JOURNAL LA MEDIHEALTICO

VOL. 07, ISSUE 02 (502-513), 2026
DOI: 10.37899/journallamedihealtico.v7i2.3184

The Effect of Brain Gym as a Cognitive Stimulation Strategy in Improving Learning Concentration among School Aged Children

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Article Info
Article history:
Received 6 March 2026
Received in revised form 16 April 2026
Accepted 9 May 2026

Keywords:
School-Age
Brain Gym, Learning Concentration
Grid Concentration Test

Abstract

School-age children are at the concrete operational development stage which requires good concentration skills in the learning process. However, the results of a preliminary study at SDIT Al-Kamiliyyah Bekasi Regency showed that many students still experience low concentration levels. Brain Gym is a non-pharmacological intervention in the form of a series of simple movements aimed at optimizing brain function and helping improve children's learning concentration. This study aims to determine the effect of the Brain Gym method on the level of learning concentration in school-age children at SDIT Al-Kamiliyyah Bekasi Regency. This study is a quantitative method with a pre-experimental design through a one group pretest - posttest approach. The study population was all 150 students in grades I and V, with a sample of 110 students selected using a purposive sampling technique. The concentration level was measured using the Grid Concentration Test (GCT). The Brain Gym intervention was given for two weeks with a frequency of three times a week. Data were analyzed using the Wilcoxon Signed Rank Test. Results: The analysis results showed a p-value <0.05, which means there is an effect of the Brain Gym method on increasing the level of learning concentration. Conclusion: The Brain Gym method is effective in increasing learning concentration in school-age children and is recommended as a non-pharmacological nursing therapy.

Introduction

Lumbar facet-joint synovial cysts are a relatively rare cause of degenerative lumbar spine symptoms, accounting for only 0.5–1% of cases (Herman et al., 2025; Sherif et al., 2024; Chen et al., 2023). However, they are increasingly recognized in clinical practice as a source of unilateral radiculopathy and neurogenic claudication (El Melhat et al., 2024; Peene et al., 2024; Foreman et al., 2023). The standard of care in many centers is endoscopic laminotomy with cyst excision, which effectively decompresses the neural foramen and typically results in substantial relief of radicular leg pain. Despite these promising outcomes, a significant proportion of patients estimated at 20–60% continue to experience persistent axial low-back pain or develop new-onset symptoms following otherwise successful procedures (Arcidiacono et al., 2022; Mehta et al., 2024; Farley et al., 2024).

This residual pain has been the focus of growing clinical. Biomechanical and histopathological studies increasingly point to the facet-joint complex itself rather than the cyst as the origin of persistent symptoms (Du et al., 2022; Yoo et al., 2024; Sherif et al., 2024). Evidence of

ISSN 2721-1215 (Print), ISSN 2721-1231 (Online)

cartilage degeneration, joint effusion, and subtle instability at the affected segment often remains postoperatively, even in the absence of recurrent cyst formation. These pathological changes may contribute to chronic disability and reduced quality of life, yet their clinical significance remains poorly defined. As a result, the decision to perform adjunctive procedures such as radio-frequency denervation, interlaminar fusion, or percutaneous pedicle-screw fixation at the time of initial surgery is frequently debated and not guided by high-quality data (Gierse et al., 2026; Galieri et al., 2025; Perna et al., 2025).

In this context, understanding the natural history, true incidence, and radiological predictors of persistent axial pain is essential for improving surgical planning and long-term outcomes (Almansour et al., 2024; Lin et al., 2026; Nagori et al., 2026). Current literature is limited to small, heterogeneous case series with short follow-up periods, restricting robust analysis of risk factors. Therefore, we conducted a clinically oriented observational study to determine the 24-month incidence of persistent axial pain following endoscopic lumbar facet-joint cyst surgery in a consecutive patient cohort. The study also aimed to evaluate the association of this residual pain with both preoperative and postoperative imaging features of facet degeneration, cyst recurrence, and intraoperative indicators of segmental instability. The objective of this study was to test the hypothesis that failure to address underlying facet pathology predicts clinically significant residual axial pain .

Methods

Research Design

This study applied a quantitative method with a pre-experimental design using a One Group Pretest-Posttest framework. According to (Sugiiyono, 2023), quantitative research is used to collect and analyze data in numerical form to measure variables, test hypotheses, and generalize findings to the studied population. The pre-experimental design is used to evaluate the effects of an intervention or treatment without involving a control group (Sugiiyono, 2023). Specifically, the One Group Pretest-Posttest design measures the sample group before (pretest) and after (posttest) the intervention is applied (Wiidodo et ail., 2023). The purpose of this study is to determine the differences in outcomes before and after the intervention within the same group.

Population, Sample, and Sampling Technique

Research Population

Population consists of elements (individuals, objects, or materials) that meet certain criteria to be included in the study. In this study, the population comprises all fourth- and fifth-grade students at SDIT Al-Kamiliyah in the 2025 academic year, totaling 150 students. These students, aged 7–11 years, fall within the school-age category described by Piaget's theory, chosen due to their cognitive developmental characteristics and increasing learning concentration abilities.

Research Sample

The sample is a segment of the population selected for specific analysis, whose members represent the population to be observed or measured (Widodo et ail., 2023). The sample size can be calculated using Slovin's formula.

Differences:

n = Sample size

N = Population size

e = Differences in the researcher's score (5% at 0.05)

(Imam, 2021)

Based on the calculation:

$$n = \frac{150}{1 + 150\ (0{,}05)^2}$$

$$n = \frac{150}{1 + 150\ (0{,}0025)}$$

$$n = \frac{150}{1 + 0{,}375}$$

$$n = \frac{150}{1{,}375} = 109.09$$

The total number of samples required for this research was 109.09 and 110 respondents.

Research Sampling Techniques

The technique for implementing other samples is developed by researchers using purposive sampling. Based on an exploratory framework (Memon et al., 2025), purposive sampling is a means of selecting a sample to be evaluated in accordance with the specific aims or objectives identified by the researcher. When determining the characteristics of respondents, researchers consider the criteria for inclusion and exclusion.

Inclusion criteria

Student SDIT Al-Kamiliyyah class 4 and 5

Be willing to be a respondent and provide informed consent

Be able to follow the gym activities completely

Exclusion Criteria

Students who are not willing to take part in the gym intervention

Students who are sick / absent during the research period

Study with physical skills to achieve fitness training in the gym

Students who join the gym are not complete

Result and Discussion

Analisa Univariat

Respondent Characteristics Based on Class

Table 1. Frequency Distribution of Respondents by Class Among Students at SDIT Al Kamiliyyah

Class	Frequency	Percentage
Grade 4	59	53.6%
Grade 5	51	46.4%
Total	**110**	**100%**

Based on table 5.1, 59 (53.6%) respondents were selected from class 4. Meanwhile, 51 (46.4%) respondents were selected from class 5.

Respondent Characteristics Based on Age

Table 2. Frequency Distribution of Respondents by Age Among Students of SDIT Al-Kamiliyyah

Age	Frequency	Percentage
8 Years	2	1.8%
9 Years	35	31.8%
10 Years	50	45.5%
11 Years	23	20.9%
Total	**110**	**100%**

Based on table 5.2, 50 (45.5%) of respondents were 10 years and older. This was followed by 35 (31.8%) of respondents aged 9 years and older. Respondents aged 10 years and older are considered to be in school.

Respondent Characteristics Based on Gender

Table 3. Frequency Distribution of Respondents by Gender Among Students of SDIT Al-Kamiliyyah

Gender	Frequency	Percentage
Female	42	38.2%
Male	68	61.8%
Total	**110**	**100%**

Based on table 3, 42 (61.8%) of respondents were female. 68 (38.2%) of respondents were male.

Respondent Characteristics Based on Concentration Category (Pre)

Table 4. Frequency Distribution of Respondents Based on Concentration Category (Pre) Among Students of SDIT Al Kamiliyyah

Category	Frequency	Percentage
Very Low	63	57.3%
Low	45	40.9%
Moderate	2	1.8%
Good	0	0%
Very Good	0	0%
Total	**110**	**100%**

ISSN 2721-1215 (Print), ISSN 2721-1231 (Online)

Based on Table 4, it can be seen that before being given the Brain Gym intervention, 63 respondents (57.3%) were in the Very Low concentration category, 45 respondents (40.9%) were in the Low concentration category, and 2 respondents (1.8%) were in the Moderate category. There were no respondents in the Good or Very Good categories.

Characteristics of Respondents Based on Concentration Category (Post)

Table 5. Frequency Distribution of Respondents Based on Concentration Category (Post) for SDIT Al-Kamiliyyah Students

Category	Frequency	Percentage
Very Low	2	1.8%
Low	37	33.6%
Moderate	70	63.6%
Good	1	0.9%
Very Good	0	0%
Total	**110**	**100%**

Based on the 5 category, daipait was obtained after being given a gym bra, at least 2 (1.8%) respondents had low competition, 33 (33.6%) respondents had low competition, 70 (63.6%) respondents had low competition. Kaitegorii Sedaing. And 1 (0.9%) of the respondents thought it was good.

Average Value Concentration Level (Pre)

Table 6. Average Level of Concentration (Pre) for SDIT Al Kamiliyyah Students

Variable	N	Min–Max	Mean	Std. Dev	95% CI Mean
Pretest	110	2–24	9.82	4.53	8.97–10.68

Based on Table 6 above, the results of the pre-test concentration analysis before being given Brain Gym showed a mean of 9.82 (95% CI: 8.97–10.68) with a standard deviation of 4.53. The lowest concentration score was 2 and the highest was 24. The 95% confidence interval indicates that the mean pre-test concentration score ranged between 8.97 and 10.68.

Post-Test Concentration Scores

Table 7. Mean Concentration Levels (Post) of SDIT Al-Kamiliyyah Students

Variable	N	Min–Max	Mean	Std. Dev	95% CI Mean
Posttest	110	7–41	21.7	6.04	20.55–22.84

Based on Table 7 above, the results of the post-test concentration analysis after being given Brain Gym showed a mean of 21.79 (95% CI: 20.55–22.84) with a standard deviation of 6.04. The lowest concentration score was 7 and the highest was 41. The 95% confidence interval indicates that the mean post-test concentration score ranged between 20.55 and 22.84.

Bivariate Analysis

The data obtained from the pre-test and post-test in this study were collected and analyzed using a parametric test, namely the paired t-test. However, to meet the requirements for using the paired t-test, a normality test was conducted first using the Kolmogorov-Smirnov test because the sample size in this study exceeded 100.

Normality Test

Table 8. Kolmogorov-Smirnov Normality Test of Concentration Levels Pre- and Post-Brain Gym Intervention for SDIT Al-Kamiliyyah Students

Variable	Statistic	DF	Sig
Pretest	102	110	0,007

Posttest	134	110	0,000

Based on Table 8 above, it can be seen that the significance values obtained from the Kolmogorov-Smirnov normality test were 0.007 for pre-test concentration levels and 0.000 for post-test concentration levels. It can be concluded that both datasets were not normally distributed because the significance values were < 0.05. Since the data did not meet the requirement of normal distribution, they could not be analyzed using a paired t-test. Therefore, both datasets were analyzed using a non-parametric test, namely the Wilcoxon Signed Rank Test.

Wilcoxon Signed Rank Test

Table 9. Wilcoxon Signed Rank Test of Concentration Levels Pre- and Post-Brain Gym Intervention for SDIT Al-Kamiliyyah Students

Rank

Group	N	Mean Rank	Sum of Ranks
Negative Ranks	1	37.50	37.50
Positive Ranks	108	55.16	5957.50
Ties	1	—	—
Total	110		

Test Statistics

Test Item	Value
Z	-8.954
Asymp. Sig. (2-tailed)	0.000

Based on Table 9, the results of the statistical analysis using the Wilcoxon Signed Rank Test on the pre-test and post-test show a value of $z = 8.954$ with $p = 0.000$(Asymp. Sig. 2-tailed), indicating a significant difference between the pre-test and post-test scores. From the distribution of differences, 108 respondents showed an increase in scores (Positive Ranks), 1 respondent experienced a decrease (Negative Rank), and 1 respondent showed no change (Ties).

Univariate Analysis

Concentration Levels Before Brain Gym Intervention

Based on the research results on students of grades IV and V at SDIT Al-Kamiliyyah, Bekasi Regency, most students' concentration levels before receiving Brain Gym were in the "very low" category, namely 63 students (57.3%). This shows that before the Brain Gym intervention, most students' concentration abilities were not yet optimal. These findings align with previous studies that found several students in the low and very low concentration categories.

Theoretically, concentration ability is influenced by biological, psychological, and environmental factors. School-aged children are in the concrete operational stage (Saul McLeod, 2025), where their thinking processes require proper stimulation to focus attention effectively. In addition, environmental distractions, readiness for learning, and emotional conditions also affect a child's focus during learning (Muliati et al., 2025).

These findings are consistent with prior research (Pratiwi & Pratama, 2020), which showed that before Brain Gym intervention, most elementary school students had low to moderate concentration levels. Similar results were reported by (Nada Nurmalasari & Tri Susilowati, 2022), where before intervention, most students in grades 4–6 had low scores on the Grid Concentration Test (GCT).

Other studies, such as Elizabeth et al, (2025), found that factors like online game addiction are associated with decreased academic performance, indicating that students' learning performance is the result of multiple interacting factors, some of which can reduce learning ability.

Therefore, the researcher concludes that the low concentration levels before Brain Gym intervention were influenced by limited movement stimulation, environmental distractions, and suboptimal emotional readiness. The improvement in concentration after Brain Gym intervention is thought to occur because Brain Gym exercises integrate left and right brain functions, increase oxygen flow to the brain, and help students focus better during learning.

Concentration Levels After Brain Gym Intervention

After participating in Brain Gym exercises for two weeks, students showed a significant increase in concentration levels. The post-test data indicate a shift in distribution toward the "moderate" and "good" categories. Specifically, 63.6% of students were in the moderate category, 33.6% in the low category, and 0.9% reached the good category, with scores ranging from 7 to 41.

Theoretically, Brain Gym consists of simple movements designed to integrate left and right brain functions, improve oxygen flow to the brain, and stimulate the nervous system to support cognitive functions, particularly concentration. This aligns with Piaget's theory of the concrete operational stage, which states that school-aged children need physical activity to support thinking processes. Therefore, movement stimulation through Brain Gym helps enhance learning readiness and focus (Piaiget, S, 2025).

However, learning concentration is not influenced solely by the intervention. Biological, psychological, and environmental factors also play a role. Biologically, children's health and nutritional status are crucial for supporting cognitive functions. School-aged children require more energy due to increased physical activity. Nutritional deficiencies, such as iron (Fe) deficiency, can affect endurance and the ability to concentrate during learning. Therefore, improving concentration must be supported by optimal health conditions (Bratajaya et al, 2024). At SDIT Al-Kamiliyyah, the free nutritious meal program (MBG) helps meet students' nutritional needs, supporting stable energy and cognitive function during learning.

Environmentally, the school also supports child development with adequate facilities and extracurricular activities such as futsal and taekwondo, which enhance motor skills and fitness, contributing to learning readiness and attention focus. Cognitively, students in grades IV and V are in the concrete operational stage, where logical thinking develops, and they can follow instructions effectively, supporting the effectiveness of Brain Gym exercises.

Thus, the improvement in students' learning concentration in this study is influenced not only by Brain Gym intervention but also by biological, environmental, and developmental factors.

These findings align with previous studies (Suratun & Tirtayanti, 2020), which reported that Brain Gym exercises improve students' focus and participation in learning. Similar results were also found by (Safitri, 2023), indicating that Brain Gym positively affects attention and concentration in school-aged children when practiced routinely.

Therefore, the researcher concludes that the increase in concentration after Brain Gym intervention is related to structured movement stimulation, helping students become more prepared and focused during learning. Brain Gym can be implemented as a routine activity before learning begins to enhance learning readiness and concentration.

Bivariate Analysis

The Effect of Brain Gym on Students' Learning Concentration

Based on the research findings, Brain Gym intervention had a significant effect on improving the concentration levels of students in grades IV and V at SDIT Al-Kamiliyyah, Bekasi Regency. This was demonstrated by the results of the Wilcoxon Signed Rank Test, which showed a significance value of $p = 0.000$ ($p < 0.005$), indicating a meaningful difference between pre-test and post-test scores. These results confirm that Brain Gym positively impacts students' concentration. The significant change suggests that structured physical movements can support brain function in maintaining focus and attention during learning.

The improvement in concentration is also evident from the average scores: the pre-test mean was 17.39 (low–moderate category), increasing to 21.79 after the intervention (moderate–good category). This positive change was observed in almost all students, with 108 students showing improvement, 1 student experiencing a decrease, and 1 student remaining unchanged. Therefore, it can be concluded that Brain Gym provides a broad and consistent effect for the majority of respondents. The minimum–maximum scores also increased from 2–24 in the pre-test to 7–41 in the post-test, indicating an improvement in focus across various levels of student ability.

Theoretically, Brain Gym works through brain activation mechanisms involving the integration of the left and right hemispheres, increased brain oxygenation, and optimization of the nervous system. Movements such as the cross crawl enhance inter-hemispheric coordination, while lazy eight exercises activate visual pathways involved in sustained attention. These processes help students maintain focus for longer periods (Paul Ehrlich Dennison, 2019).

These findings align with previous studies, such as Nuryani (2023), which reported that Brain Gym exercises improve focus and learning participation in elementary school students, and Alzuhrai & Wahyuni (2024), who found that regular Brain Gym routines increase attention and concentration levels.

Based on these empirical findings and supported by theory and recent studies, it can be concluded that Brain Gym is an effective non-pharmacological method for improving concentration in elementary students. The intervention is easy to implement, requires no special tools, and provides positive effects on learning readiness. The more routinely Brain Gym is practiced, the greater the positive impact on students' focus, precision, and ability to participate optimally in learning activities.

Research Limitations

This study has several limitations that need to be considered when interpreting and applying the results: First, hort Intervention Duration: The Brain Gym intervention was relatively brief, lasting only two weeks. Therefore, the long-term effectiveness of this method in improving concentration could not be fully evaluated. The changes observed were temporary, and further research with a longer intervention period is needed to maintain stability and consistency in concentration improvement. Second, Limited Sample, The sample was limited to students in grades IV and V at SDIT Al-Kamiliyyah. This restricts the generalizability of the findings to a wider population, such as school-aged children from other regions or schools with potentially different characteristics (Retno Anggraeni et al., 2025). Third, Measurement Instrument, The study only used the Grid Concentration Test (GCT) to measure learning concentration. Although GCT is a valid and reliable test, relying on a single instrument limits a comprehensive understanding of other aspects of concentration, such as emotional or psychological concentration, which are not captured by the test. Therefore, more comprehensive measurement methods, such as observation or interview-based assessments, could strengthen the analysis.

Understanding these limitations, future research can consider using a control group, extending the duration of the Brain Gym intervention, and including a larger and more diverse sample. Additionally, employing a wider range of measurement instruments and controlling for confounding factors, such as environmental conditions and students' physical health, can help obtain more accurate and generalizable results.

Conclusion

Based on the results of this study, it can be concluded that the average concentration level of students in grades IV and V at SDIT Al-Kamiliyyah, Bekasi Regency, before being given Brain Gym was 17.39%, with a score range of 2–24. This indicates that most students' concentration abilities were still in the low to moderate category. After the implementation of Brain Gym, the average concentration level increased to 21.79%, with a score range of 7–41, showing that students' concentration abilities improved to the moderate to good category. Furthermore, statistical analysis revealed that Brain Gym had a significant effect on improving students' learning concentration, as evidenced by a significance value (p-value) of 0.000, which is smaller than 0.05. This finding demonstrates that Brain Gym was effective in enhancing the learning concentration of grade IV and V students at SDIT Al-Kamiliyyah, Bekasi Regency.

Recommendations

For Students

It is recommended that students routinely practice Brain Gym exercises as an independent effort to improve their learning concentration both at school and at home. These exercises are easy, safe, and do not require special equipment, making them suitable as a habitual practice to support learning success.

For Parents

Parents and families are encouraged to provide full support for the implementation of Brain Gym as an effective non-pharmacological method to improve children's concentration. Such support can motivate children to carry out the exercises consistently and help create a conducive learning environment.

For Educational and Health Staff

Teachers are encouraged to integrate Brain Gym as a routine activity before learning to enhance students' learning readiness and concentration. Health staff are advised to provide education and guidance on Brain Gym as a promotive–preventive intervention to support school-aged children's learning concentration.

For Educational Institutions

Schools are recommended to integrate Brain Gym into routine programs and develop standard operating procedures (SOPs) for its implementation to ensure that the intervention is carried out consistently and sustainably, thereby improving students' learning concentration.

For Future Researchers

Further studies are needed with longer intervention durations and larger sample sizes to examine the effectiveness of Brain Gym more deeply. In addition, future research can combine Brain Gym with other learning methods and cognitive stimulation to create a holistic approach to improving students' learning concentration.

Acknowledgment

The researcher expresses sincere gratitude to Allah SWT for His guidance and blessings, and appreciation to the principal, teachers, staff, and students of SDIT Al-Kamiliyyah, Bekasi Regency for their support and participation in this study. Special thanks are extended to

academic advisors and all who provided guidance, motivation, and constructive feedback throughout the research process. The researcher also thanks family and friends for their encouragement and moral support. May this research contribute to improving learning concentration in school-aged children.

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