

*Original Article*

The Effectiveness of Rhythmic Movement Games on Memory in Children with Mental Retardation

Abbas Taghi Pour Javan¹, Ahmad Abedi², Fahime Hassan Nattaj³, Mostafa Dehghani^{*4}

1. MA student of Psychology, Department of Psychology, Isfahan University, Iran

2. PHD of Psychology, Department of Psychology, Isfahan University, Iran

3. MA student of Psychology, Department of Psychology, Isfahan University, Iran

4. MA Student of Family Counseling, Department of Psychology, Shahid Chamran University, Ahwaz, Iran

*Corresponding author's e-mail: dehghani001@gmail.com

ABSTRACT

Mental retardation is a functional interaction between an individual and the environment where s/he lives in rather than a static description which is rooted in an individual's limitations. While children are doing these movements, they learn lots of cognitive and instructional concepts and contents implicitly in that they are presented rhythmically and in a dancing manner and mixed with music that are full of joy and happiness. This study was to Efficacy of rhythmic play (dancing) on mentally retarded children's memory problems in Children at the age group of 9 to 16. The experimental method used in the study from the pretest - posttest control group. For these purpose 20 children with Mentally Retardation that were selected using multistage random cluster sampling (each group consists of 10 children). The researcher gave rhythmically bodily movements (dancing) as an intervening program to experimental (case) group twice a week (45 minutes for each session) for three months. The instrument of this research included Canners neuropsychological test of NEPSY, Raven Colored progressive matrixes for children and Vinland adaptive behavior scale questionnaire. Data was analyzed by Multivariate. The results from the present study showed that rhythmic plays affected the memory scales (short-term, active, long-term memories) and general learning in partially mental Retardation children who were teachable.

Key words: memory, mental retardation, rhythmic game

INTRODUCTION

According to internationally different statistical data provided by many studies, approximately 2.5% to 3% out of total population of children and students who are at the school age suffering significantly from intellectually developmental disorders [1, 2 and 3]. As a result, they are incapable of using normal educational programs. Today, the differences between mentally retarded children and their normal peers have just been confirmed. Mental retardation is a functional interaction between an individual and the environment where s/he lives in rather than a static description which is rooted in an individual's limitations [4]. While intellectual disorder may be interpreted as a lower level of cognitive capacity, intelligence tests provide us with an overall measurement of cognitive capacity in this case. Besides, the intellectual disorders can be diagnosed as having deficits in cognitive abilities such as memory, attention span and learning [5]. Results from research carried out on many children with mental retardation suggest that major problems in different areas including attention, memory, behavioral control, learning and etc. have been found amongst these children [6].

Memory is a place in which encoding, storing and retrieving of information takes place [7]. The simplest definition of the memory can be regarded as individual's ability to receive and store information that is well-known by most people. In fact, encoding, storing and retrieving information are three necessary steps for memory system to function well though they are interact with each other in the real world [8, 9]. Studies of intellectually

handicapped children showed that they are deficient in short-term and long-term memories as compared to their normal counterparts. Although an intellectually handicapped child may sometimes face major problems with learning at first, s/he is probably able to learn the subject by repeating it several times and then to remember it like other normal people [10]. Based on different studies, the cognitive function and the flexibility of the brain are associated with exercise and physical movements [11]. Haravand khani and his colleagues [12] studied the effect of musical activities on short – term memory in students with mental retardation in their research. 36 mentally disordered girls at the age ranging from 12 to 19 of 4th and 5th grades in the elementary schools participated in their research. The case (experimental) group was exposed to musical intervention consisted of music and rhythmic movements (dancing). Following the analysis of data gathered from this research, they found some evidence that proved the fact that performing activities accompanied by music had a positive effect on short-term memory in mentally impaired students.

In an attempt to find the most effective way, a great variety of researches have investigated the efficiency of alternative methods [13] and among them, game has seemed, with the evidence proving its effectiveness, to be a way of treating a wide range of disorders and problems offered by different researchers and psychologists during several decades [14]. Some experts have examined games for their effectiveness on different aspects of social life while some other researchers looked at their efficacy on emotional development. Several scholars tried to investigate how effective a game can be on mental and physical as well as cognitive development in children. By the same token, a number of investigators have studied the effectiveness of aerobic exercises and rhythmically bodily movements on children's performance function, attention and memory, especially children with developmental and neuropsychological disabilities. But one aspect which has hardly caught researchers' interest is the balanced movements (rhythmic exercises) that are presented to children with mental disabilities in the form of a game.

Children afflicted by intellectual disabilities are the neediest groups deserving to receive such services as games. The importance of games as an intervention (mediator) is significant since research has revealed the effect of games on cognitive, social, emotional and language development, the development of motor skills, creativity and problem solving [15]. It is of highly significant to consider this certain attribute, i.e. the suitable use of good chances of and opportunities for playing a game in order to convey educational messages, expand cognitive acts, develop motor skills, deepen social responsibility and control behaviors. Not only does a game have an effect on the development of cognitive abilities among children but it also affects the physiological structure of their brain [16, 17 and 18]. Rhythm, especially in the form of music and games, plays an important role as a part of different cultures and human education [19]. Today, particular scientific studies have demonstrated the effect of games and rhythmic exercises [20]. Besides, to play such games in a group and in the form of rhythmically pre-determined movements (dancing) can strengthen group behaviors and control mentally disordered children's behaviors too[21].

MATERIALS AND METHODS

The research method used in this study was an experimental type and had a pre- test and post- test design accompanied by a control group. Statistical population of the research comprised all mentally retarded students studying in elementary schools in the city of Esfahan in the academic year 2011-2012. To collect the required sample, 20 children with mental impairment were selected based on random multi- step sampling. That is, two special schools among five educational districts were chosen through. Moreover, 10 students, homogeneous in sensory and motor skills, were selected amongst all mentally disordered students as a sample. Participants in this sample were divided into two groups- control and experimental- and each group was randomly consisted of 10 students. To collect data, Raven IQ test, Vinland adaptive behavior scale questionnaire, Canners neuropsychological test were used. Replication was applied to the given sample based on Raven IQ test, Vinland adaptive behavior scale questionnaire. Having obtained the above children's parents' approval, the researcher gave rhythmically bodily movements (dancing) as an intervening program to experimental (case) group twice a week (45 minutes for each session) for three months. 8 rhythmic games were used in this research. Also, adaptive principles and going from simple to difficult were considered as these games have been presented. After the type of music and the kinds of songs were chosen, they have been approved by three experts or university professors and then performed with the help of physical education teachers in schools. The following are some of rhythmic movements briefly:

Rhythmic line game: in this game, the child should run on a straight line based on the rhythm and the melody of the music and should follow the instructions presented in the song (such as jump, sit down, hop, skip and ext).

Lozenge movement: the kid should move on the color-coded lines of lozenge according to the pattern which has been shown by his/her teacher and this game is also accompanied by music. At first, the child should perform this movement without music but with a song singing by himself/herself.

Sound game: children will demonstrate or simulate the movement of objects when they hear their sound in their surrounding area. For example, as soon as they hear the sound of a plane or a train, they start moving like one of them.

Colored sphere (ball) game: In this game, first colored strips in different sizes are spread on the ground and then spheres (small balls) having the same colors as strips are placed along the strips at different distances. When the song or music start playing, the child should pick the one small ball (sphere) up whose color is being mentioned in the song and then hop along the strip and finally throw the ball into the basket placing at the end of each strip. The number of balls that the child should pick them up can be added to the song or music in this game.

Game of shapes on the ground: different shapes (circle, square and) are put in different parts of the ground. While the child is singing the song playing in the recorder, s/he should move towards the shape mentioned in the song simultaneously. Animal shapes can be used in this game.

Chess board game: the child is asked to stand on a chess-like board and then s/he start hopping or skipping with two legs in different directions by hearing the instruction given in the recorder through music and song (two squares up, three squares right and exit).

Number table game: colored numbers are set inside the perimeter of a square randomly. As soon as the numbers have been mentioned in the song by using the name of animals or flowers, the child should run towards or leap into the required number.

Strip-shape game: the child are asked to walk on the strip and to do the required activity when s/he gets to the point where different shapes are placed based on this/her teacher's instruction (clapping). The number of the shapes will be gradually increased in this game.

Post-test has been carried out on both groups by means of Canners neuropsychological test. The obtained data were transferred to SPSS spread sheet for descriptive and multi-variable covariance (MANCOVA) analysis of data.

Instrumentation

Raven Colored progressive matrixes for children: This test has been revised by Raven in 1956. The test has been designed to measure the reasoning ability in children in the age ranging from 3 to 11. It includes 36 geometric shapes grouped in three sets as AB, B, A. In fact, it is a nonverbally reasoning test that is defined as a criterion for assessing the competence of logically developmental level [22]. Raven's test for children had the score of zero and one. Actually, the minimum score that a child can get in this test is zero and the maximum one is 36. Coe & et al [23], reported the reliability ratio of split- half of the test for the age group of 6 to 14 that has been set at 0.46 to 0.92. Likewise, [22] reported the retest ratio of his revised test for children at the age of 6.5 to 9.5 during one year which seemed to be 0.60 and 0.80. The results from Raven's work indicated that the test was sensitive to the fluctuations in outputs of intellectual activity which was happening at childhood. Amire [24] has reported the ratios of internal constancy of Raven test between 0.89 and 0.97 with 5000 participants.

Vinland adaptive behavior scale questionnaire: Dall has published this scale in 1965 for the first time. Then, Sparrow and his colleagues revised the original one in 1984 [25]. The scale comprises 117 items categorized into annual groups. The required information is obtained from either well-informed people or the participant herself/his self rather than collected from test conditions. This scale is based on the fact that what a person is able to do in his/her daily life. The symbol (+) indicates that the child has managed to do the given job successfully and consequently s/he will get a positive mark. In contrast, the symbol (-) is an indicative of child's failure to do the activity and therefore no mark is given to the child. The symbol (No-) shows the lack of opportunity and person's ability to do the job. In these cases, if the answer of above question is positive but of the following question is negative, the child will get a half mark otherwise no mark will be given to him/her. (F+) suggests the child's irreversible excuse. As a result there is no mark here as well. (-+) implies that the child sometimes does the job and sometimes does not. So s/he will receive a half mark. Farmarzi and his colleagues reported the reliability of 0.93 for sub-scale of this test based on α - Krounbakh method. Annstazi and Barahami [26] reported the validity of 0.81 and reliability of 0.71 for this scale. They believed that the related validity and reliability were deemed to be stronger in early age especially in mentally retarded groups.

Canners neuropsychological test: Canners designed this test in 2004 to assess neuropsychological skills such as attention, memory, sensation and motor activities and spatial -visual processing across four spectrums (invisible to very rich) and it is used for children at the 5 to 12 age groups. Jadidi and his co-workers translated this questionnaire into Persian language and extracted its norm in 2001. Internal reliability ratios ranged from 0.75 to 0.90 while the validity ratio of re- test with an eight- week interval was reported to be 0.60 to 0.90. To assess the construct validity of Canners questionnaire, all items were analyzed. Similarly, their differential validity were strongly confirmed by statistically analyzing the quality of the questionnaire as a tool for differentiating people with ADHD from those who are normal and other clinical groups. Jadidi and his colleagues [27] stated that its construct validity is assessed as being good. Also, the reliability of this tool seemed to be 0.72 by using Cronbach's alpha method.

RESULTS

Descriptive and inferential statistics were used to analyze data. In view of the fact that the values of variances are equivalent in Wilks' lambda test and the data from the research were normal, parametric tests were applied to the research data.

Table1. Descriptive criteria showing memory function for both control and experimental groups obtained from pre-test and post-test

Memory and Learning Scales	Groups	N	Pre-test		Post-test	
			M	SD	M	SD
Short-term memory	Experimental	10	7.50	3.92	4.60	2.23
	Control	10	7.20	4.21	7.40	4.20
Active memory	Experimental	10	5.40	2.61	3.50	2.15
	Control	10	5.20	3.27	5.10	3.21
Long-term memory	Experimental	10	6.40	3.56	4.30	3.17
	Control	10	6.50	3.62	6.60	3.80
General learning	Experimental	10	4.40	2.21	2.70	1.96
	Control	10	4.20	2.16	4.20	2.16
Total memory	Experimental	10	29.60	18.50	18.80	11.85
	Control	10	28.85	16.55	29.10	16.70

Table 1, shows that the means of scores related to memory function scales such as those of short-term memory, active memory, long-term memory, general learning and total (whole) memory have decreased from 7.50 to 6.40, 5.40 to 3.50, 6.40 to 4.30, 4.40 to 2.70, and 29.60 to 18.80 respectively in experimental(case) group from pre-test and post-test indicating the improvement in experimental group's performance related to problems of memory function scales and the whole memory.

Table 2. Results from Laven test showing pre-hypothesis about equivalency of variances for both groups

Variables	F	Freedom of denominator	Freedom of numerator	P.
Memory function and learning	0.130	1	18	0.723

As we see the pre-hypothesis about equivalency of variances for both groups related to two variables – memory function and learning- is confirmed. Moreover, the values of variances for both groups are equal in the society and there is no meaningful difference between them. Consequently, having considered the Laven's pre-hypothesis, the researcher can apply co-variance analysis on research results to study the research hypotheses.

Table 3. Results from MANCOVA analysis showing the effect of rhythmic exercises on children's memory function and learning for both control and experimental group

Criteria	Criteria	Change references	SS	DF	MS	F	P.	ES	SP
Post-test	STM	79.827	1	79.827	60.264	0.00	0.62	0.99	1
	AM	26.491	1	26.491	44.306	0.00	0.50	0.98	1
	LTM	47.012	1	47.012	44.519	0.00	0.46	0.92	1
	GL	50.832	1	50.832	129.439	0.00	0.32	0.71	1
	WM	286.754	1	286.754	195.211	0.00	0.73	0.95	1
Group membership	STM	26.652	1	26.652	20.560	0.00	0.92	0.98	1
	AM	7.739	1	7.739	11.308	0.00	0.91	0.98	1
	LTM	16.168	1	16.168	13.945	0.00	0.83	0.97	1
	GL	3.568	1	3.568	7.363	0.01	0.92	0.91	1
	WM	216.506	1	216.506	32.063	0.00	0.91	0.99	1

STM = Short Term Memory, AM=Active Memory, LTM= Long Term Memory, GL= General Learning WM= Whole Memory, ES= Size Effectiveness, SP= Statistical powers

Results from co-variance analysis in table 3 revealed that as pre-test effect was controlled, the difference among means of post-test scores showing the function of memory scales (short-term, active and long term memories) and general learning in mentally retarded children has appeared to be meaningful for both control and experimental groups($P \leq 0.05$). Therefore, by regarding pre-test scores as a supporting (auxiliary) variable, we can conclude that rhythmically bodily games have an effect on the problems related to memory scales and learning and total memory in mentally disabled children. Based on the eta square root, it can be said that 91% of the changes are the result of the effect of rhythmic movements on memory problems amongst mentally handicapped children who are teachable.

DISCUSSION

Results suggested that having been controlled the effect of pre-test, the researcher found that the difference among the means of post-test scores related to memory scales (short-term, active, long-term memories) and general learning in mentally retarded children for both control and experimental groups was significant ($P \leq 0.05$). Consequently, by considering the pre-test scores as a supporting (auxiliary) variable, it can be concluded that rhythmically bodily games have an effect on learning and memory scale-related problems as well as total memory in mentally retarded children. Although studies on mentally retarded children's memory indicates that they project deficit in their short and long term memories as compared with their normal counterpart, they may learn the required subject if repeated many times and can recall it like other normal people [10]. Memory deficiency gradually and in a long run makes the learning process for these children slower that causes school failure and eventually leads to a lower self-esteem in the student. Besides, because of these happenings, decrease in teacher's, parents' and student's motivation will be followed.

The findings of the current research were in agreement with the research results originating from the work of Kaita Kamijo & et al [28], Whitley & Ball [29], Geregory [30], Usefi & et al [31], Haravandkhani & et al [12] and Saadat Pour & et al [32]. Amiri [24] studied the effect of motor activities and organization on normal children's memory. Results from his research demonstrated that motor activities can improve mentally retarded children's and normal children's functions. Sutoo & Akiyama [33] in their study stated that regularly physical activity can significantly improve memory function and then increase learning ability owing to modifying central nerve system adaptations, especially hippocampus.

For the further clarification of this finding, it is better to say that musical aspect of rhythmically physical games results in establishing and enhancing the interneuron connections in cerebrum cortex through a process that is similar to the developmental process happening in the brain. That is, in the context in which movements accompanied by music the cycles responsible for sending message to inter neurons are created that can stimulate the upper part of nervous system concerned with memory and cognition. Furthermore, the child in rhythmically physical games is required to obey some pre-determined patterns of the games that can provide an opportunity for memory scales, especially active memory, to improve if the patterns are repeated or practiced. Repetition of a pattern in a rhythmic movement can help children to predict what's going on next, that is, the child with the help of his/her memory can predict the next elements of a movement. To sustain the rhythm of rhythmically physical game can enhance the memory in mentally disabled children and at the same time can reduce "memory function scales" problems.

According to the above results, it can be said that rhythmically physical activities, a powerful therapeutic intervention (mediator), have a high potentiality to improve the memory and attention in mentally retarded children who are teachable and as they are accompanied by music and song, they are more exciting and attractive to the mentioned children. So, they can simply be included in educational and rehabilitation programs. They are important because they informally affect the quality of these children and promote the memory and attention which are the underlying assumption of learning process. It seems that the use of rhythmically physical activities is a new way of the early mediators in developing mentally disabled children's skills in such a way that it can impact on cognitive, behavioral, emotional- affective skills. As an implication, therefore, it is better to investigate the effect of rhythmically physical games in pre-elementary levels.

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