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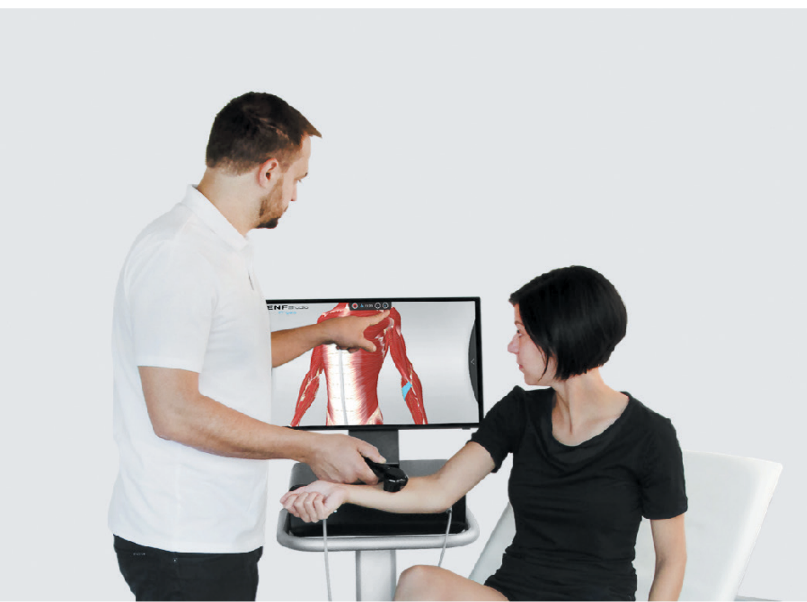

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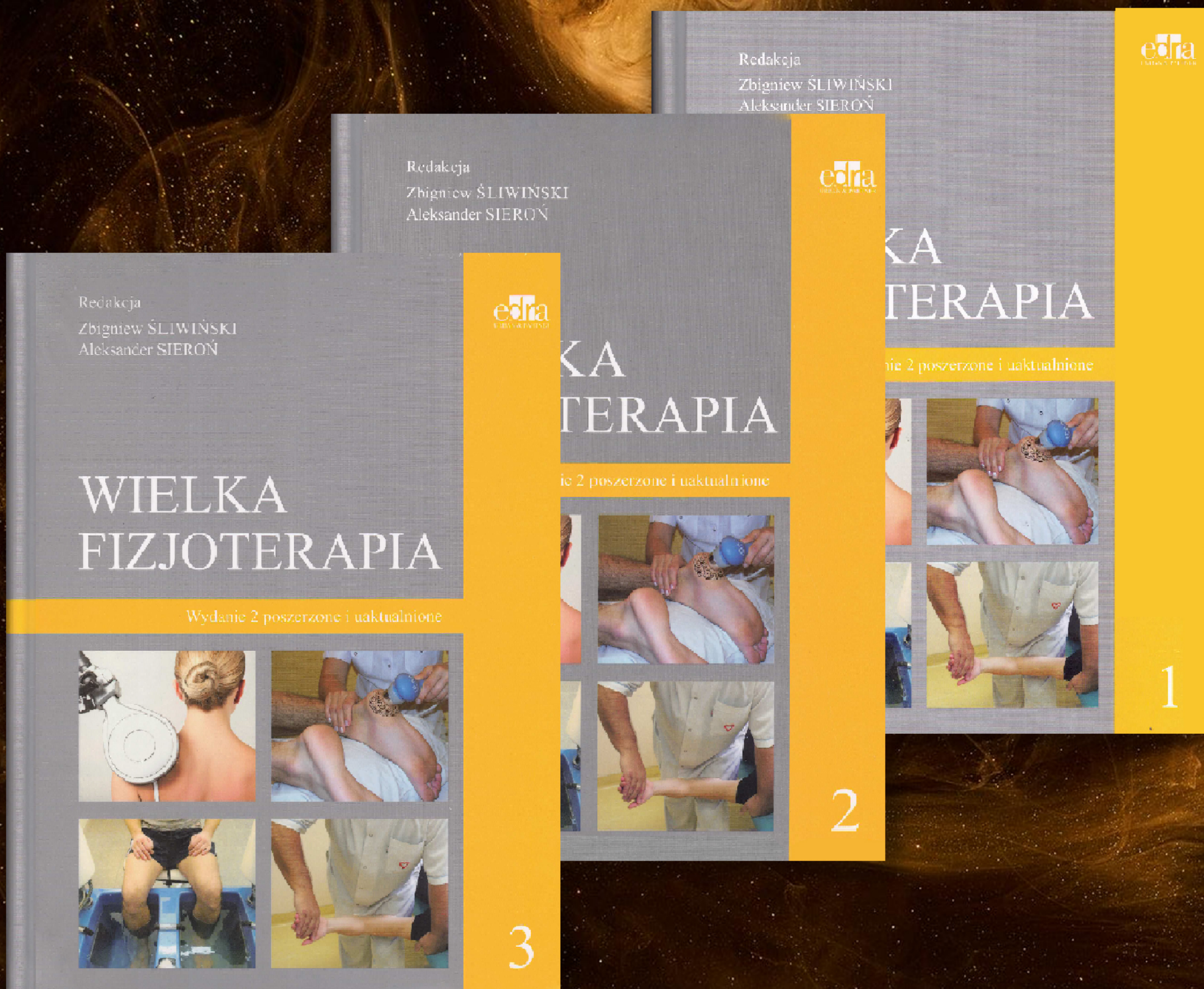

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The effect of a 12-week 'Brain Jogging' learning model on gross motor: locomotor skills

Skutki 12-tygodniowego modelu uczenia się "Brain Jogging" na zdolności motoryczne – motorykę dużą

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Abstract

Study Purpose. The primary objective of this study was to test the effects of the 'brain jogging' learning model on basic locomotor movement abilities among elementary school students.

Methods. This research is a quasi-experimental study, employing a two-group pretest-posttest design. The 'brain jogging' based learning model was compared to traditional learning models, specifically direct instruction. The sample consisted of 30 fourth-grade students, divided into two parallel grades, A and B, both possessing similar characteristics in terms of age, average height/weight, sports learning material, duration, and timing of sports learning sessions. Students receiving the 'brain jogging' based learning model treatment attended twice a week and maintained a 90% attendance rate. Each game or activity is aligned with a specific goal related to a 'brain jogging' sub-training item. Data were analyzed using SPSS IBM 26. Initial steps included comparing descriptive data to the entire population size, and establishing the distribution of variables, the mean, and the standard deviation (SD). Subsequently, an independent sample t-test was utilized to ascertain the effect of 12 weeks of the 'brain jogging' based learning model on the experimental group.

Results. The mean difference in post-test scores between control and experimental groups was determined based on the significance level from the SPSS IBM 26 output ($p < 0.05$). The independent sample t-test revealed significant results in various categories: run ($p = 0.000$), gallop ($p = 0.000$), hop ($p = 0.000$), leap ($p = 0.000$), horizontal jump ($p = 0.000$), and slide ($p = 0.009$).

Conclusions. Based on the independent sample t-test results, the hypothesis is accepted. This indicates significant differences between the control and experimental groups. Statistically significant improvements were observed in run, gallop, hop, leap, horizontal jump, and slide abilities among elementary school students. The 'brain jogging' based learning model presents a promising approach to enhancing locomotor skills.

Keywords

brain jogging, learning model, locomotor skill, elementary school, gross motor

Streszczenie

Cel Badania. Głównym celem tego badania było sprawdzenie efektów modelu uczenia się 'brain jogging' na podstawowe zdolności ruchowe uczniów szkoły podstawowej.

Metody. Badanie to ma charakter quasi-eksperymentalny, opierając się na projekcie przedtestowo-potestowym dla dwóch grup. Model uczenia się oparty na 'brain jogging' został porównany z tradycyjnymi modelami uczenia się, w szczególności z instrukcją bezpośrednią. Próbka składała się z 30 uczniów klasy czwartej, podzielonych na dwie równoległe grupy, A i B, obie charakteryzujące się podobnymi cechami pod względem wieku, średniego wzrostu/wagi, materiału z edukacji sportowej, czasu trwania oraz momentu realizacji zajęć sportowych. Uczniowie uczestniczący w programie opartym na modelu uczenia się 'brain jogging' uczęszczali na zajęcia dwa razy w tygodniu i mieli 90% frekwencję. Każda gra lub aktywność była związana z konkretnym celem dotyczącym elementu szkolenia 'brain jogging'. Dane analizowano przy użyciu SPSS IBM 26. Pierwszym krokiem było porównanie danych opisowych do całkowitej populacji oraz ustalenie rozkładu zmiennych, średniej oraz odchylenia standardowego (SD). Następnie przeprowadzono niezależny test t dla próbki, aby ustalić wpływ 12 tygodni modelu uczenia się opartego na 'brain jogging' na grupę eksperymentalną.

Wyniki. Średnia różnica w wynikach potestowych między grupą kontrolną a eksperymentalną została określona na podstawie poziomu istotności z wyjścia SPSS IBM 26 ($p < 0,05$). Niezależny test t dla próbki wykazał istotne wyniki w różnych kategoriach: bieg ($p = 0,000$), galop ($p = 0,000$), skok ($p = 0,000$), skok w dal ($p = 0,000$), skok poziomy ($p = 0,000$) oraz ślizg ($p = 0,009$).

Wnioski. Na podstawie wyników niezależnego testu t dla próbki hipoteza zostaje przyjęta. Wskazuje to na istotne różnice między grupą kontrolną a eksperymentalną. Zauważono statystycznie istotne poprawy w biegu, galopie, skoku, skoku w dal, skoku poziomym oraz zdolnościach ślizgowych wśród uczniów szkoły podstawowej. Model uczenia się oparty na 'brain jogging' stanowi obiecujące podejście do wzmacniania zdolności motorycznych.

Słowa kluczowe

brain jogging, model uczenia się, zdolność motoryczna, zdolność motoryczna, motoryka duża

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Introduction

Children are the future assets of the nation. The nation and state's survival hinges on the quality of today's children, who will become the next generation. It's crucial to recognize that childhood is a significant stage in one's life. If a child experiences motor difficulties, it can delay the development of other areas [1]. A lack of movement can lead to imperfections and abnormalities in the body. Movement is fundamental to human life, hence the importance of understanding and learning it. Early motoric needs are essential for monitoring and evaluating children's physical and motor growth. Addressing these needs also prevents unbalanced movement coordination, sensory function impairment, disabilities, and obesity [2].

Children's motor development is categorized into locomotor, non-locomotor, and manipulative movements. These are part of gross motor skills since they involve significant muscle movements. There is a positive correlation between gross and fine motor skills, as motor development originates from gross motor skills and then transitions to fine motor skills [3]. Consequently, if a child's gross motor skills are inadequate, their fine motor development will also be affected.

Locomotor movement enables children to move from one point to another and is a key component of gross motor skills. This movement encompasses coordination. Studies have shown that a majority of elementary school students exhibit low coordination [4, 5]. Benefits of mastering locomotor movements include agility, dexterity, and, crucially, the confidence to initiate movements [6]. Existing educational practices often focus solely on singular movement types, whereas children require more intricate, coordinated movements. Presently, movement coordination among children is suboptimal, especially in elementary schools [7], even though these institutions should offer diverse movement opportunities, especially in physical education. This is essential because coordination movements engage the brain [8]. The human brain, through sensory, motor, and connecting nerves, facilitates major muscle movements [9]. Hence, the brain's nerve cells must be promptly activated using brain-based learning models.

Locomotor skills, which enable efficient and effective body movement, are vital for children's development [10]. However, there's been a decline in these skills recently [11], possibly due to sedentary lifestyles, technology overuse, and shifts in traditional play patterns. This decline can restrict children's participation in sports and other physical activities [13]. In light of this, some studies suggest brain-jogging-based learning models as a solution [14]. During ages 13 to 15, children undergo significant brain changes [15], emphasizing the need to harness this period for cognitive enhancement [16]. Physical activity is crucial for maintaining brain health and function [17]. The CDC found that physical activity influences brain physiology, impacting factors like blood flow, nerve cell growth, and neurotransmitter levels [18]. Numerous studies highlight the positive effects of sports and physical activity on brain health [19]. However, multiple elements, including teacher competency, infrastructure, and student factors, influence learning outcomes in physical education. Brain jogging is a mental exercise intertwining cognition and multitasking. It emphasizes coordination, cognition, and visual tasks, challenging the brain [10, 11, 12].

The Brain Jogging-based learning model comprises coordination exercises, visual perception exercises, and cognitive system exercises [23]. These activities focus on enhancing brain function. Engaging in varied, high-concentration movement exercises stimulates the brain, fostering neuron cooperation and branching. Synapses, the connections between neurons, play a pivotal role in transmitting neural messages [24]. They regulate human responses to stimuli, including reflex movements crucial for basic locomotor skills [25]. Synapses involve neurotransmitters like acetylcholine, noradrenaline, dopamine, and serotonin [26], which spread across brain cells, activating locomotor movement abilities [11].

Research shows that a brain-jogging-based learning model fosters neuron excitability to the locomotion muscles, enhancing movement abilities [13]. Given the benefits and challenges of brain jogging, this study aims to evaluate its efficacy in enhancing basic locomotor movements in elementary school students.

Methods

This research is a quasi-experimental study using a two-group pretest-posttest design. It compares the brain jogging learning model to the conventional direct instruction model. The sample comprises 60 fourth-grade students, divided into two parallel classes, A and B, each with 30 students. Given their similar characteristics, class A served as the experimental group (using the brain-jogging model) and class B as the control group (using direct instruction). The brain-jogging model previously underwent content validity testing using Aiken V analysis with seven expert judgments, resulting in a high validity score of V 0.87. The content validity results of the brain-jogging learning model are detailed in Table 1 below.

Table 1. The content validity of the brain jogging-based learning model

	Jury I	Jury II	Jury III	Jury IV	Jury V	Jury VI	Jury VII
Amount	127	126	138	132	123	129	132

Item	Validity	Mean validity
Material activity	0.85	0.87
Safe	0.9	
Convenience	0.87	
Suitability	0.89	
Practicality	0.85	
Goals appropriate	0.86	

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In this study, the reliability test shows that the data has a value of 0.700 > 0.60. These findings show that the responses of the seven experts are consistent, implying that the brain jogging learning model's content is reliable.

Table 2. The results analysis of cronbach alpha reliability

Cronbach's alpha	N of Items
0.700	7

The brain jogging learning model used for elementary school students comprises three main elements: the coordination system, visual system, and cognitive skills. Each element has several sub-training items, detailed in Table 3 below.

Table 3. Brain jogging models

Brain jogging model	Training items	Explanation
Coordination System	Movement flow	The integration of a single movement into a continuous movement is evident.
	Movement pattern	Partial movements are combined into a single flowing movement.
	Movement change	There is a change in rapid movement without stopping.
Visual System	Tracking eye movement	The eyes move smoothly horizontally, vertically, and diagonally.
	Field of view	The viewing area is increased and spatial perception is improved.
	Focus	Distance and speed are calculated accurately.
Cognitive Skill	Working Memory	Several options are evaluated and selected.
	Preception	There's an improved understanding and organization of the information received.
	Recalling Information	The ability to recall available information in times of difficulty is enhanced.

The instrument employed in this research was adapted from the TGMD III by Dale Ulric [28]. Previously tested instruments demonstrated a reliability of 0.990 and a validity of 0.819. This suggests that the instrument is valid and reliable for measuring the gross motor skills of children in Indonesia [29]. Table 4 displays the TGMD III sub-locomotor subtest items:

Table 4. TGMD II locomotor subtest

Gross motor skills – locomotor subtest	Instructions
Run	Place 2 cones 50 feet apart. Ensure there is at least 8-10 feet (2.4-3m) of space beyond each cone to allow for a safe stopping distance. Instruct the child to run quickly from one cone to the other when you say "GO."
Gallop	Mark off a distance of 25 feet using cones or markers. Instruct the child to gallop from one cone to the other and then stop.
Hop	Tell the child to hop 4 times on their preferred foot, which should be established before testing.
Leap	Set two markers at least 30 feet apart. Instruct the child to skip from one marker to the other.
Horizontal Jump	Mark a starting line on the floor, mat, or carpet. Have the child stand behind the line. Tell the child to jump as far as they can.
Slide	Place two cones 25 feet apart in a straight line. Instruct the child to slide from one cone to the other. Allow the child to choose which direction to slide in first, then ask them to slide back to the starting position.

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Students exposed to the brain jogging learning model treatment twice a week had an average attendance rate of 90%. Each game/activity is aligned with a specific objective that corresponds to a brain jogging sub-training item. If elementary school children receive this treatment for at least 8 weeks, they will experience noticeable improvements [14]. In each session, the activities provided by the teacher vary to maintain student engagement. Each session is led by a PJOK teacher, supported by one class teacher. The games used to treat the experimental groups are listed in Table 5, while the control groups received conventional model treatments.

Table 5. Brain jogging model-based games for the experimental group

Week	Training items	Game name
1–2 & 7–8	Movement flow	Bouncing; duration 15 minutes
	Movement pattern	Hula hoop jump; duration 20 minutes
	Movement change	Know your body; duration 15 minutes
3–4 & 9–10	Tracking eye movement	Look at the pattern; duration 15 minutes
	Field of view	Move and spin; duration 15 minutes
	Movement flow	Bring a ball; duration 10 minutes
	Focus	Bring marbles; duration 10 minutes
5–6 & 11–12	Working Memory	Catch a ball; duration 15 minutes
	Preception	Throwing and catching; duration 10 minutes
	Recalling Information	Look behind; duration 10 minutes

Statistical analysis

Data was analyzed using SPSS IBM 26. Initial steps involved comparing descriptive data against the entire population's size, and determining the mean and standard deviation (SD) for variable distribution. An independent sample t-test analysis was then used to assess the effects of the 12-week brain jogging learning model training on the experimental group. The criteria for decision-making in the t-test are as follows: 1) If significance (asymp.sig, 2-tailed) < 0.05, then hypotheses are accepted. 2) If significance (asymp.sig, 2-tailed) > 0.05, the hypothesis is rejected. The subsequent section presents descriptive results covering various aspects of gross motor skills, specifically the locomotor subtests (run, gallop, hop, leap, horizontal jump, slide).

Results

The mean difference in post-test scores between control and experimental groups was based on the significance of the SPSS BMI 26 output ($p < 0.05$). According to the independent sample t-test results, there were significant differences in the scores of the control and experimental groups. This confirms the influence of the 12-week brain jogging learning model training on gross motor skills, specifically the locomotor subtest, in elementary students (Tables 5 and 6).

Table 6. Descriptive results of pre and post tests

Group	Gross Motor Skills	Pre-test		Post-test	
		Mean	SD	Mean	SD
Control	Run	2.77	0.774	3.10	0.607
	Gallop	2.90	0.712	2.80	0.551
	Hop	3.13	0.730	3.53	0.507
	Leap	2.80	0.664	2.23	0.568
	Horizontal Jump	3.07	0.691	3.13	0.681
	Slide	2.47	0.507	2.57	0.504
Experiment	Run	3.10	0.712	3.77	0.430
	Gallop	2.80	0.870	3.60	0.563
	Hop	3.53	0.785	4.30	0.750
	Leap	2.47	0.681	3.00	0.346
	Horizontal Jump	3.00	0.788	3.90	0.305
	Slide	2.13	0.629	2.87	0.346

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Table 7. Results of the post-test for both control and experimental groups, analyzed using an independent sample t-test

Group	Gross motor skills	Mean	Significance
Control Experiment	Run	3.10 3.77	0.000
Control Experiment	Gallop	2.80 3.60	0.000
Control Experiment	Hop	3.53 4.30	0.000
Control Experiment	Leap	2.23 3.00	0.000
Control Experiment	Horizontal jump	3.13 3.90	0.000
Control Experiment	Slide	2.57 2.87	0.009

Discussion

The motor development of children at primary school age 10-13 years shows characteristics that they reach the transitional motion stage and the application stage. The transitional stage is where children begin to combine and use their basic abilities obtained through sports education at school. Therefore, the role of sports learning activities in schools must be carried out appropriately and optimally. According to the results of the study, it was concluded that physical development is closely related to motor development, while motor development is the development of elements of maturity and control of body movements, where the main source is the brain [15].

Physical activity/exercise produces the hormones serotonin and dopamine [16]. These two hormones are transported from the axon to the dendrite via simple diffusion. The fast transmission that occurs at the synapse is caused by the proximity of the distance that must be traversed and the rapid diffusion. The synapse is crucial functionally because it regulates the flow of impulses through the nervous system. Not all impulses that reach the synapse are transmitted to the next neuron. Synapses determine the human response to a specific stimulus by regulating the passage of impulses through the nervous system, one of which is reflex action. Locomotor skill is one of the motion stimuli. Because this movement has two types of movement skills, receptive and propulsive, locomotor skills require the ability of the nerves to coordinate with each other. Receiving an object, such as catching, and exerting force or strength on run, gallop, hop, leap, horizontal jump, and slide are all receptive skills [17].

The application stage has characteristics of cognitive improvement, and the child's experience is influenced by the individual's ability to learn in various activities. Learning activities in schools must have characteristics that aim to develop a child's brain, besides the main goal being movement experience. This is supported by the results of a study entitled "Physical Development and Motor Development on Brain Development" which found that learning involving the brain will produce neuron cells in the brain space. Consequently, an increasing number of neuron cells will result in the brain's ability to process more information [15]. So, when children carry out coordination movements that contain elements of multitasking, their movements will be even better.

Locomotor skill is the child's movement ability when moving the body from one place to another. Locomotor abilities can be observed when children can jump, crawl, run, walk, and tiptoe. Human daily life, from the age of children to adults, is dominated by using locomotor movement activities. According to study results, locomotor movements must be emphasized with full supervision and guidance in sports learning in elementary schools to ensure the movements are executed correctly [18]. Locomotor movements play a crucial role in the implementation of sports learning, especially sports that change places or focus points, such as events in athletics, walking events, running, jumping, and floor gymnastics [19].

Basic locomotor movements are based on several learning theories that are behavioristic and cognitive. This implies that learning is influenced by internal factors (physical and mental of students), external factors, and the social environment. This is supported by conclusions from research that basic locomotor movements are effective in supporting the learning process of sports in elementary schools [20]. Locomotor basic movement ability is influenced by three main elements, namely coordination, agility, and balance [1]. Among these, coordination and agility are the most dominant factors affecting locomotor movement, accounting for 63% of the influence [21]. Therefore, the role of sports teachers in providing physical activity to their students should prioritize activities that heavily involve movement coordination and agility.

Movement coordination and agility are all included in the learning sub-model based on the brain jogging coordination system, visual system, and working memory. These two elements are also present in every type of game provided. In every game, researchers always use a ladder where the ladder is very effective in improving human biomotor abilities, especially agility and coordination. This is reinforced by research results [22]. Additionally, agility enhances the ability to move with coordination and maintain balance, as indicated by research findings [23].

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The Brain Jogging learning model is an energizing program. It uses movement to activate the brain and coordinate the brain with the body [24]. Furthermore, it's a fun training program that combines physical activity, brain training, and visualization [25]. Brain jogging includes training methods like lifekinetic, brain gym, and brain gymnastics. However, brain jogging is the result of adopting lifekinetics from countries like Germany, Australia, and Sweden. This is because the brain jogging learning model incorporates three elements: the coordination system, visual capabilities, and cognitive abilities. The primary goal of the Brain Jogging learning model, derived from LifeKinetics, is to enhance performance by harnessing structure, biochemical resources, and mental resources to stimulate thought processes, thereby creating optimal conditions for daily tasks.
The Brain Jogging learning model is an exercise that engages brain function through coordinated motion [8]. Other sources [26] added that Brain Jogging is a mental exercise model that fuses cognitive tasks with multitasking. The training in brain jogging encompasses coordination, cognition, and visual exercises. Engaging in diverse and challenging brain movements in brain jogging fosters the growth of new synapses in the brain. As a result, not only is there an enhancement in performance and the speed of information processing in our brains, but there's also a potential to offset brain damage.
The Brain Jogging learning model incorporates a blend of movement activities, cognitive challenges, and visual perception exercises, especially peripheral visual perception. The amalgamation of different limb movements, such as catching, throwing objects, visual perception training, and coordinating eyes and limbs, is a fundamental attribute of brain jogging training. Varied movement patterns captivate athletes, prompting them to explore other training modalities. This aligns with the assertion that "training variation is introduced when several components are altered. This variation is also believed to foster learning and stave off monotony and stagnation" (Sport Training Advisor, 2017). It can thus be deduced that Brain Jogging is a form of kinetic life that melds physical activity with brain activity, centering on coordination and multitasking, with the overarching aim of boosting the performance capacity of the brain by generating new neurons.
The Brain Jogging learning model is suitable for individuals ranging from 8 to 80 years of age [23]. It's a mental training methodology curated to elevate cognition, multitasking, and concentration, enabling individuals to tap into the full spectrum of the brain's potential [38]. This training is tailored to invigorate the brain's operational system, leading to a surge in cognitive, sensory, and mental prowess. More specifically, the Brain Jogging learning model seeks to enhance concentration, motivation, intelligence, multitasking, memory/attention, stress resilience, and physical fitness [36]. Brain jogging exercise is described as "a blend of motor activity and challenges in cognitive and visual perception training, particularly targeting peripheral visual field perception. The act of moving limbs in varied and unconventional ways is fundamentally a hallmark of this training" [39].
The Brain Jogging learning model predominantly employs tools like rope ladders, balls, etc. The Brain Jogging training program comprises multiple training modules such as: moving, juggling, reaction & cognitive, agility with ball, agility with ball combination, motoric, motoric combination, jumping line, ladder, ladder combination, coordination, and many others.
In the implementation of the research, the research instrument used is a test and a questionnaire. Data analysis was carried out using a variety of statistical techniques and analysis tools, including qualitative data analysis and inferential statistical analysis methods. The quantitative data obtained from the test were analyzed using an independent sample t-test. The results showed that there was a significant difference in the average post-test score of the experimental class and the control class students after being given treatment. The results of the statistical tests concluded that the average post-test score of the experimental class students was higher than the control class students. From these results, it can be concluded that the treatment using the Brain Jogging learning model for 12 weeks proved to be effective and showed a significant effect.

Conclusion

The intervention group, who were subjected to training through the Brain Jogging learning model, displayed marked improvement in several aspects of gross motor skills compared to the control group. The introduction of the Brain Jogging training model, designed to stimulate the brain, results in a comprehensive enhancement across various domains, namely cognition, concentration, motivation, intelligence, multitasking, memory/attention, stress resilience, and physical fitness.

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