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Using Nine Matrix Exercise for Promoting Cognitive & Physical Function

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Abstract

Structured physical movement plays an important role in the integrated functioning of the brain, nervous system, and muscles. Nine Matrix Exercise (NME) is a movement-based innovation derived from fundamental human movement patterns. It requires participants to move their hands, feet, or other body parts according to predetermined sequences, directions, and rhythms. This review aims to describe the concepts, principles, distinctive features, and applications of Nine Matrix Exercise for promoting cognitive and physical function by synthesizing relevant textbooks, documents, and research. The synthesis indicates that the exercise simultaneously engages perception, attention, memory, thinking, decision-making, and motor control. It may also improve neuromuscular coordination, hand–eye and foot–eye coordination, reaction speed, agility, and balance. Its principal advantages include minimal requirements for equipment and space and the flexibility to modify the grid size, movement patterns, rhythm, and level of complexity according to participants' age, ability, and training objectives. Nine Matrix Exercise can therefore be incorporated into active learning, physical exercise, motor-skill development, and health-promotion activities. It may also support enjoyable and engaging learning environments by integrating movement with academic content, rhythm, or music. Nevertheless, well-designed experimental studies are required to confirm its effectiveness, determine an appropriate training dose, and establish evidence-based application guidelines for different population groups.

Keywords: Nine Matrix Exercise, Cognitive Function, Physical Function, Movement-based Learning, Neuromuscular Coordination

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1. Background of Nine Matrix Exercise and Brain Development

Human behavior is a medium that expresses the functioning of the brain or nervous system, which is divided into 2 main parts. The first is behavior that is beyond the control of the mind, such as being startled. The second is behavior that is under the control of the mind, such as reading, writing, listening, and speaking as well as practicing various movement skills step by step or systematically as the brain has been stimulated through awareness or skill training (Krabuanrat, 2009).

For this reason, the behavior that humans express generally reflects the development of the brain's perception and learning. It starts with the feelings and thoughts that later developed into human understanding by interpreting meaning and finally becoming a behavior or various bodily movements. Therefore, to stimulate the body to have physical activity or participate in practice of various types of movement activities in a systematic and sequential manner, it needs to support the brain by integrating learning motor skills (Krabuanrat, 2009).

Training on movement perceptions and reactions is a principle of speed training which is important for the development of neuromuscular function of athletes. It requires certainty and precision to perform motor skills and sport skills accurately and quickly in a short period of time. It also includes thinking, decision making, and problem-solving in the ongoing game situations. Training or skill practice usually focuses on stimulating the brain or nervous system which is responsible for perceiving information (sensory neuron) and then sending it to the central nervous system that is responsible for collecting information to evaluate, analyze, interpret, and make decisions based on information. Nerve impulses are sent to motor neurons that act as commands and control movement in response to information sent by the central nervous system. The period of training of the nervous system is only a short period of time that emphasizes the correctness of sequence of actions, precision, and speed of movement. It uses the principles of training the perception and response of the nervous system that does not require a lot of time, distance, or space to practice. (Kerdjarean, 2008)

The Nine Matrix Exercise is an innovative program that is developed from the nine matrix movement or nine matrix square (Krabuanrat, 2009) combined with a brain gym concept. Brain gym programs are based on the claim that when learners carry out specific brain gym movements prior to a learning activity, they can improve stability, mobility, and/or sensorimotor coordination (Dennison & Dennison, 2010). Krabuanrat (2009) stated that NME is used to improve performance in terms of learning, sensory neuron function, coordination between the neurological system and muscle functioning, and a reduction in reaction time to perform the movement skill. Neamphoka (2003) explained that Nine Matrix Exercise improved step movement and speed for 50-meter runners which consistent with Neelapaijet (2006) who reported that a foot speed training program with nine matrix movement, both patterns of 60x60 centimeters and 90x90 centimeters, combined with a short-distance running program can improve speed more than short-distance running training alone.

According to Philuek (2009) who stated that training with nine matrix movements in the sizes of 90x90 centimeters, 75x75 centimeters, and 60x60 centimeters, in a three-day training and continuous training for 8 weeks can greatly improve reaction time. In addition, Kerdjarean (2008) confirmed that students who are 7-8 years who practiced using a nine-matrix movement with their hands on a classroom table at speeds of 90 and 120 bpm for 30 minutes a day, 5 days a week, and continuous training for 8 weeks, they would be able to improve their hand-eye reaction time significantly more than students who did not receive any trainings. Krabuanrat and Supaporn (2012) also supported that the use of nine matrix exercise or nine matrix movement can improve autistic students' behavior in such areas as self-control, concentration, social skills and motor skills.

The brain plays an important role in perceiving, commanding, and controlling muscles to move according to information or stimuli that the brain receives. If the teacher can transfer the body of knowledge in the content with understanding through movement activities with principles and reasons, interesting, and attracting students to practice correctly and clearly, it will greatly improve the quality of their learning perception. Moreover, it helps lay the foundation for learning in the brain called brain-based learning, which links to knowledge, understanding, intelligence and develops creativity that leads to imagination or rational thinking and systems thinking. (Dennison & Dennison, 2010)

Therefore, NME is a tool used as a medium for conveying and linking learning information through movement activities to lay the foundation and develop human brain cells for quality growth. (Outayanik et al., 2017)

2. What is the Nine Matrix Exercise?

The Nine Matrix Exercise was created as a tool for improving the brain's cognitive and cognitive interactions called "Mind Field". It also helps develop the coordination between the nervous system and muscles that stimulates and develops reaction speed in performing movement skills, speed of thinking, and decision making to be more efficient. The important working principle of nine matrix movement is to emphasize the development of both the left and right hemispheres of the brain simultaneously. It is applied from basic human movement patterns, leading to determination of methods by using the brain's working principle to control the execution of each step in a continuous sequence. (Outayanik et al., 2017)

The Nine Matrix Exercise determines the structure of the brain in perceiving, learning, and developing brain control in systematic, step-by-step manner according to the movement patterns that are created or planned systematically. The work process progresses from easy to difficult movement, slow to fast, complex, diverse movement, and more diverse directions. Working in these ways will result in the brain being stimulated and developing perception and learning, and linking information that is organized correctly according to the pattern of established movement patterns. This process is like creating a "Brain Mapping" for setting a pattern of working steps for the brain and leading to the process of perception, learning, ordering, and the development of thoughtful interactions and systematic psychomotor skills. (Outayanik et al., 2017)

Movement of the body with purpose has a form, method, and steps that are correct and systematic, which is to set the conditions for the brain to work with direction and purpose, which is different from allowing the body to move according to natural development. Therefore, feedback of the movement is a direct demonstration of the perception, learning and development of the brain that has truly progressed from training and learning and the most concrete evaluation. The movement patterns in

the nine-matrix square can be used as a guide to structure the brain to help develop motor skills and relationships in movement (Figure 1).

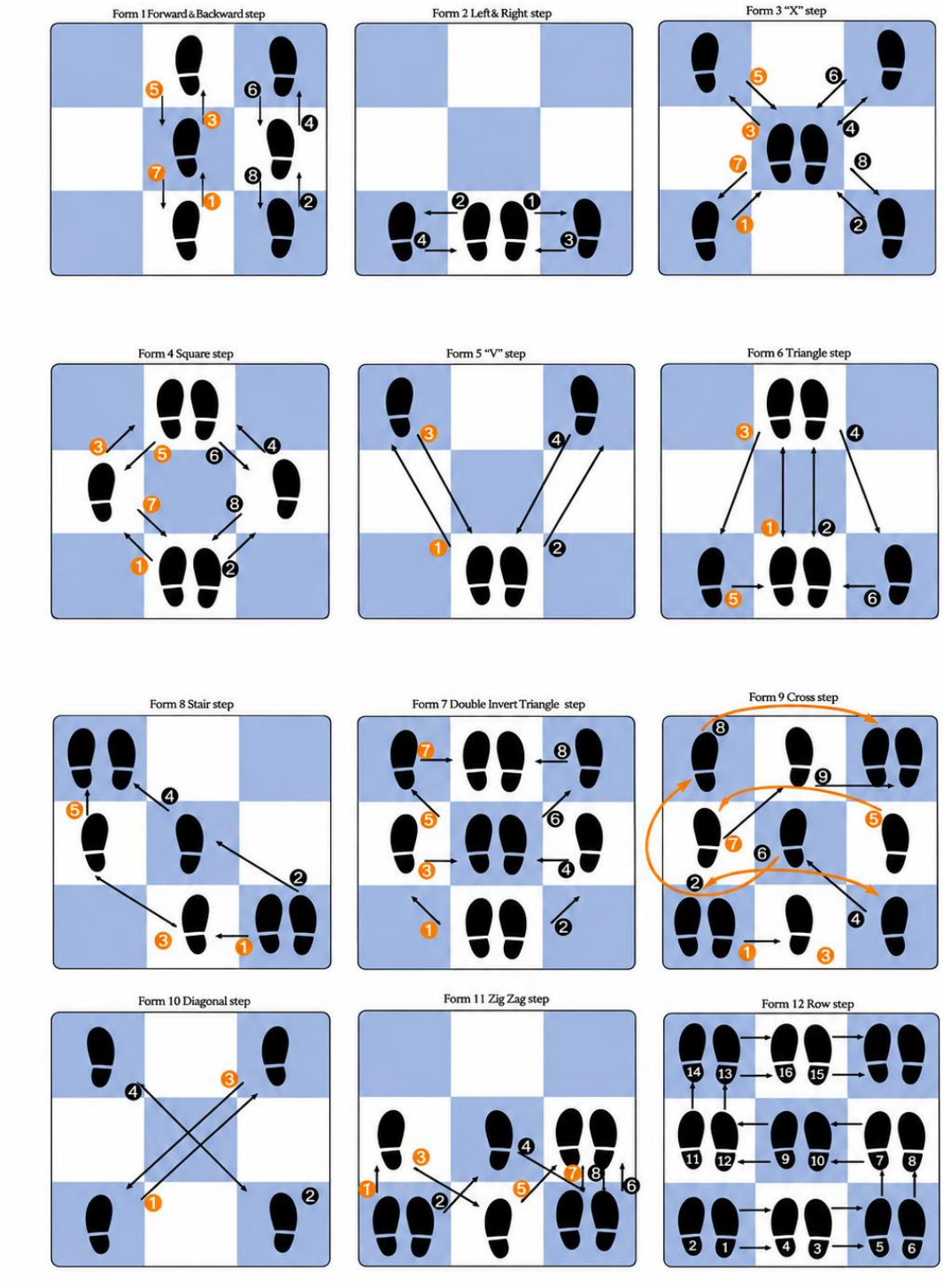


Figure 1 Nine Matrix Exercise Movement Pattern

3. Nine Matrix Exercise and the Development of Motor Skills and Learning

For human development, NME was created in order to serve as a condition for stimulating and developing a child's perception of learning and challenging children's thinking, imagination, and movement abilities in transferring knowledge, understanding, and thinking processes to connect the related information of learning in each lesson or each movement skill. This information leads to perception in understanding and accessing what happens from one's own action (output) to integrate and use it in daily life (Krabuanrat, 2009).

At the same time, NME also helps create a fun, relaxed, interesting, and challenging learning atmosphere to learn from lessons and knowledge around children. Teachers, parents, or guardians would play an important role in sparking learning by giving children opportunities to express their opinions or participate in organizing activities and creating activities or movements according to their own imagination. These ideas are related to the principle of "Active Learning & Active Play" (Krabuanrat, 2009).

Creating conditions for children to have further opportunities to express ideas or ask questions about learning issues that are reasonably related to the lesson or an inspiration for learning will lead to understanding children's later confidence and reasonableness. Providing opportunities for children to express their opinions and ask questions helps them develop more rational thinking and organize their thoughts more clearly and systematically (Krabuanrat et al., 2023).

Additionally, the advantages of using NME vary according to the goal, pattern design, organization of activities and consistency of training for each group or individual leader. However, the overall benefits of the nine-matrix square can be summarized as follows:

1) Nine Matrix Exercise helps and improves perceptual and motor reactions of the nervous system and muscles.

2) Nine Matrix Exercise helps and improves coordination in using hands and feet to practice movement skills.

3) Nine Matrix Exercise improves speed, agility and balance.

4) Nine Matrix Exercise helps and elevates the efficiency of the cardiorespiratory system.

5) Nine Matrix Exercise increases the body's energy system and elevates your body metabolism after exercise to be more efficient.

6) Nine Matrix Exercise enhances quality of life and helps regulate hormonal imbalances as it boosts hormone levels.

7) Nine Matrix Exercise is flexible because it can be used for both cardio and strength workouts.

8) Nine Matrix Exercise is another alternative tool that helps develop a variety of learning activity formats and teaching methods.

9) Nine Matrix Exercise promotes creativity, ways of thinking, and rational decision making.

10) Nine Matrix Exercise improves the process of thinking and learning. It also improves problem-solving skills, emotional balance, memory, and reduces anxiety or depression.

11) Nine Matrix Exercise reduces the risk of cognitive decline.

12) Nine Matrix Exercise stimulates and develops the left and right brain functions effectively.

13) Nine Matrix Exercise develops and promotes emotional quotient (EQ) social quotient (SQ), and intellectual quotient (IQ).

14) Nine Matrix Exercise creates an attractive and motivated learning atmosphere for students.

4. The unique features of the Nine Matrix Exercise

Unique features of the Nine Matrix Exercise are following:

1) It can be used to create activities according to the desired goals and requires little space. It is economical, convenient, and safe and can be used in any location.

2) It can be used as a tool for organizing a variety of teaching, learning, and exercise activities.

3) It has a feature for transferring learning through movement activities and music rhythms effectively.

4) The table size can be adjusted to suit the purpose or goal of use.

5) It can be applied as a tool for testing and evaluating human movement.

6) It is easy to control, use, and maintain and does not affect the environment.

It is a convenient tool that allows users to choose the best location and materials to create a 9-square table as well as nine matrix exercises according to their needs.

5. Nine Matrix Exercise and the Development of Diverse Learning Skills

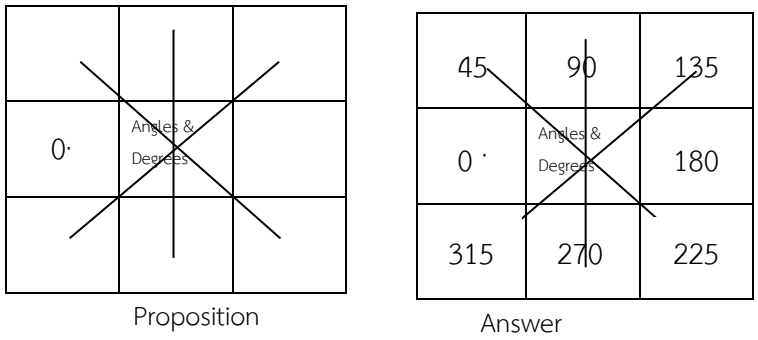
The uniqueness of Nine Matrix Exercise is that it can convey learning content through movement activities combined with teachers' creativity in applying their own teaching styles, techniques, and methods. It can create motivation and stimulate the interest of children or learners by using movement rhythms or music rhythms to help create fun and enjoyment with learning activities and movement activities that teachers designed and created to be used as a tool or innovation for children to learn through NME. This is to make it easy for children or learners to learn, remember, and understand the content in the lesson (Krabuanrat, 2009; Outayanik et al., 2017).

The example below is an integration of teaching with NME that is used as a guideline for teachers, parents, and guardians who can be applied in creating, modifying, or developing teaching methods in each learning subject group. The important goal is to make it easy for children or learners to learn and understand (Figure 2) (Krabuanrat, 2009; Outayanik et al., 2017).

The Nine Matrix Exercise can be used as a tool for conveying learning content through movement activities in a variety of formats and methods where teachers, parents, and guardians can think and create formats or teaching methods to include the 9-square channel. Children move through each of the nine squares and learn along with those movements, which stimulates the development of both the left and right hemispheres of the brain at the same time, and it also helps children develop hand-eyes coordination and foot-eyes coordination. In cases where teachers use activities that allow children or learners to move thier feet, children or students will be able to develop relationships in movement and balance in harmony and nature, which will create aesthetics, ideas, and wide imagination for children as well. All these things are very important in fostering both EQ and IQ in children at the same time. NME is an innovation in promoting methods and creativity in learning and developing systematic thinking processes for children in order to result in children developing complete growth (Maturation) in each age group (Krabuanrat, 2009).

Learning activities on angles and degrees using Nine Matrix Exercise.

Objective: To help students understand angles and their measures in degrees.



Pattern I: Have the practitioner place the number flashcards in the correct space according to the specified angle.

Pattern II: Have the practitioner move the numbers that are divisible by 45 or 90.

Pattern III: Have the practitioner move according to numbers that have opposite angles.

Figure 2 Example of the application of the Nine Matrix Exercise to student learning

6. Nine Matrix Exercise and the Development of Thinking and Learning skills

Physical movement is the structural foundation for optimal brain development and learning. The main function of NME is to allow children to move in many different patterns to support learning that results in changes in their behavior (Krabuanrat, 2009).

Learning refers to the process that causes the development and change of behavior in accordance with the conditions of organizing learning activities as a result of training, practice, and experience in learning perception, which is not the result of a response arising from development or natural growth or maturity. Behavior refers to actions or symptoms that manifest through physical actions, speech, thoughts, and feelings in response to various stimuli that the body perceives through the 5 senses: eyes, ears, nose, tongue, and touch (Krabuanrat, 2009).

Learning, thinking, imagination, and reasoning are things that can be fostered by arranging the environment to have a learning atmosphere. However, the transfer of knowledge content is the principle of natural truth for children to learn through movement and physical activities that use a variety of learning processes, formats, and methods.

These methods of transmission should start with things that are close to or around the child to learning that expand on things that are far away for the child to connect information that has reasonable understanding without confusion, and be able to transfer learned information to things around the child. Learning in each step that is complex and diverse can be sequential or systematic. Encouraging children to participate in learning by doing will help children to learn from factual knowledge that comes from actual practice, called declarative knowledge. During the awareness and learning of declarative knowledge, it is necessary and requires teachers, parents, and guardians to provide explanations, reasons, and guidance to lay the foundation for thinking, thought processes, and reasonability in thinking that leads to continuously developing progress in learning. These things are the beginning of learning that will lead to the development of logical thinking skills for children at different ages. They can transfer and connect knowledge and logically differentiate information from experience. It helps children learn how to think step by step, continuously, and systematically and be able to present ideas effectively. Therefore, cognition is learned through physical movement and physical activity. Encouraging children to learn by doing and gaining declarative knowledge will greatly affect the development of Intelligence Quotient (IQ), Emotional Quotient (EQ), and Self-Esteem (Krabuanrat, 2009).

Thinking is a skill that must be continuously practiced through experience from action or reality, where children have the opportunity to learn about each condition that sparks problems or doubts that arise in order to find answers, reasons, and conclusions or explanations of the processes and relieve doubt or to get clear answers or explanations. In particular, children between the ages of 4 and 10 years have the highest rate of growth and development of motor skills. Learning in the natural environment that surrounds children is the classroom of life where they teach children real-life subjects. Children can make the most of what they gain from their daily lives by building on their academics. Because teachers, parents, and guardians have all had childhood experiences before, they can transfer and connect knowledge to children, and make children learn each aspect of content in a valuable way with understanding and awareness of the importance of the natural and social environment around us. These are the starting points for motivating thinking to encourage children to pay attention to learning and understanding both events and things happening around them and extending them to a broader body of knowledge and accepting them rationally. The development of learning motor skills from children participating in physical activities stimulates learning of thought processes, thinking methods, and the ordering of steps in thinking logically, which is an important foundation in organizing thought structure and decision-making for children. At the same time, basic movement is considered an important skill in developing the quality of children's movement for effective daily living. Therefore, children should be taught and practiced in correct basic movement skills that affect the development of motor control systems and children's perception and movement. A child's motor control system, perception, and movement develop through motor learning and sequential practice that result in permanent correct movement skills.

It is stored in long-term memory as a motor program to support further development of specific movement in each area. In addition, it also affects the development of relationships in the brain's perception and movement control, which affect the movement development (Motor Development), thought processes, decision-making, as well as actions to solve problems or overcome obstacles in a reasonable and systematic manner. At the same time, it also helps stimulate the development of creative thinking and self-esteem too (Krabuanrat et al., 2023).

The Nine Matrix Exercise is a tool that can help develop creativity in children or learners. Parents, guardians, and teachers must design and select or organize teaching and learning activities that can convey the relationship between the content of each part of the lesson (Parts) and link it to reality (Fact) by enabling children or learners to become actors or practitioners (Practice). Physical activity or movement are closely related to the use of movement skills in daily life in society that are consistent with the environmental situation around the child by extracting information about physical activity or movement and knowledge appropriate to the maturity level of children in each age group. Therefore, this tool can focus on two key principles. The first is teaching children to think discretely or analytically, and the second is teaching children to think synthetically. These teaching methods are driven by parents, guardians, and teachers, who must strive to motivate and train children. Children will have the habit of learning by observing, remembering, and connecting information obtained from observation, comparing, separating details, and drawing conclusions (Krabuanrat et al., 2023).

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