



## Effectiveness of Brain Gym exercise enhancing performance in sculptors

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### Abstract

**Background:** Sculpture involves intricate coordination between sensory input, motor precision, and executive cognitive functions. Prolonged and repetitive sculpting tasks may contribute to cumulative neuromuscular fatigue and potential neurological disturbances. Brain Gym interventions are structured to strengthen brain-body connectivity, augment concentration, and sharpen motor proficiency, positioning them as a viable strategy to support and enhance the occupational performance of sculptors.

**Methods:** This comparative study recruited 30 stroke patients (aged 40–80 years) through convenience sampling and allocated them into two groups:

- **Group A (n=15):** Received Brain Gym exercises.
- **Group B (n=15):** Received Diaphragmatic Breathing exercise.

Both groups underwent 20 sessions over 4 weeks. Outcomes were assessed using the Nine-Hole Pegboard Test (dominant and non-dominant hand), Hand-Eye Coordination Test, and Trail Making Test at baseline and post-intervention.

**Results:** Both groups demonstrated significant within-group improvements across all outcome measures ( $p < 0.01$ ). Group A showed a 15.6% improvement in the Nine-Hole Pegboard Test (dominant hand), 13.2% improvement in the Nine-Hole Pegboard Test (non-dominant hand), 19.8% improvement in the Hand-Eye Coordination Test, and 14.9% improvement in the Trail Making Test, whereas Group B exhibited comparatively smaller gains with an 8.4% improvement in the Nine-Hole Pegboard Test (dominant hand), 6.1% improvement in the Nine-Hole Pegboard Test (non-dominant hand), 9.6% improvement in the Hand-Eye Coordination Test, and 5.2% improvement in the Trail Making Test. Between-group comparisons revealed statistically significant superior improvements in Group A across all outcome measures ( $p < 0.05$ ).

**Conclusion:** While both Brain Gym exercises and diaphragmatic breathing exercises improved fine motor performance, hand-eye coordination, and cognitive flexibility among sculptors, Brain Gym exercises demonstrated greater overall effectiveness in this study. Nonetheless, diaphragmatic breathing remains a supportive intervention that may offer complementary benefits through relaxation and stress reduction.

Further large-scale studies are warranted to establish the role of Brain Gym exercises in occupational performance enhancement and routine practice.

**Keywords:** Brain Gym exercise, sculptors, fine motor coordination, hand-eye coordination, cognitive performance, Trail Making Test, Nine-Hole Pegboard Test, neuro-motor integration

### Introduction

Art or design is what sculpture is. Every artistic endeavor aims to harmonize our emotional and cerebral selves. As different from practical actions like eating, walking, and performing one's everyday chores for a living as thought is from feeling, so too is artistic endeavor. With frequent reference to our aesthetic urges, sculpture as an activity cultivates in us the ability to perceive form in its actual manifestation as spatial reality. For their artistic performance, sculptors heavily depend on sensory integration, fine motor coordination, and cognitive control. Epidemiological research, however, shows that prolonged and repetitive sculpting tasks may put workers at risk for a number of neurological and neuromuscular issues, which are frequently underreported in occupational health data <sup>[1]</sup>.

In neuro-rehabilitation, brain training is crucial because it improves cognitive performance, lessens the burden of white matter lesions, and lowers atrophy. Due to its heightened neurological advantages for age-related atrophy

exacerbated by neuropathology, it is an excellent treatment for depression in older adults. According to neuroimaging research, increased motor cortex activity and the activation of perceptual processing areas are necessary for motor learning and skill transfer <sup>[2]</sup>.

Brain gym, often referred to as motor skills training exercises, encourage the brain's capacity to counteract the stress brought on by particular memories, circumstances, people, locations, and abilities. By stimulating both hemispheres of the brain through neural re-patterning to enhance the learning process of the entire brain, brain gym activities can enhance behavioral and academic performance. The program in Educational Kinesiology includes Brain Gym. "To pull out learning, with movement" is the definition of educational kinesiology. A sophisticated movement-based program enhances neuronal connectivity between the body and mind, enabling us to reach our full learning and life skill potential. Everyone who uses the program finds it to be incredibly enjoyable and productive.

Focus, memory, reading scientific and educational materials, writing, math, taking tests, physical coordination, relationships, personal responsibility, and organizational attitudes and skills can all be significantly enhanced by this intervention, according to research literature [3]. The inventors claim that regular brain gymnastics exercises activate and develop different brain regions, particularly the corpus callosum, which facilitates smooth and more efficient communication between the two sides of the brain for higher order thinking. Hannaford says that "activity is important for learning" and that the brain is a sophisticated organ that is centered on motion [4].

Brain Gym, introduced by Paul and Gail Dennison in the 1970s, consists of a set of simple physical movements designed to synchronize the mind and body, thereby enhancing skills such as attention, memory, and learning outcomes. As an educational kinesiology program, Brain Gym has been actively implemented in more than 87 countries worldwide. Kinesiology, the study of human movement, explores the connection between physical posture, motor activity, and brain performance. Through various structured exercises, Brain Gym aims to support the learning process by fostering integration across different domains of cognitive functioning. Its widespread application is reflected in the translation of program materials into more than 40 languages [5].

When an individual is in a conscious state, attention can be categorized into two types: active and passive. Active attention is a voluntary process characterized by heightened alertness, focused concentration, personal interest, and fulfillment of needs. It is typically stimulated by factors such as curiosity and hunger. In contrast, passive attention is an involuntary cognitive process that is readily influenced and distracted by external stimuli. The term Brain Gym refers to a structured set of movements, programs, materials, and an underlying educational philosophy. It is associated with improvements in several areas, including concentration, memory, academic performance (such as reading, writing, mathematics, and test-taking), as well as physical coordination, organizational skills, self-responsibility, and overall attitude [6].

Describe fine motor movements as actions performed by small muscle groups that solely influence specific areas of the body, like the capacity to utilize fingers and perform subtle motions accurately. Both types of movements, fine motor movements and gross motor movements, can be educated utilizing Brain Gym [7].

A key factor in learning is concentration, particularly for students who face intense academic pressures. Concentration problems have their negative impact on learning results related to understanding during lectures, accomplishing assignments, and performing well in tests. Concentration issues, which are often linked to levels of stress and academic pressures, can lead to affecting the capacity of students for learning and academic outcomes. One strategy that has been put forward for addressing concentration problems is Brain Gym exercises [8].

Student learning impairments have become a growing concern in higher education, particularly due to distractions from digital technology, stress, lack of sleep, and poor lifestyle habits that negatively affect concentration and academic performance. Research indicates that reduced focus not only hinders comprehension and task completion but also impacts overall achievement. One non-

pharmacological approach that has shown promise is brain gym exercise, a set of simple physical movements introduced by Paul Dennison to enhance cognitive function, motor coordination, and focus through the integration of both brain hemispheres. Studies demonstrate that regular practice of brain gym can improve concentration and reduce stress, making it a potential strategy to support students facing high academic demands and prolonged lecture sessions [9].

One of the abilities that is mostly formed during childhood is social skills. We may engage successfully and positively, take appropriate criticism, and demonstrate kindness, sympathy, support, acknowledgement, and the maintenance of strong and healthy relationships, especially with our peers, thanks to the development of these talents. This frequently encourages mental well-being and a calm, contented existence. The process of social development continues throughout our life since we are continuously impacted by both social institutions and other people. When playing games, kids occasionally engage in what is called Brain Gym exercises, which mix arm and eye movements with body movements to teach them how to coordinate movements and increase brain excitation or activity.

The human brain is like a muscle that requires workout. We can learn more and comprehend the interdependence of the mind and body with Brain Gym exercises [10].

For their artistic performance, sculptors heavily depend on sensory integration, fine motor coordination, and cognitive control. Epidemiological research, however, shows that extended and repetitive sculpting tasks may put workers at risk for a number of neurological and neuromuscular issues, which are sometimes not fully disclosed in occupational health data.

### **Risk factors and prevalence**

According to a cross-sectional survey of visual artists, including sculptors, more than 45% of them had hand tremors, numbness, or problems with coordination after working for more than four hours a day.

Neurological issue: The most prevalent movement disorder affecting performers is dystonia. It is typified by repeated, prolonged, involuntary muscular spasms that result in aberrant body part twisting or posturing. Continuous, involuntary muscular spasms of a single body part that occur during a specific activity and cause aberrant body part posture are known as focal task-specific dystonia (FTSD).

Up to 30% of sculptors with years of experience report experiencing cognitive tiredness, memory problems, or a reduction in their creative flexibility [11].

### **Need for the study**

Sculpting is a largely specialized form of fine art that demands exceptional situations of hand-eye collaboration, fine motor chops, internal focus, and cognitive strictness. Sculptors constantly engage in repetitive and intricate movements, which not only bear physical perfection but also violent attention and internal clarity. Over time, the physical and cognitive demands of this profession can lead to fatigue, reduced effectiveness, and indeed musculoskeletal complications. Brain Gym exercises, predicated on the principles of educational kinesiology are known to enhance brain function, meliorate attention, stimulate neural pathways, and promote better body collaboration. While several studies have explored the

benefits of Brain Gym in academe children and general populations, limited validation is available regarding its impact on occupational groups analogous as sculptors, who bear a blend of cognitive and motor excellence. This study aims to bridge that gap by probing the effectiveness of Brain Gym exercises in enhancing the performance of sculptors. The findings of this disquisition may give anon-invasive, cost-effective, and easy- to- apply approach to support the physical and cognitive demands of sculpting, ultimately perfecting work quality, artistic affair, and overall well- being of artists.

**AIM:** To check the effectiveness of brain gym exercise enhancing performance in sculptors.

## Methodolgy & materials

### Method

The data for the present study will be collected from sculptors working in selected workshops in Kopargaon. An experimental study design will be adopted. The sample population will consist of sculptors aged between 18 and 55 years who meet the inclusion criteria. A total sample size of 30 participants will be determined based on appropriate statistical assumptions for experimental studies. Participants will be selected using a convenience sampling technique and then allocated into two groups, with 15 participants in Group A (Brain Gym intervention) and 15 participants in Group B (control group).

The total duration of the study will be six months, including recruitment, intervention, and post-intervention assessment phases.

### Materials

Consent Form, nine-hole pegboard device/apparatus 9+ small pegs, Stopwatch or timer, Table and chair, Printed tracing sheets (e.g. Patterns, paths or mazes), Pen or pencil, Hand eye coordination application, Data recording sheets, Trail making sheets form

### Selection criteria

#### Inclusion Criteria

Be practicing sculptors:

- Minimum of 1 years of sculpting experience.
- Be aged between 18 and 55
- Ensures adult cognitive maturity and avoids age-related cognitive decline factors.
- Have normal or corrected-to-normal vision:
- Essential for fine visual-spatial tasks like sculpting.
- Be physically capable of performing Brain Gym exercises:

- No restrictions in gross or fine motor skills.
- Not currently engaged in other motor-cognitive training programs

### Exclusion Criteria

- Have neurological or psychiatric conditions: e.g., epilepsy, ADHD, Parkinson's, etc.
- Are under the influence of performance-enhancing substances: e.g., stimulants, cognitive enhancers.
- Have a history of recent upper limb injuries e.g., fractures, carpal tunnel syndrome, and repetitive strain injury.
- Have cognitive impairments that affect memory, attention, or executive function (as screened with a basic cognitive assessment like the MMSE).
- Refuse to give informed consent or withdraw during the study

### Outcome mesures

- Nine-hole Pegboard test {r- 0.99 (dominant hand), r – 0.98 (non-dominant hand)}
- Hand eye coordination test {r- 0.82}
- Trail making test {r- 0.89}

**Intervention:** A total of 30 sculptors will be selected for the study. All participants will undergo a structured Brain Gym exercise program designed to improve cognitive functioning, fine motor coordination, and hand-eye integration — all of which are essential for sculpting performance.

The Brain Gym intervention will be conducted over a period of 4 weeks, with five days sessions per week. Each session will last for 30 minutes, including appropriate rest periods. All sessions will be supervised by a trained physiotherapist to ensure correct execution of movements and to monitor participants' responses.

### Group Allocation

A total of 30 participants who met the inclusion criteria were enrolled in the study. The participants were divided into two groups:

- **Group A:** Brain Gym Exercise Group: 15 participants
- **Group B:** Diaphragmatic Breathing Exercises Group: 15 participants

Both groups received their respective interventions for a duration of 4 weeks.

### Intervention Protocol: (In A Chart 1.1)

Number	Movement	Specification
Category I		
1	Cross Crawl	Alternate movement of opposite arm and leg crossing the midline
2	Brain Buttons	Gentle massage below the clavicle with one hand while the other rests on abdomen
3	Hook-ups (Upper limb)	Arms crossed at wrist level with slow, deep breathing
4	Hook-ups (Lower limb)	Ankles crossed while maintaining upright posture
5	Lazy 8s (Unilateral)	Draw horizontal figure-of-eight using dominant hand
6	Lazy 8s (Bilateral)	Draw simultaneous figure-of-eight using both hands
7	Double Doodle	Simultaneous bilateral drawing using both hands
8	Arm Activation	Gentle resistance during elbow flexion and extension
9	Energy Yawn	Gentle massage around jaw muscles with controlled breathing
Category II		
1	Cross Crawl with Object	Perform cross crawl while holding a small object
2	Lazy 8s on Surface	Draw figure-of-eight on table or vertical surface

3	Double Doodle with Tools	Bilateral drawing using pencil or sculpting tool
4	Hook-ups with Visual Focus	Maintain hook-up position while focusing on visual target
5	Hand-Eye Coordination Task	Track and touch a moving target using index finger
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**Procedure**

The study received ethical approval from the RJS College of Physiotherapy Institutional Ethics Committee. Thirty sculptors (18–55 years) were selected using purposive sampling and randomly allocated into experimental (n=15) and control (n=15) groups. Baseline assessment included the Nine-Hole Pegboard Test, hand-eye coordination tests, and Trail Making Test.

The experimental group underwent a supervised Brain Gym program (30 minutes/day, 5 days/week for 4 weeks), while the control group performed supervised diaphragmatic breathing exercises (20 minutes/day, 5 days/week for 4 weeks). Post-test assessments were conducted after 4 weeks using the same outcome measures. Data were analyzed using SPSS with paired and independent t-tests, and  $p < 0.05$  was considered statistically significant. Informed consent, confidentiality, and the right to withdraw were ensured.

**Chart 1.1:** RESULT: Data analysis was performed using StatistiXL Version 2.0.

The paired t-test was used to compare pre-test and post-test scores within each group.

The unpaired t-test was used to compare percentage improvement between Group A and Group B.

For Group A, a paired t-test was applied for pre- and post-intervention comparison.

For Group B, a paired t-test was applied for pre- and post-intervention comparison.

Between-group comparisons were done using the unpaired t-test.

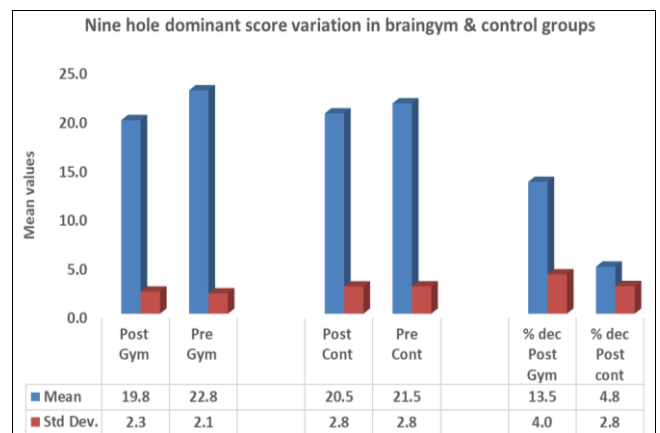
A p-value  $< 0.05$  was considered statistically significant.

**a. 9HPT (Dominant Hand)**

Between-group analysis showed that Group A demonstrated a greater percentage decrease ( $13.5\% \pm 4.0$ ) compared to Group B ( $4.8\% \pm 2.8$ ).

The mean difference was 8.661 with a t-value of 6.827 and  $p < 0.01$ , indicating a statistically significant difference.

This suggests that Brain Gym exercises were more effective in improving dominant hand dexterity and motor speed.



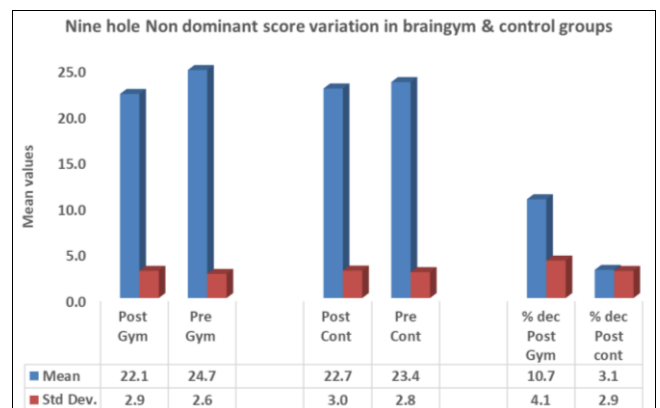
**Graph 1:**

**b. 9HPT (Non-Dominant Hand)**

Group A showed a higher percentage decrease ( $10.7\% \pm 4.1$ ) compared to Group B ( $3.1\% \pm 2.9$ ).

The mean difference was 7.643 with a t-value of 5.914 and  $p < 0.01$ , showing statistical significance.

This indicates better improvement in non-dominant hand coordination in the Brain Gym group.



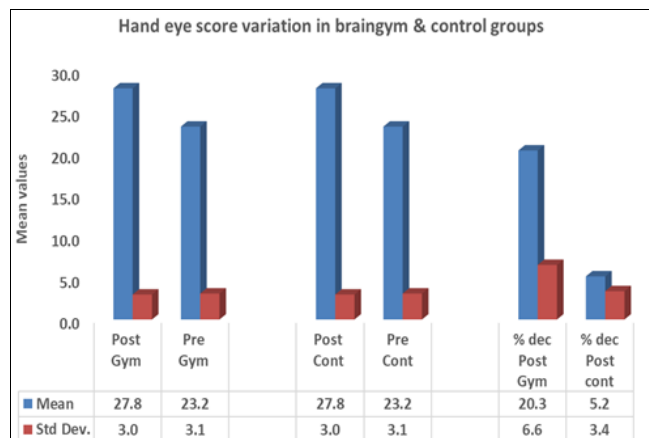
**Graph 2:**

**c. Hand-Eye (HE) Test**

Between-group analysis revealed that Group A showed a greater percentage increase ( $20.3\% \pm 6.6$ ) compared to Group B ( $5.2\% \pm 3.4$ ).

The mean difference was 15.141 with a t-value of 7.924 and  $p < 0.01$ , indicating a statistically highly significant difference.

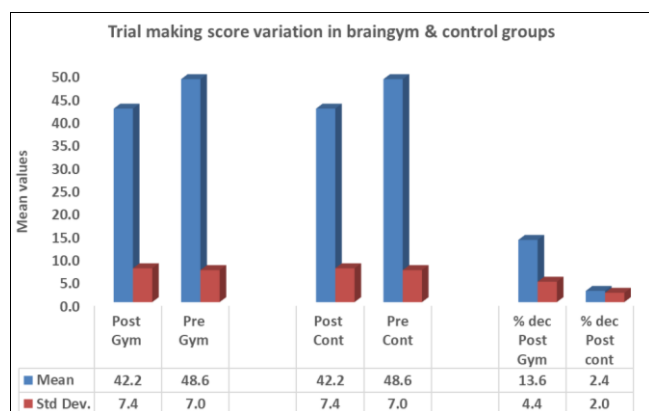
This demonstrates that Brain Gym exercises were more effective in improving hand–eye coordination.



Graph 3:

#### d. Trail Making (TM) Test

Group A demonstrated a higher percentage decrease ( $13.6\% \pm 4.4$ ) compared to Group B ( $2.4\% \pm 2.0$ ). The mean difference was 11.106 with a t-value of 8.800 and  $p < 0.01$ , showing a statistically significant difference. These findings indicate that Brain Gym exercises were more effective in enhancing cognitive processing speed and executive function compared to the control group.



Graph 4:

#### Discussion

The present study estimated the effectiveness of Brain Gym exercises in perfecting fine motor performance, hand – eye collaboration, and cognitive inflexibility among sculptors. Sculpting requires sustained visual – motor integration, perfection, and administrative control, and repetitious fine motor exertion may lead to neuromuscular fatigue and cognitive prostration (Ray & Pal, 2022) [11].

Thirty actors ( $n = 30$ ) were aimlessly allocated into Group A (Brain Gym,  $n = 15$ ) and Group B (Diaphragmatic Breathing,  $n = 15$ ). Pre- and post-intervention assessments were conducted using the Nine- Hole Pegboard Test (9HPT), Hand – Eye Coordination Test (HE Test), and Trail Making Test (TMT).

Both groups showed enhancement following intervention; still, Group A demonstrated significantly lesser advancements across all outgrowth measures. The Brain

Gym group showed lesser reduction in task completion time in 9HPT (dominant and non-dominant hands), indicating enhanced fine motor dexterity. Greater enhancement in HE Test scores reflected superior visuomotor integration, while reduced TMT completion time indicated better attention, sequencing capability, and cognitive inflexibility.

The superior issues in the Brain Gym group may be attributed to enhanced interhemispheric integration, bettered sensorimotor collaboration, and increased cortical activation, promoting neural malleability (Dennison & Dennison, 1994; Hafez, 2017) [2, 6]. Movement- grounded cognitive training has been shown to enhance administrative functions and processing speed (Cano- Estrada *et al.*, 2022; Mendrofa *et al.*, 2020) [5, 14].

Overall, the findings support that Brain Gym exercises are more effective than diaphragmatic breathing in enhancing motor perfection and cognitive performance in sculptors. Brain Gym can be considered a simple, non-invasive, and cost-effective occupational intervention to ameliorate functional effectiveness and cultural performance.

#### Conclusion

The present study demonstrates that both Brain Gym and diaphragmatic breathing exercises significantly bettered fine motor performance, hand – eye collaboration, and cognitive inflexibility among sculptors. still, the Brain Gym group showed significantly lesser advancements in the Nine- Hole Pegboard Test, Hand – Eye Coordination Test, and Trail Making Test compared to the control group.

These findings suggest that Brain Gym exercises are more effective in enhancing sensorimotor integration, visuomotor collaboration, and administrative functioning needed for sculpturing tasks. Due to its simplicity, non-invasive nature, and cost- effectiveness, Brain Gym may serve as an effective occupational intervention. farther exploration with larger samples and longer durations is recommended to regularize protocols and confirm long- term benefits.

#### Future Scope of The Study

Unborn exploration should concentrate on assessing the long- term goods of Brain Gym exercises through extended follow- up ages to determine the sustainability of cognitive and motor advancements. Studies with a larger sample size are recommended to enhance statistical power and ameliorate the generalizability of findings. Incorporating task-specific performance measures, similar as direct assessment of sculpturing perfection, productivity, or quality of work affair, would increase occupational applicability and ecological validity. unborn examinations may also include relative analysis with other cognitive- motor training approaches to establish relative effectiveness. also, multi-center trials and addition of different professional groups engaged in fine motor conditioning could strengthen external validity and broaden the connection of the intervention across different functional and occupational settings.

#### Reference

1. Riva J. Basic Structures of Sculpture. Wayne State University, 1946.
2. Hafez R. Effect of brain gym on manipulating skills and balance for beginners in rhythmic gymnastics. Science, Movement and Health, 2017;17(1):66–72.

3. Maheswari G, Indu H. Brain activation using Brain Gym for effective learning. *Journal of Advanced Zoology*,2023;44:1053–1060.
4. Vaishnavi V, Waqar M, Chaitanya A. Importance of Brain gym as exercise in physiotherapy and rehabilitation. *International Journal of Research in Pharmaceutical Sciences*,2020;11:1386–1389.
5. Cano-Estrada A, Jimenez-Mendoza A, Contreras-Guerrero D, Hernandez-Alejandro M, Salas-Casas A. The Effect of Brain Gym on Global Cognitive Function of Institutionalized Older People. *International Journal of Mental Health Promotion*, 2022, 24(3).
6. Dennison PE, Dennison G, Wilutzky U, Petres-Lesch H. *Brain gym*. Ventura, CA: Edu-Kinesthetics, 1994.
7. Jariyah MA, Sutejo MN, Addini RA. The Influence of Brain Gym (Cecilia Koester) On the Development of Fine Motorcy In Children Aged 4–6 Years. *Physiotherapy and Physical Rehabilitation Journal*,2024;3(1):21–28.
8. Nafiah N, Al Gifari MY, Oktaviani YE. The Effectiveness of Brain Gym Exercise on Students Learning Concentration. *FISIO MU: Physiotherapy Evidences*,2025;6(1):61–66.
9. Kulkarni C, Khandale SR. Effect of brain gym exercises on the attention span in young adults. *International Journal for Advance Research and Development*,2019;4(4):71–75.
10. Kundarwati AT, Khasanah NP, Fauziyah N. Brain Gym for physical motor development in children aged 3–4 years. *Innovation and Social Science*, 2023.
11. Ray S, Pal PK. Dystonia in performing artists: Beyond focal hand dystonia. *Canadian Journal of Neurological Sciences*,2022;49(1):29–37.
12. Saccà F, Costabile T, Abate F, Liguori A, Paciello F, Pane C, *et al.* Normalization of timed neuropsychological tests with the PATA rate and nine-hole pegboard tests. *Journal of Neuropsychology*,2018;12(3):471–483.
13. Adzani NA, Awanis A, Ariyanti L. Effectiveness of Providing Brain Gym on Gross Motor Development in Preschool Children. *FISIO MU: Physiotherapy Evidences*,2024;5(1):33–41.
14. Mendrofa FA, Iswanti DI, Hani U. Efficacy of brain gym on the cognitive function improvement of people with dementia. *Jurnal Keperawatan Jiwa*,2020;8(4):557.
15. O’Sullivan SB, Schmitz TJ. *Physical rehabilitation*. 6th ed. Philadelphia: F.A. Davis Company, 2014.
16. Jalilinasab S, Saemi E, Abedanzadeh R. Fundamental motor and social skills of children: the role of Brain Gym exercise. *Early Child Development and Care*,2022;192(14):2256–2267.