RESEARCH PAPER

The Effectiveness Of Neurobic Exercise In Improving Memory Among College Students-Experimental Study

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Abstract
Introduction: Memory is a foundational element of cognitive processes, significantly influencing learning, academic achievement, and everyday decision-making. In recent years, there has been growing interest in the use of movement-based educational strategies, such as Neurobic exercise which aim to enhance mental performance through structured physical activities. It aims to explore the cognitive processes that may be influenced by physical movement, particularly in relation to memory enhancement
Objective: The primary objective of the study is to find out the effectiveness of neurobic exercise in improving memory among college students.
Methodology: A simple random sampling was conducted at School of Medical Education, Gandhinagar, Kottayam with students of the age group between 18 to 25 years. Those people who satisfy our inclusion criteria are screened for this experimental study, pre test-post test design with control group and experimental group. Outcome measures by Memory Functioning Questionnaire , Montreal Cognitive Assessment scale.
Result: Within-group pre- and post-intervention comparisons were performed using the Paired t-test.The difference between groups at post-test was found to be statistically significant, with the obtained p-values being <0.05, indicating that the probability of observing this difference by chance is minimal. Hence, the improvement noted in the intervention **group can be attributed to the effect of the intervention rather than random variation.**
Conclusion: The present study concluded that neurobic exercise significantly improves memory among college students.

Keywords: Memory, Montreal Cognitive Assessment, Memory Functioning Questionnaire

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Introduction

Memory is a fundamental cognitive function that allows individuals to encode, store, and retrieve information. It plays a crucial role in learning, decision-making, and daily functioning. Memory is generally categorized into three stages: sensory memory, which briefly holds sensory information, short-term (or working) memory, which temporarily retains information for active processing, and long-term memory, which stores information over extended periods. These systems work together to help the brain process experiences and apply knowledge when needed. Given its significance, enhancing memory has become a major focus in educational, psychological, and neuroscientific research[4]. Traditionally, memory development has been approached through cognitive training and repetition-based learning strategies. However, in recent years, there has been increasing interest in alternative and holistic methods that incorporate physical movement to stimulate brain function.

Neurobic exercise is a unique brain exercise program based on the latest finding of scientific research. The brain exercise program is presenting the combination of physical sense, including vision,hearing,taste,smell,with changing the daily routine.

This study seeks to bridge that gap by investigating how Neurobic Exercise practices may influence memory performance. Specifically, it aims to explore whether incorporating Neurobic exercises into learning environments can produce measurable improvements in both short-term and long-term memory

Neurobic exercise is a unique brain exercise program based on the latest finding of scientific research.The brain exercise programe is presenting the combination of phsical sense,including vision,hearing,taste,smell,with changing the daily routine. It stimulates neural activity to reinforce and produce brain cells constantly.Neurobics activate neural system to work and increase blood supply to the brain. Study conducted on critical thinking predicting academic performance beyond general cognitive ability. They concluded that critical thinking skills are significant predictors of academic performance, even beyond general cognitive abilities[1]. Study conducted on the development of academic achievement and cognitive abilities. They concluded that there is a bidirectional relationship between cognitive abilities and academic achievement, with each influencing the development of the other over time[2]. Study on working memory and academic performance among school students. They concluded that there is a positive correlation between working memory and academic performance, suggesting that enhancing children's working memory through training can lead to improved academic outcomes[15]. Study on the effect of cognitive ability on academic achievement. They concluded that cognitive ability significantly and positively affects academic achievement, with self-discipline partially mediating this relationship and planning playing a significant moderating role.[2]

Cognition: It refers the mental process involved in gaining knowledge. These cognitive processes include thinking, knowing, remembering, judging, and problem solving. Cognition is defined as all the processes by which sensory input is transformed, reduced, elaborated, stored, recovered, and used.

Memory: Memory is one of the most fundamental aspects of human cognition, playing a critical role in learning, decision-making, and the overall ability to function in daily life. It enables individuals to retain information, recall past experiences, and apply knowledge to new situations.

Neurobic Exercise: Nowadays youngsters are spending more time engaged with electronic gadgets. Their brain functions are lower than those of ancient generation. Neurobic exercises are brain training activities designed to stimulate the brain in novel and unexpected ways, enhancing cognitive function, neuroplasticity and overall mental sharpness.

Unlike other traditional exercises for the body,neurobic target the brain by engaging multiple sense, breaking routine patterns and forming new neural connections. The goal is to prevent mental stagnation and promote the growth of new synapses.

Neuro Physiology of Neurobic Exercise: Neurobic deliberately disrupts our regular habits to break away from our old neural pathway. This disruption triggers the release of Neurotrophin,a natural growth hormone that boots brain fitness.Neurotrophin stimulate thedevelopment of new neural pathway and forming fresh connections in the brain.

Neurotrophin: Neurotrophins are a family of protein that include the survival, development and function of neuron. It belong to a class of growth factor secreted protein that can signal particular cell to grow. The ability of brain to grow new neuron from neural stem cell, this process is known as neurogenesis.

2.Methodology and Methods

2.1 Aim

The aim of the study is to find out the effectiveness of Neurobic exercise in improving memory among college students.

2.2 Objectives

- To study the effectiveness of Neurobic exercise to improve memory
- To study the effectiveness of Neurobic exercise to improve cognition
- To compare the effectiveness of aerobic exercise in improving memory

2.3 Need of the study

The study aims that Neurobic exercise can stimulate the memory and improving academic performance in college students.

Neurobic exercises improve neural function in the areas where cognitive dysfunction are at greater risk,and developing and allow for early cognitive rehabilitation techniques.

This study aims that aerobic exercise can maintain and improve cognition in college students.

This study can provide better advice on relieving stress and there by improve the cognitive function in college students.

Study design: Experimental study

Sampling method: Convenient sampling

2.6 Sample size:30

Study Duration -7 weeks

Study setting: School of medical education, Kottayam

Study Population – Allied Health Science students

Inclusion Criteria

- Mild cognitive impairment
- Both Gender
- Age group 18 to 25

3.0 Exclusion Criteria

- Cardiac and Pulmonary dysfunctions
- Lower limb pathologies
- Non co-operative students
- Visual and auditory impairment

Outcome measures

Memory Functioning questionnaire

Montreal Cognitive Assessment Tool

3.2 Data collection

The study is conducted in first year BPT students of physiotherapy department of the School of Medical Education, Gandhinagar, Arpookara, Kottayam, Kerala . 30 participants were selected based on their academic performance. The subjects who met the inclusion criteria were allotted into two groups: Group A – Neurobic Exercise.

1.Physical Neurobic Exercise-Non- dominant Hand exercise with writing and Ear pinch squats 2.Environmental Neurobic Exercise-Eyes closed navigation Exercise andEyes closed eating 3.Auditory Neurobic Exercises-Reading Exercise andTracking individual instrument.

Group B – Aerobic Exercise. Step-up,Jog in place,Side to-side shuffle,Jumping Jacks,Static Cycling.

Students were selected by random sampling using a head-and-tail coin toss method. Informed consent was obtained from all the subjects for voluntary participation in the study.The pre test was conducted using the Memory Functioning questionnaire and Montreal Cognitive Assessment Tool assessment tool.Group A received neurobic exercise, and group B received aerobic exercises. The intervention was carried out five days per week for seven weeks .After that, the post test was conducted. The values were then given to the statistician for analysis and interpretation.

Measurement and outcome measure

Demographic data was collected and participants were evaluated with Memory Functioning questionnaire and Montreal Cognitive Assessment Tool

3.3 Procedure

The research is an experimental approach to find out the effectiveness of neurobic exercise in improving memory among college students.

The study is conducted in first year BPT students of physiotherapy department of the School of Medical Education, Gandhinagar, Arpookara, Kottayam, Kerala – 686008.Prior obtaining approval from the Ethical committee, permission was obtained from the School of Medical Education, Gandhinagar for sample collection from the student population aged 18–25 years. The subjects who met the inclusion criteria were allotted into two groups i.e. Group A - Neurobic Exercise, Group B – Aerobic Exercise. An informed consent was obtained from all the subjects for voluntary participation in the study. The intervention was carried out five days per week for seven weeks .After that, the post test was conducted. The values were then given to the statistician for analysis and interpretation.

4. Result & Discussions

4.1 Analysis & Interpretation

Result

Table 1. Baseline Comparison of Memory Functioning Questionnaire (MFQ) and Montreal Cognitive Assessment (MoCA) Scores Between Control and Experimental Groups

Variable	**Control Group Mean ± SD (n=10)**	**Experimental Group Mean ± SD (n=10)**
MFQ Pre-test	3.02 ± 0.54	3.49 ± 0.81
MoCA Pre-test	20.80 ± 3.58	20.40 ± 2.07

At baseline, the mean MFQ score was slightly higher in the experimental group (3.49 ± 0.81) compared to the control group (3.02 ± 0.54). Similarly, the baseline MoCA scores were comparable between the control (20.80 ± 3.58) and experimental groups (20.40 ± 2.07).

Table 2. Comparison of Memory Functioning Questionnaire (MFQ) Scores Before and After Intervention Within Groups (n=10)

Group	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	t-value	p-value	Cohen's d
Control (n=10)	3.02 ± 0.54	4.23 ± 0.78	1.21	-5.76	<0.001	1.82
Experimental (n=10)	3.49 ± 0.81	5.63 ± 0.61	2.14	-9.38	<0.001	2.97

***Test used**: Paired t-test*

The control group demonstrated a statistically significant increase in MFQ scores following the study period (mean difference = 1.21, $t = -5.76$, $p < 0.001$). However, the experimental group showed a substantially greater improvement in MFQ scores (mean difference = 2.14, $t = -9.38$, $p < 0.001$). The effect size was very large in both groups, with a larger effect observed in the experimental group (Cohen's d = 2.97) the neurobic exercises had a strong positive effect on memory functioning.

Figure 1. Comparison of MFQ Scores Before and After Intervention

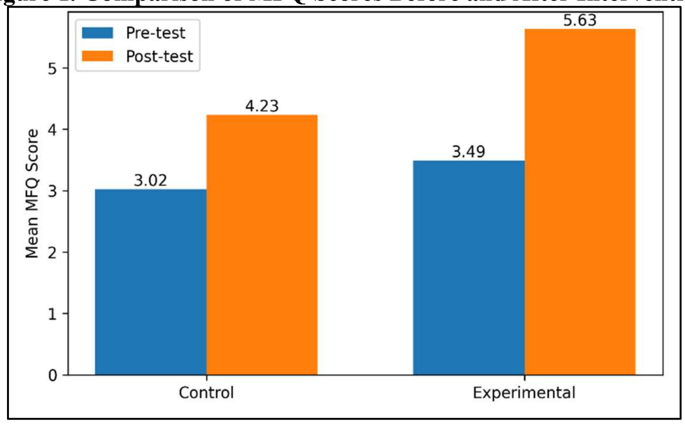


Table 3. Comparison of Montreal Cognitive Assessment (MoCA) Scores Before and After Intervention Within Groups (n=10)

Group	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	t-value	p-value	Cohen's d
Control (n=10)	20.80 ± 3.58	24.40 ± 2.22	3.60	-6.19	<0.001	1.96
Experimental (n=10)	20.40 ± 2.07	25.00 ± 2.00	4.60	-15.06	<0.001	4.76

Test used: Paired t-test

Both groups exhibited significant improvements in cognitive performance as measured by the MoCA. The control group improved by 3.60 points ($t = -6.19$, $p < 0.001$), while the experimental group improved by 4.60 points ($t = -15.06$, $p < 0.001$). The experimental group demonstrated a markedly larger effect size (Cohen's d = 4.76). a very strong impact of neurobic exercises on cognitive functioning.

Figure 2. Comparison of MoCA Scores Before and After Intervention

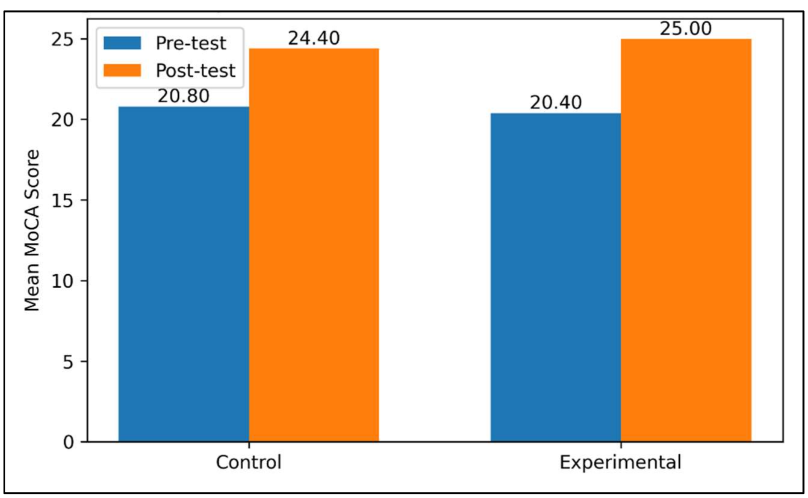


Table 4. Comparison of Change in MFQ Scores Between Control and Experimental Groups

Outcome	Control Mean Change ± SD	Experimental Mean Change ± SD	Test Statistic	p-value	Effect Size
MFQ Change Score	1.21 ± 0.66	2.14 ± 0.72	Mann–Whitney U = 17.0	0.014	Rank-biserial correlation = 0.660

The increase in MFQ scores was significantly greater in the experimental group than in the control group (U = 17.0, p = 0.014). The large rank-biserial correlation (0.660)a substantial effect of neurobic exercise on memory improvement.

Figure 3. Comparison of Mean Change in MFQ Scores Between Groups

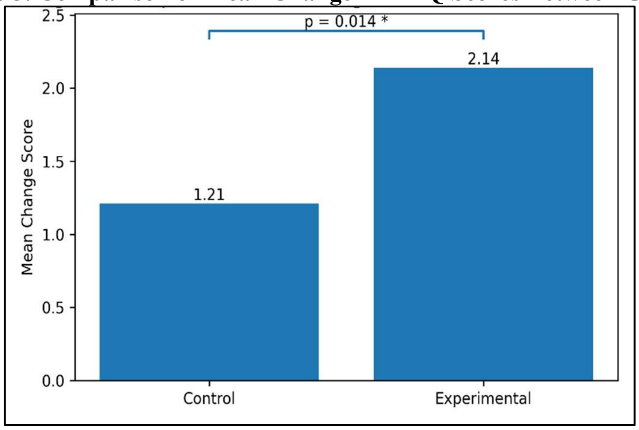
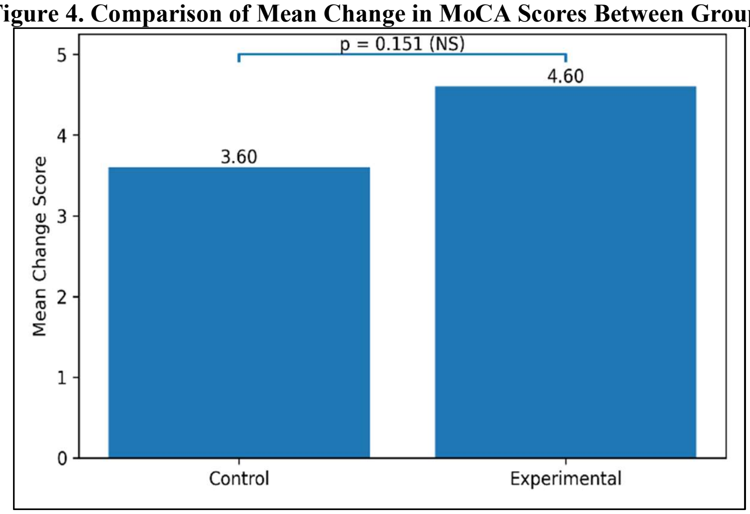


Table 5. Comparison of Change in MoCA Scores Between Control and Experimental Groups

Outcome	Control Mean Change ± SD	Experimental Mean Change ± SD	Test Statistic	p-value	Effect Size
MoCA Change Score	3.60 ± 1.84	4.60 ± 0.97	Welch's t = -1.52	0.151	Cohen's d = 0.681

Although the experimental group demonstrated a greater mean improvement in MoCA scores compared with the control group (4.60 vs. 3.60 points), the difference was not statistically significant (p = 0.151). Therefore, while neurobic exercises appeared to improve cognitive performance, the improvement was not significantly greater than that observed in the control group. The moderate effect size (Cohen's d = 0.681).

Figure 4. Comparison of Mean Change in MoCA Scores Between Groups



4.1 Statistical Analysis

Data were entered into Microsoft Excel and analysed using Jamovi version 2.7.14. Descriptive statistics were used to summarize participant characteristics and study variables. Continuous variables were presented as mean and standard deviation (SD), while categorical variables were expressed as frequencies and percentages. Normality of the data was assessed using the Shapiro–Wilk test.

Baseline comparability between the control and experimental groups was evaluated using independent samples t-tests for normally distributed variables. Within-group changes in Memory Functioning Questionnaire (MFQ) scores and Montreal Cognitive Assessment (MoCA) scores from pre-test to post-test were analysed using paired samples t-tests. Mean differences, t-values, p-values, and effect sizes (Cohen's d) were reported. To evaluate the effectiveness of the intervention between groups, change scores were calculated by subtracting pre-test scores from post-test scores. The change in MFQ scores between the control and experimental groups was compared using the Mann–

Whitney U test because the assumptions for parametric testing were not met. Effect size was reported using the rank-biserial correlation.

The change in MoCA scores between the control and experimental groups was compared using Welch's independent samples t-test to account for unequal variances between groups. Effect size was reported using Cohen's d. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

4.2 Implications of the Study

- Enhanced cognitive function and learning ability
- Improved mental health and reduced academic stress
- Long term memory benefits
- Personalized learning and cognitive diversity
- Social and collaborative learning benefits

5. Conclusion

Based on the Alternative Hypothesis

Neurobic exercises significantly improved memory functioning among college students. The experimental group showed greater improvement in Memory Functioning Questionnaire scores compared with the control group. Although cognitive performance measured by MoCA improved in both groups, the between-group difference was not statistically significant. Neurobic exercises may be an effective strategy for enhancing memory among college students.

5.1 Limitation Of the Study

The sample size was small

There was no equal distribution of male and female

This study had no follow up after 2 weeks of intervention so long term effect could not be suggested

Future scope of the stydy

Over coming the limitation by increasing the sample size

Improve cognitive load management in students

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