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The effect of brain gymnastics training on psychological performance of elementary girls

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ABSTRACT

The lack of diverse motor experiences can delay motor development. The aim of this research is to investigate the effect of brain gymnastics training on psychological performance of first and second primary school girls. The design of this research was semi-experimental groups to examine the effect of children's brain gymnastics training on psychological performance of primary school children. The population of this study consisted of 30 primary schools in Tabriz in the academic year 2024-2025. To collect information, Goodinough's manikin drawing test was used to measure psychological performance, with a validity of 92%. Brain gymnastics activities were used for motor performance. One-way analysis of covariance test at the 0.05 level were used to analyze the data by SPSS 22 software. The results showed that brain gymnastics exercises have a significant positive effect on the psychological performance of primary school girls. Brain gymnastics can function as a powerful non-pharmacological intervention. Based on the findings of this study, it can be concluded that a structured program of brain gymnastics serves as an effective and significant intervention for enhancing the psychological performance of primary school girls.

KEYWORDS: brain gymnastics, psychological performance, primary school girls.

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INTRODUCTION

The environment in which children grow up today has become somewhat complex and dangerous, preventing them from movement and physical activities and depriving them of situations that provide perceptual information. Children who spend most of their time watching television or playing computer games develop sedentary and passive habits. The lack of diverse motor experiences can delay motor development (Ismailpour & Pakdamn, 2016). The characteristics of this period include continuous physical, motor, cognitive, and emotional growth, such that early experiences and learning in this period are very effective in subsequent learning. In fact, the child's past experiences play an important role in their future learning. The child is naturally interested in play; play is a means of gaining personal pleasure and creating variety in life (Gallahue, 2015).

Indeed, the rate of learning and cognitive development in preschool and primary school children is at its highest level, making this stage a critical period (Sarıkaya & Coşkun, 2015). Therefore, providing high-quality interventions to children during this educational period will have a positive impact on their cognitive development (Clark & Kingsley, 2020). Exercise, due to its beneficial effects on physical and mental health, has received increasing attention for the development of preschool and primary school children. Evidence indicates that exercise positively affects cognition through multiple mechanisms, including glucose transport, angiogenesis, and levels of neurotransmitters (Alvarez-Bueno et al., 2017).

Furthermore, exercise can stimulate cognitive development in children, especially preschool and primary school children (Norris, van Steen, Direito, & Stamatakis, 2020). The skills and relationships learned during exercise have a lasting impact on other aspects of children's learning (Bidzan-Bluma & Lipowska, 2018). In primary schools and kindergartens, introducing exercise as an effective supplementary activity can play a positive role in children's learning (Norris et al., 2020). According to Piaget's theory of cognitive development, motor activity is essential for operational intelligence, especially spatial thinking (Lawrence, 1957). This theory indicates that action is the source of perception and the basis of thought, and children's psychological development is the result of the subject's adaptation to the object through action (Piaget & Cook, 1952). Piaget emphasized that physical and motor experiences are essential for the child's conceptual development of movement and speed, especially in the early stages of development (Piaget, 2013).

A positive correlation has been observed between exercise and academic performance among children, likely due to changes in cognition, including executive function, memory, and fluid intelligence (Philip D. Tomporowski et al., 2015). Many studies have focused on the positive effects of exercise on the prefrontal cortex and hippocampus. Increased activation in the prefrontal cortex, which plays a role in cognitive control, has been observed after exercise interventions (Sánchez-López et al., 2019; Sember, Jurak, Kovač, Morrison, & Starc, 2020). It seems that individuals who had better cognitive development in early childhood were more prepared for learning and had stronger academic abilities throughout the educational process (Bryant, Duncan, & Schmitt, 2021), and children with higher cognitive ability showed stronger physical fitness (Latorre-Roman, et al., 2020).

Researchers have also considered play as a variable that leads to the child's progress in motor, academic, social, and emotional areas (Goodway, Ozmun, & Gallahue, 2019). However, the choice of the type of play regarding how it affects children's motor skills is debatable. Therefore, given the limitations of interventional programs on children's fundamental skills, it is necessary to consider appropriate programs for the development of children's motor and cognitive skills and to provide a program using simple, inexpensive, enjoyable, and non-aggressive tools, which is very important for primary school children. Studies have shown that movement affects cognitive processes, learning, and subsequently, students' academic performance (Taylor, 2009).

Given the explanations provided, one of the physical activities that has recently gained favor among coaches, teachers, and parents is brain gymnastics training. The founders of this program claim that with these exercises, individuals can learn anything faster and easier, perform better in sports activities, have better and more regular concentration, and overcome learning problems compared to others. In fact, sport brain gymnastics has a solid foundation in neuroscience and includes integrative movements, cross-lateral movements, and balance, which mechanically activate both sport hemispheres using the motor and sensory cortex, stimulate the vestibular system for balance, and reduce the fight-or-flight mechanism (Spaulding, Mostert, & Beam, 2010). Yanuarita (2012) stated that brain gymnastics training can be performed by all people, especially primary school children, because brain gymnastics training is an academic kinesiology program that can not only facilitate blood flow and oxygen to the sport but can also optimally stimulate sport work and function, meaning activating more abilities of the right and left sport so that cooperation between the right and left hemispheres can be connected by performing brain gymnastics training. This is consistent with the results of Panglipurethias's research (2015), which states that gymnastics training can significantly reduce the level of depression in depressed individuals. Research results prove that brain gymnastics training is a fun, easy, and suitable exercise for daily activities because it can be done anytime and anywhere, can clean the sport and clear it of negative thoughts, and also reduces tension, incompatibility, stress, and anxiety, and increases cognitive function (Pragholapati, 2019; Arbainingsih et al., 2021; Moradi et al., 2020; Sa'ida et al., 2023; Pratama et al., 2022; Cano-Estrada et al., 2022).

Findings underscore the potential of brain gymnastics as a practical, scalable, and cost-effective strategy to enhance cognitive health. Its integration into routine elderly care may help delay cognitive decline and promote healthier aging, particularly in low-resource settings (Purwanti et al., 2025).

Findings underscore the potential of brain gymnastics as a practical, scalable, and cost-effective strategy to enhance cognitive health. Its integration into routine elderly care may help delay cognitive decline and promote healthier aging, particularly in low-resource settings (Martina et al., 2025). The results of this study can be concluded that brain exercises can improve the memory of preschool children (Rahmi et al., 2025). Prodyanatasari (2025) indicates that Brain Gym is an effective, low-cost, and practical classroom intervention that enhances concentration and supports learning readiness.

Since primary school children are the core of society who build the future of the community, sports psychologists and education specialists have long studied factors affecting their health and well-being. One of the effective and essential factors in children's psychological and cognitive functioning is physical activity. Therefore, given the importance of motor activities in improving the psychological and cognitive performance of primary school children and considering the existing shortcomings in this field within the country and the lack of experimental research on the impact of this method, conducting such research is necessary to examine the effect of brain gymnastics training on psychological performance of elementary girls, which will demonstrate the importance of the present research. Furthermore, the results of this research can be beneficial for psychological counselors, sports professors, and coaches.

RESEARCH METHOD

This research was semi-experimental and used an experimental design (pre-test-post-test) with a control group.

Statistical Population

Participants of this study included all students of Tabriz primary school girls in in the academic year 2024-2025, numbering 657 people.

Participants

The researcher used a multi-step process to select the statistical sample. First, using a university letter of introduction, they contacted the General Department of Education in Tabriz, which subsequently referred them to the local education districts. For the first sampling stage, two schools were selected using a cluster sampling method from two education districts. This provided a pool of female primary school students from those schools, totaling 657 individuals. In the second stage, 30 children were voluntarily recruited from this pool for the research. Finally, these 30 participants were randomly assigned to either the experimental or control group.

Research Measurement Tool

Projective tests, which are grounded in psychoanalytic theory, were used to collect information in this research. Proponents of the psychoanalytic school argue that many aspects of an individual's personality cannot be measured through conscious self-assessment methods like questionnaires. They contend that to gain an accurate understanding of a person's inner world, a method must be used that bypasses unconscious psychological resistances and defenses.

Consequently, projective drawings provide a means to access the subject's inner world, allowing for an evaluation of their unconscious and deep-seated personality characteristics (Paul, 2000). These drawing tests serve as criteria for measuring mental functions, assessing personality and family dynamics, evaluating emotions, fears, and needs, and identifying gender roles (Milne,

1999).

Manikin Drawing Test

The use of human figures drawn by young children has long been common for numerous purposes. The Goodenough Human Figure Drawing Test, designed in 1926 by Florence Laura Goodenough, was developed to assess children's cognitive abilities and intelligence. It was later revised by Harris in 1963. According to the test's developers, a relationship exists between a child's age and their mental abilities; as age increases, the child typically includes more details in the human figure. This test is applicable for children aged 3 to 15 years. However, a lack of cognitive development and maturation in 4- to 5-year-old children, as well as weaknesses in mental imagery (especially in autistic children), can affect drawing ability (Bradley et al., 2008; Hilazi et al., 1998). The drawing method in this test is considered a reflection of the subject's anxieties, impulses, and self-confidence (Linfield & Wood, 2000). Personality factors also influence the results; children who are more socially and behaviorally adapted tend to include more details in their drawings (Bahrami, 2002).

Validity and Reliability of the Goodenough Test

Given the prevalence of the use of the Goodenough test in the world and Iran, the validity and reliability of the Goodenough test for preschool children is not much debated. Research has shown that this test has the highest accuracy for children aged 3 to 10 years (Hasanzadeh & Minaei, 2000).

The reliability of specific signs in the Human Figure Drawing test has been reported as relatively variable according to various studies. Tashakkor et al. (2007) reported that the split-half reliability of the test is 0.80 and the test-retest method is 0.70, which is satisfactory. Cahill obtained test-retest reliability from 0.81 to 0.99 from 4 newer studies. (Lilienfeld, Wood, & Garb, 2000). Regarding the validity of the test based on projective tests, research has shown that the Human Figure test has high sensitivity. Test-retest reliability coefficients using Harris's guidelines (1963) have been moderate (0.74) (Groth & Marnetta, 1997). Its validity for measuring intelligence was reported as r=0.57 (Kanof & Prow, 1985) and for psychological problems as r=0.53 (Kampaus & Plisha, 1991).

Brain gymnastics activities include:

Drawing the figure 8, Cross-crawl movement (crossing hand and foot), Cross-over sit-ups, Neck rolls, Thinking Cap, Drawing the infinity sign, Drawing the infinity sign with the sit bones, Abdominal breathing, Bending head and torso forward, Stretching the hamstrings, Another stretch for the hamstrings, Sliding hands down the legs, The Owl, Active Hand, Spot Massage, Balance movement, Drinking water, Grounding, Changing directions in space, Massaging jaw muscles, Rubbing fingers on ears, Placing hands on forehead and locking hands.

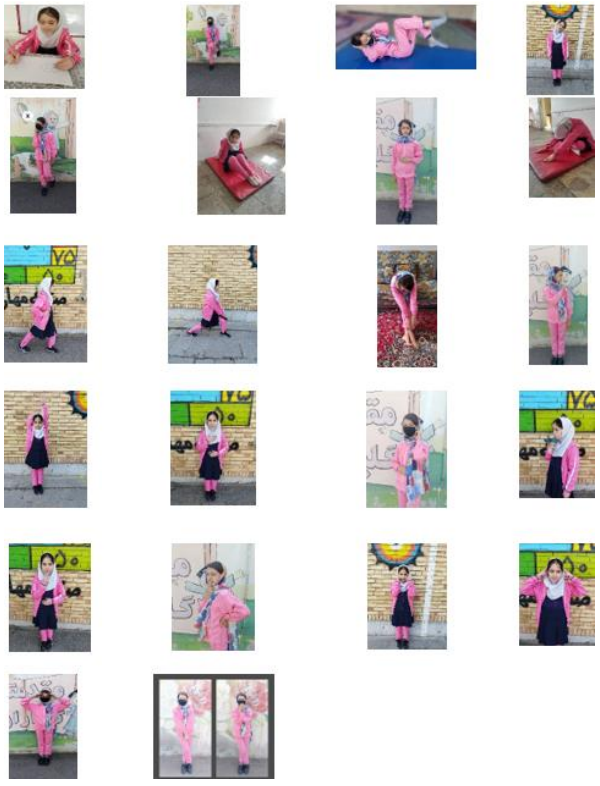

Figure 1. Some of Brain gymnastics activities

Research Implementation Method

During the first stage, a cluster sampling method was used to select participants from the statistical population of all female primary school students in Tabriz. Two educational districts were chosen, and one primary school was selected from each district.

In the second stage, 30 children were voluntarily selected from these schools. These participants were then randomly assigned to two groups: an experimental group and a control group. Following the assignment, a post-test was administered to both groups. The post-test consisted of the projective tests "Human Figure Drawing" and "Family Drawing."

PROCEDURE

Informed Consent and Intervention: A letter detailing the study and the brain gymnastics program was sent to the parents of the children in the experimental group to obtain their informed consent. Upon securing consent, the interventional program was implemented.

The experimental group participated in a structured brain gymnastics training program for two months. The program consisted of three 40-minute sessions per week, conducted in a group format. Each session was structured as follows:

* 5 minutes: Warm-up
* 10 minutes: Practicing previously learned movements
* 10 minutes: Instruction on new movements
* 10 minutes: Performing the new movements
* 5 minutes: Cool-down

The control group did not receive this training. During the experimental group's sessions, the control group engaged in their regular lessons or other activities that were unrelated to physical education or body awareness. This control measure ensured that any observed effects could be attributed to the brain gymnastics training intervention.

DATA COLLECTION

Pre-test Administration: Prior to the intervention, all children in both the experimental and control groups were administered the pre-test. Each child was provided with a white A4 sheet of paper, a pencil, an eraser, and a pack of six colored pencils. For the Human Figure Drawing test, the instruction was: "Children, I want you to draw a picture of a person. Please try to draw your best drawing." There was no time pressure for completion.

After collecting the drawings and allowing for a short break, the Family Drawing test was administered. The children were instructed to "draw your family." Again, there was no rush to collect the drawings. Upon completion, each child was asked a brief set of questions about their family drawing, including, "Is this your family?", "Which one is you?", and "Where are mom and dad?" Their responses were recorded directly on the drawing sheets.

Post-test Administration: After the two-month brain gymnastics training intervention concluded, the same Human Figure Drawing and Family Drawing tests were re-administered to both groups as the post-test, following the identical procedure used in the pre-test.

Data Scoring and Analysis

To ensure objective scoring, the pre-test and post-test drawings were scored by four psychology students according to specific standardized instructions. From these, the three scores that were most closely aligned for each drawing were selected, and their average was calculated. This average score constituted the final data point used for subsequent analysis.

Statistical Analysis Methods

Prior to conducting the ANCOVA, its underlying assumptions were tested. The analysis was conducted at a significance level of $\alpha = 0.05$.

RESULTS

Table 1. The difference in psychological performance of post-test between the control and brain gymnastics training groups

Source of Variation	Sum Squares	df	Mean Squares	F	Sig.	Eta
Pre-test Effect	15.447	1	15.447	2.1462	.001	.883
Group Effect	14.422	1	14.422	5.1688	.001	.683
Error	7.868	27	0.291			
Total	55823	30				

A significant difference in post-test psychological performance was found between the groups following the intervention. The analysis of covariance, controlling for pre-test scores, showed this effect was statistically significant ($F = 5.17$, *p* = .001, $\eta^2 = 0.68$), as detailed in Table 1.

Table 2. Adjusted mean of psychological performance of girls in the two control and brain gymnastics training groups

Group	N	Adjusted Mean	Std. Error
Control	15	34.04	.112
brain gymnastics training	15	52.04	.112

The brain gymnastics training group demonstrated a significantly higher mean score in psychological performance (M = 52.04) compared to the control group (M = 34.04), as presented in Table 2. Therefore, the brain gymnastics exercises are concluded to be effective in increasing psychological performance among the first and second-grade girls.

DISCUSSION

The results of this study demonstrate that brain gymnastics training exercises have a significant positive effect on the psychological performance of elementary girls. This finding aligns with a substantial body of literature. It is consistent with research highlighting the cognitive benefits of sustained physical activity (and with numerous studies confirming the positive effects of exercise on children's cognitive function and academic success ((Abolrahimi & Salehian, 2025; Prodyanatasari, 2025; Rahmi, et al., 2024; Hosseinzadeh & Salehian, 2024).

This effect can be explained through several mechanisms. From a neurobiological perspective, regular physical activity induces beneficial changes in the central nervous system, including neurogenesis in the hippocampus, increased angiogenesis, and growth in grey matter volume within regions critical for learning and memory (Singh et al., 2019). This establishes physical exercise as a potent stimulus for cognitive development. Furthermore, developmental psychology emphasizes "education through physicality," with modern theories underscoring the role of movement in establishing foundational mental processes from infancy through adolescence (Tomporowski et al., 2011).

Brain gymnastics training, in particular, appears to be an effective "cognitive-motor program" (Dennison, 2021) that engages the whole body—emotions, movements, and integrative functions—to enhance learning. It is proposed that such activities balance hemispheric communication, calm the nervous system, and stimulate areas responsible for focus and emotional regulation (Cahill, as cited in Jumrah, 2008; Varela et al., 2023). By increasing cerebral blood flow and oxygen, and by managing energy expenditure, brain gymnastics training can reduce learning-related stress and fatigue, thereby increasing motivation and cognitive capacity in school-aged children (Sa'ida et al., 2023).

The analysis also revealed that brain gymnastics training significantly increased positive excitement in the participants. While direct precedent for this specific finding is limited in the literature, the result is consistent with the broader understanding that physical activity has a protective effect on neurological and emotional health and can reduce negative emotional excitability (Abolrahimi & Salehian, 2025; Prodyanatasari, 2025; Rahmi, et al., 2024; Hosseinzadeh & Salehian, 2024).

The explanation for this outcome lies in the role of exercise in emotional regulation. Physical activity is known to impact emotional balance, self-confidence, and stress reduction (Arefi et al., 2017). Specifically, brain gymnastics training can function as a powerful non-pharmacological intervention. By enhancing blood flow and oxygen to the brain, it may aid in dissipating negative emotional states. The exercises are designed to reduce tension, anger, and fear, while improving emotional control and concentration, ultimately leading to greater mental peace and happiness (Dennison & Gail, 2009).

CONCLUSION

In conclusion, the findings of this study affirm that brain gymnastics training serves as a potent, non-pharmacological intervention for enhancing the psychological and cognitive well-being of elementary school girls. The significant improvements observed in psychological performance and positive excitement are firmly supported by established neurobiological and developmental principles. The evidence indicates that these exercises act as a comprehensive cognitive-motor program, fostering brain development through increased cerebral blood flow and neurogenesis, while simultaneously promoting emotional regulation by reducing stress and negative excitability. Ultimately, integrating brain gymnastics into educational frameworks presents a holistic strategy to bolster not only cognitive function and academic readiness but also to cultivate essential emotional resilience and positive mental health in children.

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