabilities. In 2019, the World Health Organization (WHO) estimated that over 450 million children worldwide were experiencing mental disorders or intellectual disabilities, with an anticipated 15% increase in 2020.

Fundamentally, all humans are considered equally valuable in the eyes of the Almighty. However, the reality we encounter is that a portion of society tends to marginalize individuals with disabilities. This can lead to a loss of self-esteem and the emergence of discrimination against people with disabilities. This is not correct, as they do not need to be shunned; rather, they require motivation and guidance to adapt. In essence, individuals with disabilities, including those with intellectual disabilities, remain individual and social beings who seek to fulfill their life needs just like others. Therefore, it is only fitting that they receive support and education.

Individuals with intellectual disabilities experience developmental delays compared to individuals of the same age. This condition is accompanied by an inability to easily learn and adapt to their environment. The American Association on Mental Deficiency (AAMD) defines intellectual disability as a general intellectual functioning below average with an IQ of 84 or below based on IQ tests. Individuals with intellectual disabilities can also be classified based on the etiology of their condition (Toth & King, 2009). Classification based on IQ includes:

- 1) Mild intellectual disability with an IQ of 50-69
- 2) Moderate intellectual disability with an IQ of 35-49
- 3) Severe intellectual disability with an IQ of 20-34
- 4) Profound intellectual disability with an IQ below 20
- 5) Other intellectual disabilities involve sensory, physical, behavioral disturbances, where IQ tests may be standard.

Intellectual disabilities are further classified into four groups, including those who can be taught with an IQ between 70 and 50, those who can be trained with an IQ between 30 and 49, and those who are dependent with an IQ below 29 (Costeff et al., 1983). The difference in intellectual function between intellectually disabled children and their typically developing counterparts leads to difficulties in coordinating motor components. Brain dysfunction contributes to delayed motor development in intellectually disabled children, including impaired motor coordination (Zainuri Subhan, 2017).

Coordination is the ability to integrate various elements of the motor system with sensory perception into efficient, fast, and accurate movement patterns (Sukadiyanto, 2005). Coordinated movements integrate different elements of the motor system with sensory perception into efficient, fast, and accurate movement patterns, relying on the brain as the central nervous system. Yumaika's 2020 study explained that individuals with intellectual disabilities struggle with coordinating movements, hindering their ability to optimize motion harmony (Yumaika, 2020). Coordination is a crucial aspect of movement perfection, reflecting an individual's ability to execute movements rapidly despite various challenges. Individuals with mild intellectual disabilities may face hindrances in eye-hand coordination, slowing them down in performing daily tasks. Nur Aisyah in 2016

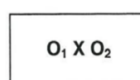
added that the motor development of intellectually disabled individuals is impeded due to a positive correlation between intellectual disability, physical problems, and motor aspects. Fine motor skills in intellectual disabilities may develop after mastering gross motor movements, involving eye-hand coordination. However, individuals with mild intellectual disabilities exhibit low eye-hand coordination, impacting their daily activities (nur.d., 2016). Adequate coordination solves desired motor tasks, while insufficient coordination limits motion. These limitations result in difficulties for intellectually disabled individuals to adapt to their environment. Therefore, repeated active movement activities (exercise) are necessary to enhance their coordination abilities.

To enhance the development of individuals with intellectual disabilities, continuous brain stimulation is essential. In this context, therapy plays a crucial role, and cognitive occupational therapy involves simple movements that can be easily followed by children, optimizing brain performance (Arief Hidayat et al., 2021). Brain gymnastics incorporates straightforward movements designed to optimize cognitive functions. These movements stimulate the brain under stressful conditions by forming connections between the brain and the body, integrating entire areas, and enhancing abilities and performance. Enny Wulandari's 2018 research explains that providing stimulus to the brain through brain gymnastics activates inactive neural synapses, forming new impulse pathways. The creation of these new impulse pathways enables nerves to transmit signals from receptors that are accustomed to receiving the same information, facilitating the effective execution of previously taught fine motor skills (Enny Wulandari, 2018).

Based on the above discussion, the researcher aims to conduct further investigation into how individuals with mild intellectual disabilities can enhance their coordination abilities through brain gymnastics, enabling them to continue developing their motor skills. The researcher hopes that the preliminary thesis seminar proposal titled "The Influence of Brain Gymnastics Exercise on Improving Coordination Abilities in Mild Intellectual Disabilities" will be approved, facilitating the pursuit of additional research in this area.

METHODS

This study adopts a pre-experimental design employing a pre-test and post-test group approach. Observations are conducted before the experiment (pre-test - O1) and after the experiment (post-test - O2). This design enables a more accurate assessment of treatment outcomes by comparing them with the baseline condition before the intervention (Sugiyono, 2013). The design can be illustrated as follows:



O1 = pre-test
 O2 = post-test
 X = Intervention

According to Hendriana (2011), "To develop a skill effectively, it requires one month or three to four weeks of practice." Additionally, Nugraha (2012) suggests that "Training should ideally be conducted at least three times a week to avoid chronic fatigue." Based on the insights provided by these experts, the author intends to conduct the research over 12 sessions.

In this study, the researcher will collaborate with a coach from the Special Olympics Indonesia DKI Jakarta who specializes in training athletes with mild intellectual disabilities. The research instrument involves an initial assessment to measure coordination abilities. Following the initial assessment, the researcher will administer brain gymnastics exercises to the participants. The assessment instruments utilized in this study include both tests and measurements.

The instruments utilized in the research include: (1) Speaker/sound system, (2) Laptop, (3) Stopwatch, (4) Tennis ball, (5) Cone, (6) Wall, and (7) Evaluation form

The instruments employed in this study encompass: eye-hand coordination, utilizing a tennis ball throw-and-catch test aimed at measuring eye-hand coordination (Fenanlampir, 2015).

The procedure for conducting the eye-hand coordination test is as follows: (1) The sample stands 2 meters away from a rebounding wall, (2) The ball is thrown with one hand and caught with the other, (3) Before the sample begins, a trial is allowed for acclimatization, (4) Each throw hitting the target and being caught earns a score of 1, (5) Points are scored only if the sample does not cross the boundary line while catching the ball, (6) The test lasts for 30 seconds, and (7) Two throws are performed, and the final score is the highest obtained from the two throws conducted.

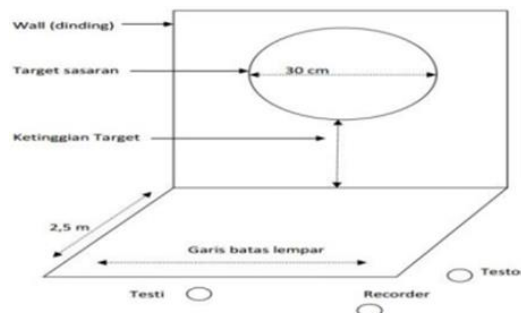


Figure 1

Illustrates the testing field for the tennis ball throw-and-catch coordination test.

Data Collection Technique

The data collection technique involves the use of tests and measurements. The eye-hand coordination test utilizes the tennis ball throw-and-catch test. The results of this test are recorded in an evaluation form as the initial test outcomes. Subsequently, the participants undergo brain gymnastics exercises under the supervision of the coach and researcher. A post-treatment test is conducted on the participants, and the initial and final test results are compared to determine the coordination abilities of the sample after the intervention.

Data Analysis Technique

The data analysis technique employed in this research utilizes the dependent t-test statistical method to ascertain differences in the test results.

Statistical Hypothesis

- $H_0: \mu A = 0$: There is no improvement in the eye-hand coordination abilities of individuals with mild intellectual disabilities after undergoing brain gymnastics exercises.
- $H_a: \mu A \neq 0$: There is an improvement in the eye-hand coordination abilities of individuals with mild intellectual disabilities after undergoing brain gymnastics exercises.

RESULTS AND DISCUSSION

Descriptive Statistics

Descriptive analysis aims to provide a general overview of the research variables. This descriptive analysis is expected to offer insights into the data regarding the effects of brain gymnastics exercises on the eye-hand coordination abilities of individuals with mild intellectual disabilities who are members of Special Olympics Indonesia DKI Jakarta. For detailed descriptions of each variable, refer to the following table:

Table 1.
Description Analysis

	N	Minimum	Maximum	Mean	Std.Deviation
Pre-Test	16	1.00	16.00	8.4375	4.50139
Post-Test	16	5.00	21.00	12.6250	5.04480
Valid N (listwise)	16				

Source: Primary Data

Based on the results presented in the above **Table 1**, the eye-hand coordination abilities of individuals with mild intellectual disabilities can be summarized as follows:

- The pre-test data for eye-hand coordination from 16 samples yielded an average score of 8.43 with a standard deviation of 4.5. The maximum achievable eye-hand coordination score for the samples was 16, while the minimum was 1.
- The post-test data for eye-hand coordination from 16 samples resulted in an average score of 12.62 with a standard deviation of 5.04. The maximum achievable eye-hand coordination score for the samples was 21, while the minimum was 5.

Thus, there is a difference in the average scores between the pre-test and post-test for eye-hand coordination in individuals with mild intellectual disabilities, with the final test yielding a score of 12.62 compared to the previous average of 8.4.

Based on the above description, this provides a general overview of the information obtained from the research results. Hypothesis testing was conducted using a t-test with a 5% error rate or 95% confidence level. However, before employing parametric statistics, the normality of the data must be tested first.

Normality Test

This test is conducted to determine whether the data follows a normal distribution or not. If the test results indicate a normal distribution, then one of the conditions for using parametric statistical analysis is satisfied. The normality test procedure is conducted using the Kolmogorov-Smirnov test, with the following conditions:

The hypotheses utilized are as follows:

(H₀): Residuals are normally distributed

(H₁): Residuals are not normally distributed

If the p-value is greater than 0.05, H₀ is accepted, indicating that the normality assumption is met.

The results of the normality test can be observed in the table below:

Table 2.
Normality Test Result

		Unstandardized Residual
N		16
Normal Parameters ^{a,b}	Mean	.0000000
	Std.Deviation	1.57400223
Most Extreme Differences	Absolute	.123
	Positive	.113
	Negative	-.123
Test Statistic		.123
Asymp.Sig.(2-tailed)		.200 ^{c,d}

Source: Primary Data

Based on **Table 2**, the obtained p-value is 0.200. Since this value is greater than 0.005, it can be concluded that H₀ is accepted, indicating that the normality assumption has been satisfied. This implies that the data used for eye-hand coordination in the brain gymnastics exercise sample is normally distributed.

Hypothesis Testing

To ascertain the difference between the pre-test and post-test, the author employed the paired-samples t-test, as it is assumed that the pre-test and post-test are not independent.

Research Hypotheses:

H₀: The average scores of the pre-test and post-test are the same(not significantly different).

H₁: The average scores of the pre-test and post-test are not the same(significantly different).

The decision-making basis involves comparing the calculated t-value with the critical t-value from the t-table. If the calculated t-value is greater than the critical t-value or if the negative calculated t-value is less than the negative critical t-value, the difference is deemed significant. This implies the rejection of H₀ and acceptance of H₁. Conversely, if the calculated t-value is less than the critical t-value or if the negative calculated t-value is greater than the negative critical t-value, the difference is considered not significant. This leads to the acceptance of H₀ and the rejection of H₁.

The paired-sample t-test calculations were performed using the SPSS software version 26.00. so that the results in **Table 3** are obtained as follows:

Table 3.

Paired t-test for hand-eye coordination with mild mental impairment

	Paired Differences						df	Sig. (2-table)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t		
				Lower	Upper			
Pretetst - Posttest	-4.187	1.601	0.400	-5.040	-3.335	-10.464	15	0.000

Source: Primary Data

Based on **Table 3**, the calculated t-value for the eye-hand coordination of individuals with mild intellectual disabilities is -10.46, with a significance value of 0.000. The critical t-value with 15 degrees of freedom and $\alpha = 5\%$ is 2.131. Since the calculated t-value is greater than the critical t-value, or the significance value (0.000) is less than 0.05, H_0 is rejected. Consequently, it can be concluded that there is a significant difference in the eye-hand coordination abilities of individuals with mild intellectual disabilities between the pre-test and post-test. Based on the statistical results, it is found that the hand-eye coordination abilities of individuals with mild intellectual disabilities are higher after undergoing brain gymnastics exercises compared to before the intervention.

Discussion

From the results of this study, it is evident that there is an improvement in eye-hand coordination abilities following brain gymnastics exercises. The initial test data had an average score of 8.43, while the final test data had an average score of 12.62, indicating an improvement of 4.19. According to Table 4.3, the calculated t-value is -10.46, with a significance value of 0.000. The critical t-value with 15 degrees of freedom and $\alpha = 5\%$ is 2.131. As the calculated t-value is greater than the critical t-value, or the significance value (0.000) is less than 0.05, H_0 is rejected. Hence, it can be concluded that there is a significant difference in eye-hand coordination abilities before and after brain gymnastics exercises. Based on the statistical analysis, it is evident that the eye-hand coordination of individuals with mild intellectual disabilities has shown improvement.

CONCLUSION

Based on the research findings presented in Chapter 4, it can be concluded that brain gymnastics exercises have an impact on improving eye-hand coordination abilities in individuals with mild intellectual disabilities. The obtained t-value of 10.46 from the research data is greater than the critical t-value of 2.131. Based on the research findings, the following recommendations can be provided:

1. For researchers interested in addressing this issue, it is suggested to conduct further studies involving other influential variables on motor skills in the field of

- sports, particularly within Special Olympics Indonesia (SOIna). This will contribute to enriching the knowledge in the field of sports science.
2. For coaches, based on the research results, brain gymnastics exercises can be employed as an effort to enhance the eye-hand coordination abilities of athletes with mild intellectual disabilities, especially in sports that require effective coordination between the eyes and hands. This will contribute to honing individual skills for achieving optimal performance.
 3. For teachers in schools, the implementation of brain gymnastics exercises can be incorporated into the learning process to provide a variety of learning experiences for individuals with mild intellectual disabilities, preventing monotony.
 4. For parents, brain gymnastics exercises can be considered as an alternative approach to developing good fundamental motor skills in their children.

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