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The Effectiveness of Brain Gym on Concentration and Memory Performance of IT Academic Probation Students: A Case Study of UTAS-Shinas, Sultanate of Oman

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ABSTRACT
Despite the various academic services in place, many students still enter academic probation status and find it difficult to exit due to a low Cumulative Grade Point Average (CGPA). High academic achievements require a satisfactory level of concentration and working memory performance. This study aims to examine the effectiveness of Brain Gym exercises in improving concentration and memory levels among students on academic probation. This quasi-experimental study involved 48 students from the College of Computing and Information Sciences at the University of Technology and Applied Sciences (UTAS-Shinas), all in their first-year Diploma semester 1 of the academic year 2024-2025. The participants were allocated into a control group and an intervention group, and both groups were subjected to pre-tests and post-tests. Data on concentration were collected using Grid Concentration Exercise questionnaires, while the Digit Span Test and Spatial Test were used to assess memory performance. Two non-parametric tests were used to analyze the data: the Spearman Rank Order correlation test was used to determine the relationship between the pre-test and post-test scores for both groups, and the Wilcoxon Pair Signed Rank Test was used to measure the difference between the post-test scores of the control and intervention groups. The study's findings show a significant increase in the students' concentration performance for the intervention group by 19.1%. The finding also shows a significant improvement for Digit Span memory and Spatial Memory Skills among participants in the intervention group by 29.7%.

INTRODUCTION

Academic probation is nearly a universal policy practiced at most post-secondary institutions. It serves as a warning to students who fall below the satisfactory level to improve their performance, or else face the risk of dismissal. At the University of Technology and Applied Sciences (UTAS) in Oman, a student who fails to maintain a Cumulative Grade Point Average (CGPA) of 2.0 will be placed on first probation. If a student fails to achieve the required GPA at the end of the succeeding semesters, the

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student will receive a second, then a third, and may receive a fourth probation. Failure to improve in subsequent semesters will result in the student's dismissal and inability to graduate (Manpower, 2004).

Most higher education institutions provide academic support tools and services to help students achieve academic success (Bowman et al., 2020). Some of those programs include advising/counselling, weekly sessions, and warning letters (Damashek, 2003; Plak et al., 2022). However, despite the university's efforts, students are still struggling to maintain satisfactory academic standing. These students eventually leave the university, which affects the retention and graduation rate. Research has shown that academic intervention has a positive effect on both retention and graduation (Brown et al., 2021; Sneyers & De Witte, 2018). It suggests that an effective intervention based on scientific research may help improve academic achievement among at-risk students. According to the literature, low academic performance is associated with poor concentration and memory retention levels. The importance of memory and concentration is evident in numerous related literatures on the teaching and learning process. Students can hardly memorize without classroom concentration (Comighud, 2021).

One of the tools that may improve a student's concentration and memory, and potentially help raise their CGPA, is physical exercise. Studies have shown that physical exercise has a positive influence on cognitive functioning and behavior (Liu et al., 2025; Winter et al., 2007). There has been a long-standing discussion about the effect of physical exercise on the brain, and the community has been particularly interested in its impact on cognitive functions, spatial learning, and memory (Cassilhas et al., 2016; Srinivas et al., 2021). Exercise enhances cognitive function, which is linked to improved academic performance, including better grades, higher GPA, and increased attendance (Leary et al., 2025). In a systematic review of 58 high-quality studies on physical activity interventions and cognitive and academic performance, it was found that 60% of academic performance analyses revealed positive effects, especially in mathematics (Singh et al., 2019).

One of the widely recognized physical exercises for students is Brain Gym, a collection of movements aimed at connecting the body and mind, which has been shown to improve learning (Baloh, 2022; Marpaung et al., 2017). It may also relieve stress, improve memory, and increase concentration (Herawati et al., 2022). Several studies have been conducted using Brain Gym as a tool to improve academic performance; however, these studies have limited their focus to the effect of Brain Gym on either memory or concentration. While Brain Gym has also been utilized for healthy and institutionalized older people and mentally disabled students, literature is absent of using it to improve student's performance among probation students.

In the hope of finding an effective tool to help academically challenged students, this study aims to explore the effectiveness of Brain Gym on the concentration and memory of IT students who are currently on probation at the UTAS-Shinas branch. The results of this research could inform university administrators about the possible benefits of the program, which may offer the support needed by at-risk students. Therefore, the objectives of this study are: (1) to compare the influence of Brain Gym on both working memory performance and concentration of the control group and intervention groups before and after the intervention; (2) to find out which of working memory performance or concentration has improved more after the intervention exercises.

LITERATURE REVIEW

Multiple lines of evidence suggest the importance of exercise for cognitive and brain function. Many research studies also suggest that "physical exercise (PE) affects brain plasticity, influencing cognition and well-being. PE is defined as planned, structured, repetitive" (Mandolesi et al., 2018). Brain gym® is a type of PE and is known to be "an innovative approach drawn from a comprehensive body of research from developmental specialists" (Dawood et al., 2022). It is a type of cognitive intervention to enhance working memory performance (Abduh & Tahar, 2018; Ben Izhak & Lavidor, 2023). Brain Gym®, also known as educational kinesiology, was developed by the Dennisons in the 1970s as a program comprising a series of simple movements that activate the brain and facilitate whole-brain learning. The program is designed to re-educate the mind and body, making it easier to learn any skill. Brain gym is designed to generate neural pathways through exercise, repetition, and stimulation (Dawood et al., 2022). Clients, teachers, and students reported the effectiveness of this program for over 20 years (Kariuki & Kent, 2004; Siroya et al., 2021).

Two areas that Brain Gym can improve are concentration and memory performance. Learning concentration is defined as a person's ability to focus their thoughts and attention in the learning process. In a study on elementary students, Brain Gym was proven to have a positive impact on students' concentration (S. Anggraini & Dewi, 2022; Devayanti et al., 2024; Pratiwi & Pratama, 2020). A couple of studies have also increased the learning concentration of students, specifically 6th-grade students at SD 02 Hayaping who underwent online learning during the COVID-19 pandemic (S. Anggraini & Dewi, 2022) and grade 5 students at SD Plus Mutiara Sains Bangi after brain gym was used (I. R. Anggraini et al., 2023).

On the other hand, memory, also known as the ability to recall, is the capacity to remember past events, information, or skills (Kauts & Sharma, 2012). Brain gym has been shown to increase memory performance and focus, which ultimately leads to improved concentration in learning (Herawati et al., 2022; Sa'idah et al., 2023). Brain gym also demonstrates that stimulating brain training and consistent physical movement improve the working memory performance of students with learning disabilities (Abduh & Tahar, 2018; Karci & Sirmen, 2025). Relevant studies suggest a significant increase in the Intelligence Quotient (IQ) of elementary students after using the Brain Gym intervention (Marpaung et al., 2017; C. Ramos-galarza, et al., 2023). Many studies have shown that Brain Gym interventions have been applied to children to improve their academic performance. Moreover, a study of grade VI children in a public elementary school in Kendari has shown that using Brain Gym improves students' memory (Wahyuni et al., 2024). Overall, the literature highlights the effect of Brain Gym on both the memory and performance of elementary students. This insight gives an opportunity to utilize its effect on the university-level probation students.

METHODS

Research Design

This research employed a quantitative research design to investigate the effect of Brain Gym exercises on students under academic probation, with a particular focus on improvements in concentration and memory. The research employed a quasi-experimental design with a pre-test and post-test (Muse & Baldwin, 2021). A quantitative research design is appropriate in this context because it provides statistical analysis and objective measurement of data. Additionally, supporting the evaluation of the findings and their impact on outcomes facilitates comparisons between control and intervention groups to identify the specific effects of motor skills or cognitive performance in Brain Gym.

Sample and Data Collection

This research employed a quasi-experimental design with a control group. The population in this study consisted of 56 active students in Diploma I who were under academic probation in Semester 1 of the 2024-2025 academic year at the College of Computing and Information Sciences, UTAS-Shinas. The sampling method used is a total population approach. However, of the 56, only 48 students were selected, representing approximately 86% of the population, with an estimated dropout rate of 0.6%, a 95% confidence level, and a 5% margin of error. A sample size of 48 is considered a reasonable sample size that will yield meaningful findings and is deemed sufficient for this study (Manolitsis et al., 2019). The independent variable in this research is Brain Gym, and the dependent variable is probation students. All participants were subjected to a pre-test before being segregated into two groups: a control group (n = 24) and a brain gym intervention group (n = 24).

The students were randomly assigned to either the control or intervention group to ensure that both groups were similar at baseline, thereby minimizing potential biases and increasing the validity of the findings for both groups (Söderström, 2022). Randomization is a suitable method in this context because it ensures that students' characteristics, abilities, or academic motivations do not systematically bias the findings of this study. Students' consents were obtained prior to the study being conducted. The students were subjected to pre-tests and post-tests in a natural and controlled classroom setting.

Instruments

The concentration instrument used in this study is the Grid Concentration Exercise questionnaire (S. Anggraini & Dewi, 2022), consisting of three different levels: easy (5x5 numbered squares from 00 to 24), moderate (8x8 numbered squares from 00 to 63), and difficult (10x10 numbered squares from

00 to 99), placed randomly. Respondents must sort the numbered squares in ascending order in 60 seconds for each level. The average scores of the three levels were assessed as follows: High concentration learning ≥15; moderate concentration learning, 8-14; and low concentration learning ≤7.

In terms of memory instruments, this study employs a combination of two common tests used in cognitive and neuroscience studies for their high reliability and validity (Abduh & Tahar, 2018; Kane et al., 2005). The tests were in the form of cognitive computerized tasks, namely the Digit Span Memory Test and the Spatial Memory Test. In this study, both tests were accessed from the websites Total Brain and Human Benchmark, respectively. The Digit Span Memory Test shows a series of random numbers sequentially on the screen before they disappear. The numbers are increased every time according to the difficulty level. The participants must repeat the numbers on the screen so that the same digits reappear in the right sequence in which they were shown. The Spatial Memory Test entailed selecting the elements in a specific order on the screen. In the Spatial Memory Test, participants had to memorize the order in which items appeared in specific locations and then select the items in the same order they appeared on the screen. The average scores of the two tests were assessed as follows: high memory level ≥15, moderate memory level 8-14, and low memory level ≤7.

A brief orientation was provided to the intervention group regarding the objectives, purpose, procedures, confidentiality guarantee, benefits, and duration of the study. Additionally, a consent form was signed by all participants to ensure their full cooperation and commitment throughout the intervention process. The Brain Gym intervention includes five super pace movements, namely, hand twisting, moving hands toward, reverse pat & rub, thumb and pinky fingers in reverse motion, and two fingers interlocked with the thumb in reverse. The tests were conducted three times a week for 10 minutes, from September 22nd to November 16th, 2024, over 8 weeks (approximately 2 months). All the results for the pre- and post-tests were obtained in the same context for accurate comparison purposes.

Data Analysis

Data analysis was conducted using IBM SPSS Statistics 23, with a significance level of $P < 0.05$. The data from the pilot study were tested using Spearman's Rank-order correlation to determine the relationship between scores obtained before and after the intervention. The Spearman Rank-order correlation analysis on the scores of concentration abilities and working memory performance before and after intervention illustrates a strong and positive relationship, with significant values ($Z = -3.785$, $P = 0.00$) and ($Z = -1.656$, $P = .098$), respectively. The Wilcoxon Matched-Pairs Signed Rank Test was used to analyze the difference in scores between the two concentration abilities and working memory performance of both groups after the intervention programs. A non-parametric test was selected for the analysis, as the study involved a small sample size for each study group. To analyze the difference in pre-test and post-test learning concentration and memory performance, an independent sample t-test was used, resulting in a significance level of $p < 0.05$ and a confidence level of 98%.

RESULTS AND DISCUSSION

Concentration Abilities Group's Scores

The first aspect of the study aimed to assess the effectiveness of Brain Gym activities on the concentration levels of students under academic probation. The mean concentration result of the intervention group, as shown in Table 1, increased after they received brain gym exercises, as indicated by the pre-test ($M = 9.63$, $SD = 2.961$) and post-test ($M = 11.88$, $SD = 3.530$) results. It represents a relative standard deviation of approximately a 29.7% increase in students' concentration performance. In contrast, the control group's result indicates a minimal increase from the pre-test ($M=10.83$, $SD=1.971$) to the post-test ($M=10.88$, $SD=2.112$), which shows a relative standard deviation of 19.4% in the students' concentration performance.

Table 1. Wilcoxon Signed Ranks Concentration Test Analysis of the Intervention

	Intervention Group					Percentiles		
	N	Mean	St. Deviation	Minimum	Maximum	25th	50th (Median)	75th
Pre-Test	24	9.63	2.961	5	15	7.00	10.00	11.75
Post-Test	24	11.88	3.53	5	19	9.25	11.00	14.00

Table 2. Wilcoxon Signed Ranks Concentration Test Analysis of the Control Group

	Control Group					Percentiles		
Pre-Test	24	10.83	1.971	8	16	9.25	11.00	12.00
Post-Test	24	10.88	2.112	5	13	9.25	11.00	13.00

Concentration test scores show a significant improvement among IT students under academic probation before and after the Brain Gym intervention, as indicated in Figure 1. Initially, seven students in the pre-test group scored low grades (≤7). This number dramatically reduced to only one student after the Brain Gym intervention, indicating a notable decline. Similarly, the moderate (8-14) saw an increase in the number of students from 15 before the intervention to 20 afterwards. The high (≥15) experiences growth with the number of students from 2 to 4. This shift suggests that the majority of students benefited from the Brain Gym intervention and progressed to a higher level on the scale.

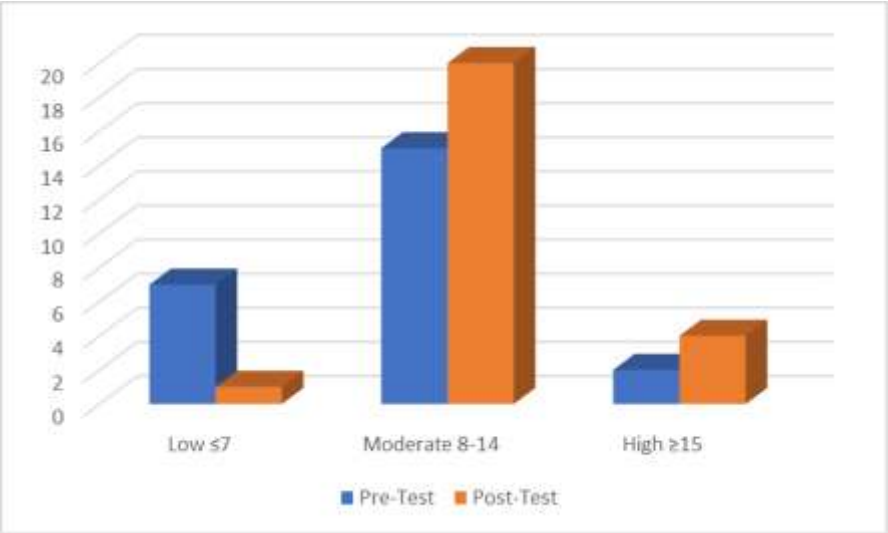

Figure 1. The Distribution of the Concentration Test Scores of the Intervention Group Before and After the Brain Gym Intervention

The outcomes revealed a statistically significant difference between the pre-test and post-test results for the Intervention group. Of the 24 participants under academic probation from IT, 19 students demonstrated an improvement in their concentration level, with a mean of 10.82 and a sum of ranks of 205.50. While only one participant displayed a negative decrease, with a mean of 4.50 and a sum of ranks of 4.50, four participants showed no change in their concentration level, as shown in Table 2. These outcomes indicate that Brain Gym activities had a substantial positive impact on students' concentration levels ($Z = -3.785$, $p = 0.00$).

Table 3. Wilcoxon Signed Ranks Concentration Test Analysis of the Intervention Group

Concentration Test	Description	N	Mean Rank	Sum of Ranks	Sig	
Post-Test	Negative Ranks	1a	4.5	4.5		
Pre-Test	Positive Ranks	19b	10.82	205.5	-3.785b	.000
	Ties	4c				
	Total	**24**				

On the other hand, the control group showed minimal improvements compared to the intervention group's results, with only 12 students out of 24 showing improvement, yielding a mean of 12.36 and a sum of ranks of 86.5. Seven students showed negative improvement, and five students remained at the same concentration level on both tests, as indicated in Table 3. Judging from the post-test results of both groups, there is a strong positive relation between the two groups' results, with a p-value of 1, as Table 4 indicates. It indicates that Brain Gym affects the increase in learning concentration of student participants.

Table 4. Wilcoxon Signed Ranks Concentration Test Analysis of the Control Group

Concentration Test	Description	N	Mean Rank	Sum of Ranks	Z	Sig
Post-Test	Negative Ranks	7[a]	12.36	86.5	-.345[b]	.730
Pre-Test	Positive Ranks	12[b]	8.63	103.5		
	Ties	5[c]				
	Total	**24**				

Table 5. The Correlation between Intervention and Control Groups on Concentration Post-Tests

Description		Post-Test (Intervention Group)	Post-test (Control Group)
Post-Test Intervention Group	Pearson Correlation	1	-0.415
	Sig. (2 Tailed)		0.044
	N	24	24
Post-Test Control Group	Pearson Correlation	-0.415	1
	Sig. (2 Tailed)	0.044	
	N	24	24

The significant increase observed in concentration in the intervention group is consistent with other research findings that have studied movement-based interventions and their relationship to the development of concentration levels. Researchers have found that brain gym activities can enhance neural efficiency, thereby improving cognitive functions such as focus and attention. Research has revealed that supplying the maximum volume of O2 can boost blood flow by taking it up and affecting all parts of the body, including the brain, which supports optimal brain function (S. Anggraini & Dewi, 2022). Similarly, movement-based interventions enhance the release of neurotransmitters such as dopamine and serotonin, which are crucial for attention and cognitive performance; therefore, physical activity has a positive impact on brain function (Millman et al., 2021; Ratey, 2008). Relevant research has revealed that Brain Gym not only enhances cognitive processing but also promotes emotional health and academic engagement (Siroya et al., 2021; Vazou et al., 2019).

These results also align with recent broader research that seeks to integrate physical movement into educational environments. Research found a positive association between classroom-based physical activity and academic-related outcomes (Peiris et al., 2022; Watson et al., 2017). Relevant research has emphasized that individuals with learning challenges who participate in structured exercise programs report improved sustained concentration and reduced cognitive fatigue (Manocchio et al., 2025; Singh et al., 2019). Another study suggests that Brain Gym activities are an effective tool for enhancing concentration levels, as they have demonstrated positive effects on attention improvement (Nafi'ah et al., 2025; Rahayu et al., 2022).

In fact, the combination of cognitive engagement with the Brain Gym activities is responsible for the increase in concentration levels seen in this study. Brain Gym movements are actually designed to boost the coordination of brain hemispheres and neural circuits, which are essential for cognitive tasks such as concentration. The results of this study suggest that Brain Gym activities are highly beneficial for enhancing learning concentration among higher education students.

Memory Performance Group's Scores

Based on Table 5, the statistical results showed an increase in the mean working memory function result of the participants after receiving Brain Gym intervention, from the pre-test (M = 9.22, SD = 4.31) to the post-test (M = 13.22, SD = 7.96). It represents a relative standard deviation of approximately a 60.2% increase in the student's working memory function. In contrast, the control group's result indicates a decrease from the pre-test (M=11.9, SD=8.28) to the post-test (M=10.33, SD=4.11), which represents a 39.78% relative standard deviation in students' working memory function.

Table 6. Wilcoxon Signed Ranks Memory Test Analysis of the Intervention

	Intervention Group					Percentiles		
	N	**Mean**	**St. Deviation**	**Minimum**	**Maximum**	**25th**	**50th (Median)**	**75th**
Pre-Test	24	9.22	4.31	3.5	21.5	6.5	7.75	10.5
Post-Test	24	13.22	7.96	6	33	7.6	10.75	14.37

Table 7. Wilcoxon Signed Ranks Memory Test Analysis of the Control Groups

	Control Group					Percentiles		
Pre-Test	24	11.91	8.28	4	37.5	6.0	9.7	14.5
Post-Test	24	10.33	4.11	5	24.5	7.1	10.0	12.0

The analysis of memory performance test scores before and after the Brain Gym intervention reveals a significant improvement among IT students under academic probation, as indicated in Figure 2. Initially, eight students in the pre-test group scored low grades (≤7). This number was dramatically reduced to half (4) after Brain Gym intervention, indicating a notable decline. Similarly, the moderate (8-14) group saw a minimal increase of one student from 13 before the intervention to 14 afterwards. The high (≥15) increased to double with the number of students from 3 to 6. These changes indicate that most students advanced to a higher level on the scale and have benefited from the Brain Gym intervention.

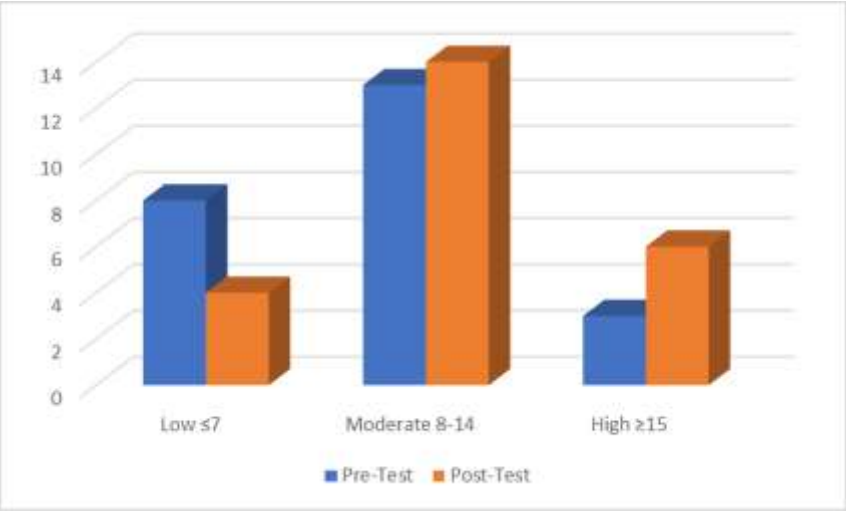

Figure 2. The Distribution of the Memory Performance Test Scores of the Intervention Group Before and After the Brain Gym Intervention

The findings revealed a statistically significant difference between the pre-test and post-test results for the Intervention group. Among 24 IT students under academic probation, 13 demonstrated improvement in their working memory performance, with a mean of 13.65 and a sum of ranks of 177.5. Nine participants displayed a negative decrease, with a mean of 8.39 and a sum of ranks of 75.5, whereas only one participant showed no improvement in memory working function level, as Table 6 illustrates. These outcomes indicate that Brain Gym activities had a positive impact on students' working memory performance (Z = -1.656, P = .098).

Table 8. Wilcoxon Signed Ranks Memory Test Analysis of the Intervention Group

Memory Test (Intervention Group)	Ranks	N	Mean Rank	Sum of Ranks	Z	Sig
Post-Test	Negative Ranks	9[a]	8.39	75.5	-1.656[b]	.098
Pre-Test	Positive Ranks	13[b]	13.65	177.5		
Ties		1[c]				
Total		**24**				

On the other hand, the control group showed minimal improvement compared to the intervention group, with only 11 students out of 24 showing improvement, yielding a mean of 13.20 and a sum of ranks of 132. While 10 students showed negative improvement, and three students maintained the same working memory performance on both tests, as indicated in Table 7. Based on the post-test results of both groups, there is a strong positive relation between the two groups' results, with a p-value of 1, as Table 8 illustrates. It indicates that Brain Gym increases the working memory performance of student participants.

Table 9. Wilcoxon Signed Ranks Memory Test Analysis of the Control Group Memory Test

Memory Test (Control Group)	Ranks	N	Mean Rank	Sum of Ranks	Z	Sig
Post-Test	Negative Ranks	10[a]	13.20	132	-.575[b]	.566

Memory Test (Control Group)	Ranks	N	Mean Rank	Sum of Ranks	Z	Sig
Pre-Test	Positive Ranks	11[b]	9	99		
Ties		3[c]				
Total		**24**				

Table 10. The Correlation between Intervention and Control Groups on Working Memory Post-Tests

Memory Test (Control Group)	Ranks	N	Mean Rank	Sum of Ranks	Z	Sig
Post-Test	Negative Ranks	10[a]	13.20	132	-.575[b]	.566
Pre-Test	Positive Ranks	11[b]	9	99		
Ties		3[c]				
Total		**24**				

Numerous recent studies have found that the most fundamental brain function enhancement is related to increasing stimulation to enhance working memory capacity. Relevant research states that the student's memory is closely related to the brain function ability, and differences in student memory working performance are not the factor of being intelligent or unintelligent, but rather the mechanisms used in the process of improving the memory performance and practice using such techniques (Almarzouki, 2024; Aspanani et al., 2023). The same study states that if the teacher does not involve students in the learning process, students' memory can affect the amount of knowledge learned and stored in their long-term memory, and therefore become weak. This finding is consistent with Wahyuni et al. (2024), who found that people can recall approximately 90% of what is said and done. It has been found in Indonesia that the percentage of students experiencing learning difficulties due to low memory performance increased from 28% in 2010 to 78% in 2012. Learning, thinking, remembering, creativity, and intelligence are processes that include the entire body in addition to the brain. Several studies have demonstrated how involving many teaching strategies can enhance student learning outcomes (Heilporn et al., 2021; Kusmawan et al., 2025). Relevant studies state that the working memory capacity can be expanded through targeted training (Alain, 2022; Morrison & Chein, 2011). It can include, for example, a combination of ideas and imagination, utilizing software, devices, and games. Some studies suggest that students who engage in regular Brain Gym exercises exhibit improvements in cognitive functions, such as attention and memory (Abduh & Tahar, 2018; Siroya et al., 2021). From the findings, it is clear that the memory function of the participant students improved after the Brain Gym intervention, as 60% of the students in the intervention group demonstrated a memory improvement compared to 40% of the students in the control group. Some participants in this study, however, did not report an increase in their memory; this was due to additional reasons, including the students' inability to focus during the implementation of brain gym and improper execution of the program's phases. Memory is one of the factors that greatly influences, especially in the learning process and the improvement of children's academic achievement.

CONCLUSION

The study's findings highlight the effect of Brain Gym activities on students in probation status. Integrating Brain Gym into students' activities has enhanced their concentration, as evidenced by the before-and-after results. Moreover, doing the Brain Gym activities has also improved the students' memory. Students agreed that incorporating Brain Gym into their daily activities will help them retain their learning, which will eventually lead to better grades and ultimately help them exit probation. The results aligned with other existing literature that has studied the role of physical movements on concentration and memory levels. The study further suggests that incorporating Brain Gym activities

into academic classes in higher education institutions will have a positive effect on students. Moreover, the findings of this study have wider implications for educational practices, highlighting the need for program heads and teachers to integrate Brain Gym activities into classes or students' activities to promote better retention of study materials. It offers valuable insights for educators and decision-makers in Oman. However, long-term effects should be studied further, including the applicability across various demographic factors and educational contexts, as well as a comparison of the effect of Brain Gym with other techniques.

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The authors declare no funding and conflicts of interest for this research.

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