http:// ijp.mums.ac.ir
Original Article (Pages: 16028-16046)

Comparing the Effectiveness of the Brain Gymnastics and Spark Programs on the Gross Motor Skills of Trainable Mentally Retarded Female Students

Homa Harzandi[1], * Mir Hamid Salehian[2]

[1] Department of Physical Education, Tabriz branch, Islamic Azad University, Tabriz, Iran.

[2] Department of Physical Education, Tabriz branch, Islamic Azad University, Tabriz, Iran.

Abstract

Background: The main purpose of this study was to compare the effectiveness of brain gymnastics exercises and spark on gross motor skills of mentally retarded female students.

Methods: The present study is semi-experimental and applied research. 45 mentally retarded girls aged 8-12 years (with the mean age of 10±1.9 years) were included in the study and were divided into three groups of 15 subjects: brain gymnastics, spark and control. Bruininks-Oseretsky gross test was used as the pre- and posttest; it consists of four components: running speed and agility, static and dynamic balance, bilateral coordination, and strength. The brain gymnastics and Spark groups were practiced by the intervention groups for two months (3 sessions of 45 minutes in a week) under the supervision of the researcher and according to the special conditions of mentally retarded children. To compare the dependent variables, the analysis of variance (ANOVA) test was used.

Results: It was revealed that brain gymnastics and spark exercises had a positive and significant effect on the mean scores of gross motor skills (running speed and agility, static balance, dynamic balance, bilateral coordination, and strength) of the trainable mentally retarded girls. Nonetheless, spark exercises were more effective than brain gymnastics.

Conclusion: It seems that the greater effectiveness of the Spark movement program is due to the fact that it provides the participants with a better training opportunity, creating more appropriate time, facilities and equipment. Its content is mainly oriented towards the development of motor skills; it exposes children to a variety of training conditions, enjoys high levels of participatory learning and low levels of stress, and nicely motivates children for continuing the exercises.

Key Words: Brain Gymnastics, Gross Motor Skills, Spark, Trainable Mental Retardation.

* Please cite this article as: Harzandi H, Salehian MH. Comparing the Effectiveness of the Brain Gymnastics and Spark Programs on the Gross Motor Skills of Trainable Mentally Retarded Female Students. Int J Pediatr 2022; 10 (5):16028-16046. DOI: **10.22038/ijp.2022.61358.4722**

****Corresponding Author:***

Mir Hamid Salehian, Department of Physical Education, Tabriz branch, Islamic Azad University, Tabriz, Iran. Email: m_salehian@iaut.ac.ir

Received date: Oct.31,2021; Accepted date:Mar.22,2022

1- INTRODUCTION

Despite the advances in science and global health, mental disorders are still one of the main problems facing human beings. The highest percentage of mental disorders in the world is allocated to people with mental disabilities. Research has shown that these people are not only mentally different from their peers, but also physically lower. For example, it has been shown that people with retardation achieve low levels of preparation for standardized tests, especially in measurements of cardiovascular endurance, body composition, muscle strength and endurance, and coordination (1). Also, based on the background literature, it has been shown that children with mental disabilities have weaker basic motor skills than healthy children (2). Basic motor skills are called the building blocks for the development of most complex motor skills (3).

Research has shown that children with intellectual disabilities scored lower on all items of specific basic motor skills than her healthy peers, but this rate varied from item to item. Because these children have cognitive problems, some motor tasks may cause many problems that can be related to the need for more cognitive information that is necessary for successful performance of the task (4). It is expected that complex motor tasks have a stronger relationship with children's cognitive functioning than simple motor tasks (5).

Various studies have shown the importance of basic motor skills. Research evidence suggests that basic motor skills allow children to move in space (6), creating awareness of responding to various stimuli (7). Skills that are improperly accepted in early childhood may have negative effects on motor functions in later life (8). If mastering these skills is a prerequisite for success in special sport activities, children who are unsuccessful in the basic patterns of these skills, cannot participate effectively and successfully in sport activities and need motor skills to provide daily life movements (9). Since movement is directly related to cognition and mind, those who are cognitively and mentally challenged will be less able to perform motor tasks than healthy people. The development of basic motor skills in children with mental retardation is more important, because these skills facilitate the cognitive development of children (10) and have positive contributions in the daily lives of these people (11).

Therefore, children can not only enjoy activities and games during this period, but also they can develop readiness for the later years of their life, which in turn can lead to an active lifestyle (11). Due to the importance of developing basic motor skills, a lot of research has been done in this field, especially on the factors affecting the development of these skills, and several programs have been developed for this purpose, including Spark programs.

Another program that has recently gained widespread acceptance among educators, teachers and parents is brain gymnastics (12). The founders of this program claim that people with these exercises can learn faster and easier, perform better in sports, be more focused and organized, and overcome learning problems and issues. They also claim that these movements further strengthen and coordinate large and fine movements (13). But the effects of this program are still debated. On the other hand, researchers today have paid much attention to variables that promote child development in the fields of movement, education, and social-emotional issues (14), but choosing the type of game in how it affects children's motor skills is important. Therefore, due to the problems of mentally retarded children and due to the limited intervention programs on the basic skills of these children, it is necessary to provide a program using simple, cheap, enjoyable and safe tools for these children. Thus, based on the above mentioned evidence, in this study, the researcher considers that there is a relationship between motor abilities and cognitive development, and that movement affects the students' learning processes and education. From a psychological point of view, two explanations have been given for this relationship. First, cognitive and motor functions are paired with each other through identical brain structures. For example, the cerebellum and premotor cortex are involved in both cognitive and motor function, and disturbances in these brain structures cause motor and cognitive problems. Motor function is involved, and disruption of these brain structures causes motor and cognitive problems (15). The second explanation is that motor and cognitive functions follow the same developmental timeline between the ages of 5 to 10 (5).

A simple way to integrate movement in the classroom is to use brain gymnastics, and recent brain research has supported the use of them (16). The Brain gymnastics program with a focus on the development of perceptual-motor skills was developed by Paul Denison (1994). It includes 26 simple movements that can be enjoyable for children. The program also has a solid foundation in neuroscience and includes two-way intersectional balance movements that mechanically activate both hemispheres of the brain through motor and sensory cortices; and stimulates the arterial system for balance and reduces the mechanism of war and escape (12). This program combines the work of Everton (1937), related theoretical foundations with perceptual-motor theories (17) and the idea of Doman-Delacato neurological re-modeling (18). The information processing approach states that where the midline of the body is cut, that is, the line that divides the body into two halves, more time is required for information processing; and these tasks are more complex than tasks on one side of the body (19). Crossing the midline of the body refers to any activity that leads to tracking the eye, reaching and stepping across the midline of the body. The basic motor skills include tasks such as kicking, throwing, etc., and the inability to cross the midline of the body may be an important factor in preventing the learning and performance of basic skills (20). Then, since the brain gymnastics program includes such movements, it can have the potential to improve the performance of basic motor skills. The question that arises in this regard is whether providing brain gymnastics activities for this group of children can provide the basis for normal motor development and help their academic progress?

Playing is another factor that can have an important role in increasing the training opportunities for the development of motor skills and motor concepts. According to Akbari (2009), fundamental movement and environmental factors play a key role in the development of these skills (21). There are, however, some contradictions in this regard; as Wang (2014), for instance, did not confirm this finding.

Education is one of the most important social institutions that play a vital role in nurturing people. Identifying talents and creating the necessary conditions for the learners' flourishing in various physical, intellectual and social fields is one of the heavy responsibilities of education. Since elementary school is actually the entry point of a long and important movement in children's lives, it is of special importance both quantitatively and qualitatively. Therefore, this research seeks to provide new strategies to help elementary school students with dementia and to draw the attention of educational planners to the quantity and quality of sport activities in order to improve students' motor skills and academic achievement. To the best of our knowledge, only one study has been done on the effect of brain gymnastics on basic motor skills; and more research is needed to evaluate the effectiveness of this program in the field of movements. Moreover, research on the effect of physical activity on academic achievement has yielded conflicting results. And very few of these studies have been assigned to mentally retarded children (22). Investigations are, then, needed for identifying the best types of physical activities that affect academic achievement, especially among the mentally retarded children.

2- MATERIALS AND METHODS

This study was a pretest-posttest semi-experimental and applied research.

2-1. Participants

The population of this study consisted of all trainable mentally retarded female students of 8 to 12 years old (10±1.9) in Tabriz city studying in the exceptional public schools during the academic year of 2020-2021.

Several steps were taken to select the statistical sample. First, the researcher was introduced to the Department of Exceptional Education. At schools, after taking the initial tests, the subjects suspected of having cognitive problems were selected by a Psychologist and a Raven IQ test was distributed among them, along with a questionnaire of the personal characteristics to be answered by the parents of these children. Ultimately, 45 volunteers were selected based on the scores obtained and their similarity in characteristics, after final approval by a psychologist; and were randomly divided into two experimental and one control groups (15 participants each). All the groups were examined prior to and after the intervention period by the Bruininks-oseretsky motor proficiency test.

2-2. Instruments

2-2-1. The Raven IQ test

The Raven IQ test was used to measure the children's intelligence. Raven IQ test or Raven matrix is a non-verbal group intelligence test and is commonly used in educational settings and is also known as visual intelligence test. This 60-question test is used to assess individuals' abstract reasoning as part of general intelligence. This test is the most common and popular test designed for the age group of 5 years and above. The answers to these 36 questions have 6 to 8 options, and the order of the questions is from easy to difficult. The measurement is also done by Spearman's general intelligence agent. In each item, the subject is asked to identify the missing element and complete it.

2-2-2. Bruininks-oseretsky motor proficiency test

Bruininks-oseretsky motor proficiency test is the reference norm for the fine and gross motor skills of children aged 5 to 14 years. This test helps researchers identify normal children from disorder ones. This scale includes 8 subtests with a long form of 46 and a short form of 14 items. The test-retest reliability coefficient of this test is 0.87 in the long form and 0.86 in the short form. Its four subtests measure gross motor skills and the other four subtests measure fine motor skills.

2-3. Procedure

The basis of the exercise program selected in this study was the Spark exercise and brain gymnastics programs. At the beginning of the research, after a preliminary study of the Spark movement program and brain gymnastics, some parts of the program that could affect the development of gross motor skills were selected. At this stage, the selected training program was performed separately for the Spark and brain gymnastics groups, in 24 sessions 60 minutes each. During this time, the control group resumed her normal activities. At the end of the twenty-fourth session, a posttest was performed.

2-4. Spark training program

The exercise program selected in this study is derived from the Spark exercise program, which is related to the development of children's basic skills, including sports, games and active creativity for children. This exercise program includes 45 minutes in each session, which is divided into four parts (**Table 1**):

a) The first 15 minutes of the program include warm-up

b) 10 minutes of play including movement skills

c) 10 minutes including manipulation skills

d) Finally, cool down for 10 minutes.

2-5. Brain Gymnastics Protocol

The Brain gymnastics include the following activities:

2-5-1. Lazy 8: Drawing a Latin figure 8 in the air with the right hand, left hand and simultaneously with both hands in different sizes and in different positions up, down, middle and around with the pursuit of the shape by the eyes. It will be repeated 8 times with both hands.

Fig. 1: Lazy 8

2-5-2. Cross crawl: The student alternately brings her right elbow to the knee of the left foot and the elbow of the left hand to the knee of the right foot, doing this movement with 10 repetitions.

Fig. 2: Cross crawl

2-5-3. Sit-Up Cross Crawls: The student lies on her back on a solid surface. Bends the knees towards the head and lifts the legs off the ground. She places her hands behind her back, raising her heads a few inches off the ground so that they do not stretch her necks; slowly and simultaneously brings her elbows to the knees of the opposite foot, and turns her back as far as she is comfortable. Then, she brings her elbows and knees apart again. At the same time, she brings the elbow of the other hand to the knee of the other foot.

Fig. 3: Sit-Up Cross Crawls

2-5-4. Neck rolls: The student, after being in a comfortable position (sitting or standing), turns his head to one side and takes a deep breath, and then turns his head to the other side as he does the exhalation slowly, for about 8 seconds. Then the neck is rotated from below. In fact, the child thinks that she is drawing a smile on her head. Take a deep breath and move in the opposite direction again. During the exercise, she opens and closes her eyes. The exercise is done a total of 4 times for each side.

Fig. 4: Neck rolls

2-5-5. Think of an X: The student closes her eyes and imagines looking at a large X. If it is difficult for her, she can draw a large X in the middle of a sheet of white paper and look at it right in front of her eyes.

Fig. 5: Think of an X

2-5-6. The double doodle: This activity can be done in two ways:

i) The student is asked to draw the infinite shape three times with a pencil or pen. After writing the infinite symbol three times, she writes one letter of the alphabet.

ii) The student makes a movement by hearing each letter of the alphabet; the sign I (a) means raising the left hand, the sign T (b) means raising both hands and the sign R (c) means raising the right hand.

Fig. 6: The double doodle

2-5-7. The Rocker: The student sits on a solid surface. Leaning on her hands in the back, she raises her bent knees. The sacrum should be on the ground and the sacrum should be shaken to scratch the infinite mark.

Fig. 7: The Rocker

2-5-8. Belly breathing: The student stands or sits comfortably placing her left hand on her abdomen and her right hand on her navel. She takes a deep breath, holds it for 8 seconds, and exhales slowly. She imagines her stomach becoming full and empty. This movement is repeated two to four times.

Fig. 8: Belly breathing

2-5-9. The Energizer: The student sits on a chair, comfortably separates her legs and puts her hands on her knees, in a resting position. Then, she bends her head and torso and brings them down to her knees until they feel comfortable; takes a deep breath and slowly releases the trunk as she raises it, repeating this movement for two to three times.

Fig. 9: The Energizer

2-5-10. Calf pump: The student stands in front of a wall and leans on it, brings the right foot back, and lifts the heel, leans on the left foot, and takes a deep breath, releases with the breath and the heels in 8 numbers. She brings the right heel to the ground. Feels comfortable and raises the heel again and repeats her action for 3 times. This movement is done with both feet.

Fig. 10: Calf pump

2-5-11. The Grounder: The student stands on a flat, firm surface with her right foot on the right side of her body, turning as far as possible and pointing to the right with her right foot. Then she takes a deep breath, and while slowly releasing it with 8 numbers, she bends the right knee to the right and moves until the knee reaches exactly to the toes. She repeats this movement twice. She also performs this activity twice with her left foot.

Fig. 11: The Grounder

2-5-12. Gravity Glider: The student sits on a chair, crosses her right ankle over her left foot, takes a deep breath, and exhales with 8 numbers as she leans forward and pulls her arms forward. The movement is repeated twice. Then she places the left foot on the right foot and repeats this process twice. This movement improves self-confidence, stability and stature. With the fingers of her right hand, she grasps the muscles and tendons of the thumb and lifts them inwards into the legs and knees. She releases her foot and her breath with 8 numbers. This movement is repeated four times for each foot.

Fig. 12: Gravity Glider

2-5-13. The Owl: The student stands or sits comfortably. She raises one hand to the opposite shoulder and hooks it, rotating an area of the trapezius muscle between the neck and shoulder to the side where she holds the muscle with her hand, and takes a deep breath. As she turns her head down and to the other side, she releases her breath with 8 numbers. Imagining drawing a smiling face, she raises her head again and starts from the hooked hand. This movement is repeated several times with both hands**.**

Fig. 13: The Owl

2-5-14. The active arm: The student stretches and holds the right hand and under the elbow with the left hand with isometric contraction, then performs this movement with the other hand, in different directions and above the head and sides; front and back with 10 repetitions for each hand**.**

Fig. 14: The active arm

2-5-15. Brain buttons: The student massages two points under the collarbone with one hand while holding the other hand on the navel. This activity takes one minute for each hand.

Fig. 15: Brain buttons

2-5-16. Balance Buttons: This movement involves the following steps:

i. Stand with open legs

ii. Place the right hand on the abdomen.

iii. Place the index finger and middle finger of the left hand on the bone behind the ear (parietal bone).

iv. Bend the knee of the right foot and hold it up while taking deep breaths, keep her balance on the left foot and count to 8.

v. Then keep balance on the right foot and count to 8, while on the left foot; change the position of the hands. Repeat this operation 5 times with each foot.

Fig. 16: Balance Buttons

2-5-17. Drink Water: Drinking some water helps to stay alert and think; because all the chemical and electrical functions of our brain and central nervous system depend on good electrical conduction between the brain and other body senses.

Fig. 17: Drink Water

2-5-18. Earth Buttons: The child sits comfortably and places her index and middle fingers on the chin, placing the palm of her left hand above the navel so that her fingers are pointing down.

Fig. 18: Earth Buttons

2-5-19. Space buttons: The student stands with her right foot in front of her left foot and does not need to stretch. The index finger and middle of the left hand are gently placed on the space between the nose and the upper lip, rubbing the area with her fingers in a circular motion and bending her torso on her right foot while breathing. She raises her torso, focuses with her eyes on the farthest point, and bends the torso again and looks at her right foot. She repeats the movement four to five times and changes her legs and arms.

Fig. 19: Space buttons

2-5-20. Energy Yawn: The child stands or lies on the back and places her index fingers or the middle of both hands on the right and left muscles of the jaw. To find the jaw muscles, one can first find the corner muscles of the jaw that are connected, then gently move, tap, and squeeze her fingers when they touch the stiff muscle, that is, they are in the right place. While opening her mouth like a yawn, she rubs the jaw muscles and gently closes her jaws after yawning, repeating this process several times.

Fig. 20: Energy Yawn

2-5-21. Thinking Cap: The student stands or sits and gently points her ears with her thumb and forefinger, allowing her thumb to slide up and down. She repeats this movement two or more times.

Fig. 21: Thinking Cap

2-5-22. Positive Points: The students sit or stand and cross their benches in front of each other; and do not hook her thighs together. Then they place all fingers, except the thumb, horizontally on the forehead. To be more effective, they can hook up and put their tongue on the roof of the mouth.

Fig. 22: Positive Points

2-5-23. Hook-up: This movement can be done in a sitting, standing or lying down position. The student ties her hands together and brings her fingers close to her chest, puts her feet together on her wrists, closes her eyes, and takes a few deep breaths and relaxes.

Fig. 23: Hook-up

Table-1: The training schedule derived from the Spark program

Sessions	Warm up activity	Exercise
1	Warm-up and type 1 hyperactivity, 25 minutes	The second type of Activities and chilled 20 minutes
2	Warm-up, walk on heels and toes, jump with spin	Throwing the ball up, Throwing the ball against, The wall, cooling
3	Warming-up, slipping, Walking on heels and toes, jumping with a spin	Hitting the ball against the wall, ground balls, cooling
4	Warm-up, walk on heels and toes, spin jump	Throwing the ball up, free Dribble, cooling
5	Warm-up, frog, jump rope, Jogging	Hitting movement, passing The hat, cooling
6	Warm-up, wolf in the air, Sit-up, slide	Pass the hat, keep the ball in the air, cool
7	Warm-up, jump in the rings, hopping in the rings	Middle, pass, free dribble, Cooling
8	Warming-up, climbing up, jumping and clapping hands	Aiming, exchanging the ball Between the legs and above The head, cooling
9	Warming-up, jumping over The rope, liking	Seven stones, exchanging balls From left and right, who to hit, Cooling
10	Warming-up, uncle chain weaver, sit-down and stand-up, vault	Bear in the middle, wolf and herd, chill
11	Warming-up, sack racing, Tug of war, trot	Throw the ring, hit the ball with the baton, Cooling
12	Warm-up, make the meal Faster, vault	Hitting the ball against the wall, rope pulling, cooling
13	Warming-up, uncle chained, Scrambled eggs	Tug of war, swapping the Ball between the legs and Above the head, Cooling
14	Warm-up, jump over two lines In pairs and one foot	Linear dribble, move and Hit, cool
15	Warm-up, movement skills, Parachute	Ground balls, hitting the ball To the circle on the wall, Cooling
16	Warming-up, seven stones, race with a sack	Move, hit, pass the ball by Hand, cool down
17	Warm-up, dorna and crow, Jump over the line of a pair of legs and one foot	Aiming, playing with rockets And ping pong balls, Cooling
18	Heating, special rotation, sit-up	Middle bear, upright bear, Chain weaver uncle, cooling
19	Warm-up, jump over the rope, Middle	Hitting the ball against the Wall, passing the hat, Cooling

2-6. How to score

Scores on the Bruininks-oseretsky test are calculated based on the items listed on the test. In this way, the sub-test examines one of the motor skills. The examiner records the results by observing the performance on each part of the test that is repeated twice; but at the end of each part, the score of the best performance is considered. At the end, from the sum of the scores of each section and its standardization through the relevant tables, the scores for different skills are obtained, and from the sum of the standard skill scores, the final score for the gross motor skills is obtained.

2-7. Statistical analysis

Descriptive and inferential statistics were used to statistically analyze the obtained raw data. Descriptive statistics were used to calculate central indices and the dispersion of quantitative scales and to draw graphs and tables, and inferential statistics were used to test hypotheses. To this end, the multivariate analysis of covariance (MANCOVA) was used using SPSS21 software.

3- RESULTS

The descriptive statistics, including the mean and standard deviations of research variables in different groups are shown in **Table 2**.

Table-2: Descriptive indicators of research variables

Variables	Groups	N	Mean	Std. dev.
IQ	Spark	15	74.35	3.13
	Brain Gym	15	74.30	3.12
	Control	15	74.28	3.13
pretest Gross motor skills	Spark	15	124.35	18.18
	Brain Gym	15	124.15	17.19
	Control	15	124.40	18.11
posttest Gross motor skills	Spark	15	142.19	19.12
	Brain Gym	15	141.17	19.17
	Control	15	124.15	17.17
pretest Running speed and agility	Spark	15	10.12	0.65
	Brain Gym	15	10.15	0.62
	Control	15	10.10	0.64
posttest Running speed and agility	Spark	15	9.87	0.61
	Brain Gym	15	9.78	0.60
	Control	15	10.08	0.61
Pretest balance	Spark	15	9.74	1.75
	Brain Gym	15	9.69	1.69
	Control	15	9.85	1.70
Posttest balance	Spark	15	11.15	1.68
	Brain Gym	15	10.95	1.72
	Control	15	9.83	1.71
pretest Bilateral Coordination	Spark	15	9.85	2.15
	Brain Gym	15	0.60	2.38
	Control	15	9.74	2.65
posttest Bilateral Coordination	Spark	15	11.25	2.57
	Brain Gym	15	11.16	2.43
	Control	15	9.67	2.46
pretest Power	Spark	15	97.12	11.14
	Brain Gym	15	98.01	11.65
	Control	15	98.16	10.99
posttest Power	Spark	15	111.94	12.16
	Brain Gym	15	112.05	11.78
	Control	15	98.04	10.78

The analysis of covariance was also performed to compare the posttest mean scores of the gross motor skills between the control and experimental cerebral gymnastics group. The results are presented in **Table 3**.

Table-3: The difference between the control and cerebral gymnastics group in the posttest gross motor skills

Source of change	Total Squares	df	Average Squares	F	Sig	Squared
Pretest Effect	461.08	1	461.08	1582.2	0.001	0.983
Group Effect	418.54	1	418.54	1438.15	0.001	0.790
Error	7.868	27	0.291	-	-	-
Total	55823	30	-	-	-	-

According to **Table 3**, it can be seen that the effect of the group is significant at the level of 99% probability (p = 0.001, Eta squared = 79, F = 1438.15). That is, after adjusting the pretest scores, the amount of gross motor skills in the posttest in the control group and the brain gymnastics group is significantly different.

Table-4: The modified mean of gross motor skills in the control and brain gymnastics groups

Group	N	Modified mean	Std. dev.
Control	15	39.264	0.128
Brain Gym	15	47.143	0.128

According to **Table 4**, the adjusted means indicate that the amount of gross motor skills in the cerebral gymnastics group (m = 47.14) is significantly higher than that in the control group (m = 39.26). Therefore, it is concluded that the brain gymnastics exercises have a significant positive effect on increasing the level of gross motor skills of the girls with mental disabilities.

Table-5: The difference between the control and spark group in the posttest gross motor skills

Source of change	Total Squares	df	Average Squares	F	Sig.	Squared
Pretest Effect	532.41	1	532.41	1399.6	0.001	0.979
Group Effect	129.58	1	129.58	351.09	0.001	0.741
Error	10.193	27	0.377	-	-	-
Total	5343	30	-	-	-	-

The results of the analysis of covariance, presented in **Table 5,** indicate that the effect of the group is significant at the level of 99% probability (p = 0.001, Eta squared = 74, F = 351.09). That is, after adjusting the pretest scores, the level of gross motor skills in the posttest is significantly different between the control and the spark group.

Table-6: The modified mean score of gross motor skills in the groups of control and spark

Group	N	Modified mean	Std. dev.
Control	15	38.33	0.159
Spark	15	41.18	0.159

According to **Table 6**, the adjusted means indicate that the level of perceptual and motor skills in the Spark group (m = 41.18) is significantly higher than the control group (m = 38.33). Therefore, it is concluded that Spark exercises have a significant positive effect on increasing the gross motor skills of children.

Table-7: The difference between the brain gymnastics and spark groups in the posttest gross motor Skills

Source of change	Total Squares	df	Average Squares	F	Sig.	Squared
Pretest Effect	432.63	1	432.63	2375.1	0.001	0.590
Group Effect	80.257	1	80.257	440.61	0.001	0.586
Error	4.918	27	0.182	-	-	-
Total	61570	30	-	-	-	-

According to **Table 7**, it can be said that the effect of the group is significant at the level of 99% probability (p = 0.006, Eta square = 0.49, F = 440.61). That is, after adjusting the pretest scores, the level of gross motor skills in the posttest is significantly different between the cerebral gymnastics group and the spark group.

Table-8: The modified mean score of gross motor skills in the groups of spark and brain gymnastics

Group	N	Modified mean	Std. dev.
Brain Gym	15	35.18	0.01
Spark	15	42.64	0.01

As shown in **Table 8**, there is a significant difference between the level of gross motor skills in the brain gymnastics group (m = 35.18) and the spark group (m = 42.64). Therefore, it is concluded that the effect of spark exercises on gross motor skills of mentally retarded girls is greater than that of the brain gymnastics exercises.

The results of the univariate analysis of covariance demonstrated in **Table 9**, reveal that in all components (balance, power, speed and agility, coordination), the effect of the group is not significant at the level of 99% probability (p <0.01). That is, after adjusting the pretest scores, there is a significant difference in the posttest mean scores of different components (balance, power, speed and agility, coordination) between the brain gymnastics and the spark groups. Therefore, it is concluded that the Spark exercises have a greater and more significant effect than the brain gymnastics exercises on enhancing the components of the motor skills (balance, power, speed and agility, coordination) among the mentally retarded girls.

Table-9: Comparing the components of balance, power, speed and agility, and coordination between the brain gymnastic and spark groups

Source of change	The Dependent Variable	Sum of squares	Df	Average of Squares	F	Sig.	Squared
Group	Posttest Balance	88.923	1	88.923	214.28	0.001	0.714
	Posttest Power	53.542	1	53.542	12.623	0.003	0.218
	Posttest Speed	126.43	1	126.43	81.821	0.001	0.565
	Posttest Coordination	83.875	1	83.875	141.47	0.001	0.345
Error	Posttest balance	9.433	22	0.431	-	-	-
	Post-test Power	124.32	22	4.436	-	-	-
	Posttest Speed	27.323	22	1.311	-	-	-
	Posttest Coordination	12.213	22	0.7	-	-	-

4- DISCUSSION

The results revealed that thew brain gymnastics activities have a significant effect on the gross motor skills of the trainable mentally retarded girls. This finding is consistent with the findings of Salehian and Dehghan and (2020), Arsalani et al. (2019), Zare et al. (2017), Faal et al. (2017), Safarzaei and Rezaei (2015), Akbari (2009) and Ardestani (2009) and no contradictory research was found in this regard**.**

According to the theory of dynamic systems, this significant effect can be due to the influence of the environment on the development of mobility skills. The theory of dynamic systems considers motor development to be the result of the interaction of maturity and the environment. Contrary to the theory of maturity and based on the view of dynamic systems, maturity alone does not lead to the development of basic skills; and the environment and environmental factors play a decisive role in the development of these skills. Among the most important reasons for the greater effectiveness of motor learning games than the other two programs are the opportunity to practice, stimulate and enrich the environment and the quality of education provided. Another factor to be considered is the nature of the training program, which plays an important role in its effectiveness. Motor learning games based on Schmidt's theory of motor schema have been able to have a greater impact on motor skills due to the variety of exercises and high variability, as well as the alignment of the program content with the development of motor skills.

Salehian and Dehghan (2020) by examining the effect of Spark training program on the gross and fine motor skills of 6-8-year-old boys with trainable mental disability showed the significant effect of this perceptual motor program (24). Faal et al. (2017) by comparing the effect of the Spark exercise program and basketball techniques on the motor skills of trainable mentally retarded boys concluded that both activities can have a significant effect on the learning of gross motor skills among the disabled boys (8).

Zare et al. (2017) comparing the effect of the Spark exercise program with selected exercises on the development of basic mobility skills of preschool girls showed that both of the Spark exercise program and the selected exercises had a significant effect on the development of basic mobility skills; but the difference between the two intervention groups was not significant (25).

According to the results of the current study, the selected exercise program has a very good effect on the growth of gross motor skills in children with disorders. Since the personal characteristics of family-related factors and out-of-program training opportunities were controlled, it can be said that the factor most likely influencing the subjects is creating regular and purposeful training opportunities for the experimental group. Due to the great influence of regularity and purposefulness in the success of training programs, it can be said that performing this program in a period of 12 sessions should have helped enrich the training opportunity and enhance the motor skills in this group.

It can be said that the selected exercise program by creating appropriate facilities and equipment for children has been able to give them the opportunity to enrich their motor experiences and be able to an achieve higher motor and cognitive development, an opportunity that the parents are not usually able to create at home and the schools do not obtain the satisfying results due to the lack of purposeful and regular programs. Adequate facilities, equipment and time are vital for the development of motor and cognitive skills. Parents and educators should attempt to provide opportunities to learn motor skills, which are essential for children's developmental talent and success in sports skills, especially in secondary childhood, adolescence, and adulthood (26). Regarding the quality of education provided to the experimental group, some other important factors that are involved in the superiority of this group over the control group include the important factors of quality of education, as well as the variety of programs and motivation. Spark training program on the one hand is based on the game and on the other hand it is organized in a way that every day is different from the day before, which by itself encourages the child to participate in the program. Spark training program includes a large number of skills, including a large number of motor skills there are subtle and cognitive skills. The participants practice all motor and cognitive skills in almost every session. This allows the experimental group to grow in all motor and cognitive skills (27). Furthermore, some experts believe that motor skill training provides good opportunities to actively absorb various sensory inputs from the environment. In fact, purposeful motor activities improve the interactions of the cerebral cortex and this leads to the improvement of cognitive abilities, as well (28).

In line with our results, Dana and Christodoulides (2019) confirmed that such activities can improve the manipulative and locomotor skills of children with neuropsychological learning disabilities (29). Golabchi and Salehian (2021) studied the effectiveness of a swimming training on reducing coping behaviors, cognitive problems, and inattention of elementary school hyperactive girls. They revealed that the exercises strengthened the primary nervous system and promoted the superior brain functions such as motor skills. Similarly, Sabzi et al. (2021) reported the significant effects of water-treadmill exercises on motor skills of children with attention deficit hyperactivity disorder (30).

The results of the present study also showed that Spark exercises have a greater effect than brain gymnastics on the gross motor skills of trainable mentally retarded girls. Considering that no similar research has been done on the effectiveness of Spark exercises in comparison to brain gymnastics, no consistent and inconsistent findings were found in this regard. However, Wang (2014), comparing the perceptual-motor training to some other programs, concluded that this training significantly improves the gross motor skills of mentally retarded children. The findings of the present study also indicated the improvement of mobility skills after participating in the perceptual-motor program. But it is noteworthy that there are different types of perceptual-motor training. Wang's research training protocol was implemented for 6 months, while in the present study, the training lasted for 8 weeks. As described by Wang, Spark exercises and brain gymnastics for mentally retarded girls in the present study, may have improved the nervous system to better perform their gross motor skills (31).

5- CONCLUSION

It seems that the greater effectiveness of the Spark movement program is due to the fact that it provides the participants with a better training opportunity, creating more appropriate time, facilities and equipment. Its content is mainly oriented towards the development of motor skills; it exposes children to a variety of training conditions, enjoys high levels of participatory learning and low levels of stress, and nicely motivates children for continuing the exercises. Nonetheless, the subjects' performance in motor skills has also improved significantly. This improvement might be due to the fact that in the motor learning games practiced by the subjects in this study, various types of motor skills have been used, the subjects have practiced and repeated movements that are in line with the needs of the skill model, and the similarity in the task components was also considered, The obtained results can be considered in the framework of the dynamic systems perspective, according to which the task characteristics and environmental conditions are effective in the development of basic motor abilities.

According to the results, it is suggested that the teachers and education officials use this program to improve the quality of educational programs in combination with motor learning games. It is suggested that the country's educational departments offer special physical activity programs to improve the level of motor skills of these children along with other educational programs.

6- REFERENCES

1. Zareian H, Amiri Hui F, Taraj S. The effect of educational games on short-term memory and dictation of Primary school students with specific learning disabilities. Journal of Exceptional Children. 2009; 9(4): 374-367.

2. Golabchi M, Salehian M. The Effectiveness of Swimming Training on Reducing Coping Behaviors, Cognitive Problems, and Inattention of Elementary School Hyperactive Girls. Int J Pediatr 2021; 9 (11): 14896-14906.

3. Ashrafi, L., Namazizadeh, M., & Davari, F. The effect of rhythmic exercises on perceptual-motor skills of children with visual impairment. Motor Behavior, 2014; 3(18): 117-130.

4. Ghanbari N, Rafiei SH, Soltani R, Ghanbari Z, Yazdani F. The effect of occupational therapy interventions on cognitive-motor function and drawing skills of children with mental disabilities. Rehabilitation Medicine. 2014; 4 (1).

5. Namdar Tajri S, Farrokhi A, Rostami R, Kordi MR, Moghaddas Tabrizi Y. The effect of physical training intervention on motor skills of 7 to 10-year-old boys with developmental coordination disorder. Sports Management and Motor Behavior. 2015; 11 (22): 68-59.

6. Kowsari S. The effect of selected physical activity on the development of motor skills in children with attention deficit, hyperactivity disorder, Master Thesis, University of Tehran; 2010.

7. Gheiji HR, Kordi H, Farokhi A, Bahram A. The effect of traditional and ordinary games on the development of manipulative skills of trainable mentally retarded boys. Lorestan University of Medical Sciences. 2013; 15(5).

8. Faal Moghanloo H, Hosseini FS, Mikaeli F. Comparison of the effect of Spark motor program and basketball techniques on gross motor skills of trainable mentally retarded boys, Faculty of Physical Education and Sport Sciences, Urmia University; 2014.

9. Beng S, Gwenn S. Relationship between perceptual-motor development and motor performance of nine years old boys, Master's thesis, university of Colorado.2016.

10. Heydari L, Qasemi Kahrizaki GA, Salehi H. The effect of a rhythmic movement program on the perceptual-motor abilities of trainable mentally retarded children. Master Thesis, University of Isfahan; 2010.

11. Hashemi M, Salehian MH. Effect of selected games on the development of manipulative skills in 4-6 year-old preschool girls. Med Sport. 2015; 68: 49-55.

12. Lokinda,. Brain Gym Teacher's Edition details the 26 Brain Gym activities used around the world by people of all ages and abilities to make learning easier. Third edition 2010.

13. Hardman, M. L., Drew, C. J., Agen, M, W. Human exceptionality: school, community, and family, Tehran, First Edition, Danzheh Publication.2009; 10(32):43-58.

14. Gallahue DL Understanding motor development at different stages of life. Tehran, first edition, Nafee No Publications; 2013.

15. Diamond. A. Close interrelation of motor development and cognitive development and of the cerebellum and prefrontal cortex. Child Development. 2010; (71): 44-56.

16. Akbari, H., Ziaee, V. The effect of different educational programs on the development of fundamental skills of preschool children in Tehran city. Research project approved by the Medical-Sports Research Center, Tehran University of Medical Sciences.2009.

17. Bruininks VL, Bruininks Rh. Motor proficiency of learning disabled and nondisable student. Percept motor skills.1997; (44): 1131-1137.

18. Landerl K., Willburger E. Temporal processing, attention and learning disorders. Learning and Individual Differences.2010; 20(3):393-401.

19. Brenner, J. The effect of physiotherapy in a group on the motor function of children with developmental coordination disorder. Thesis MA in physiotherapy, University of the Witwatersrand.2008.

20. Rahmati Z., Aslankhani M. A., Farsi, A. The effect of a special motor program on the motor skills of visually impaired primary school students. Master Thesis, Shahid Beheshti University. 2010.

21. Haywood K.M. Life Span Motor Development (in Mehdi Namazizadeh and Mohammad Ali Aslankhani trans.), Samat Publications, Tehran, sixth edition 2005.

22. Engelsman BC, Wilson PH, Westenberg Y, Dysens J. Fine motor deficiencies in children with developMental. Coordination disorder and learning disabilities: an underlying open-loop control deficit. Human movement science. 2013; 22(4): 495-513.

23. Grovand E, Aslankhani MA, Farsi A. The Effect of Selected and Spark motor Programs on Manipulative Skills of trainable Mentally Retarded Children, The Second National Conference on Sports Science, Mohaghegh Ardabili University; 2017.

24. Salehian MH, Dehghan M. The Effect of Spark Exercise Program on Gross and Fine Motor Skills of 6-8 Year old Boys with Mental Retardation, Unpublished thesis. 2020.

25. Zare R., Ayatizadeh Tafti F., Fallah Yakhodani H.R. Comparison of the effect of Spark exercise program with selected exercises on the development of basic mobility skills of preschool girls, Master Thesis in Motor Behavior, University of Tehran; 2007.

26. Safarzaei Y, Rezaei M. The effect of Spark motor program on fundamental skill development of 6 to 8-year-old boys in Zahedan, the first national conference on new achievements in physical education and sports, Chabahar International University; 2015.

27. Bushnel EW, Paul B. Motor development and the mind; the potential role of motor abilities as a determinant of aspects of perceptual development. Child development. 2013; 64: 1005-1021.

28. Kakavand AR. Psychology and education of exceptional children. First edition. Ravan publications; 2006.

29. Dana A., Christodoulides E. (2019). The Effects of a Period of Selected Physical Activity on Improving Manipulative and Locomotors Skills of Children with Neuropsychological Learning Disabilities, Journal of Rehabilitation Sciences and Research, 7, 25-30.

30. Sabzi A.H, Dana, A, Salehian M.A., Shaygan Yekta H. (2021). The Effect of Water Treadmill Exercise on Children with Attention Deficit Hyperactivity Disorder, International Journal of Pediatric, 9(6): 13671-13681.

31. Wang JH. A study on gross motor skills of preschool children, Journal of Research Children Education, 2014; 49(3): 246-264.