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The Effect of Teaching Music on Active Memory of Educable Mentally-Retarded Children

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Abstract

The present study was conducted with the purpose of considering the effectiveness of teaching music on active memory of educable mentally retarded children. For this purpose, a group of 20 mentally retarded students were randomly selected and then the subjects were randomly divided into one experimental group and one control group. Pretest was conducted on both groups and then the test group was taught music for 18 sessions, 60 minutes each (3 sessions a week). The tools used in this study include three subscales of Wechsler Intelligence Scale for Children (WISC-IV), which measure working memory and include letter-number sequencing, digit span and arithmetic. To test the hypotheses, first, descriptive statistics indicators related to pretest and posttest scores were used in data description section, and then, using ANCOVA and proper statistical calculations with SPSS software package, data were analyzed. Results showed that teaching music led to an improvement in working memory performance in working memory subscales, with the most effect being on letter-sequencing and the least effect on digit span subscale ($P<0.01$). Therefore, that the results indicated that teaching music led to improved working memory performance in educable mentally retarded children.

Keywords: music, working memory, mental retardation

Introduction

For compatibility with the environment, human beings have always needed tools to satisfy their physical and mental needs and art has been one of the primary tools for psychological compatibility and mental conformance of humans with different natural and social phenomena. Art is a phenomenon that has spread in all layers of a community. Art is the creator of beauty and mental tranquility in society and the individual. First message of art is inner peace, which leads to consistency and conformity of feelings, emotions, thoughts and tendencies, and the second message of art is social peace resulting in social affinity through sympathy and strengthening of sensory sharing. However, the undeniable effect of art on education, moral and mental purification has always been noticed by psychologists, psychoanalysts, artists and knowledgeable art-enthusiasts (Anaseri, 2001).

Among different arts, since music acts more explicitly and quickly in motivating human emotions and changing mental and social states, and is the most intimate, desirable and most beautiful means of human communication, it should be addressed and used in communication, intimacy and peace. In this regard, Seif Behzad (2008) suggests that music is a unique art which has been a means of comfort for humans over many centuries.

Also, music is a knowledge that today has gained a special position as an efficient and scientific therapeutic discipline among humanities and mathematics (Zadeh Muhammadi, 2009).

In fact, music therapy has referred to the use of music and planned musical program to rehabilitate all people with special needs. American Music Therapy Association (AMTA) (2010) defines music therapy as the use of music for therapeutic goals such as rehabilitation, creation, and reinforcement of physical and mental health. Australian Music Therapy Association (2011) defines music therapy as the planned and creative use of music for securing welfare and health in the individual, so that every individual with any ability and regardless of a musical background enjoys it. In fact, music therapy as a discipline refers to studying and learning of the relationship between music and health (Stige, 2002).

Also, Tagg (2004) suggests that skillful use of music and related tools can prove effective in treating rehabilitation and improvement of life conditions for people suffering from behavioral, emotional, cognitive, social, mental, and social disorders, because music in all arts has more influence due to its audio/energetic nature.

But, the use of music is not limited to behavior and feelings. Today, music therapy is known as one of the effective ways in education. In this regard, Sze and Yu (2004) believe that music therapy plays an important role in special education because many students with disability require special educational treatments and music therapy, due to its variety and appeal, has many of these characteristics. In Individual with Disabilities Education Act (1997), also, music therapy has been considered as one of the methods related to special education.

Lattom (1981) reports regarding part of his results that music therapists have worked with different ages ranging from children to elders with too diverse reference patients. These patients have had various illnesses including mental illnesses, growth disabilities, physical disabilities due to neural injuries, orthopedic disabilities, sensual injuries, and other medical disorders for treatment of which caretakers have utilized special music therapy methodologies. For this reason, Aldridge (2007) considers music therapy as a challenging but effective method in rehabilitating slow-paced people, claiming that music can be effective in restoring, maintaining and improving emotional, physical, physiological, and mental health of mentally retarded people.

In this regard, it should be noted that one of the characteristics of mentally retarded people is difficulty in remembering information. Deficiencies of these people in terms of memory are very broad, but they often have certain problems in active memory (Bray, Flethcher & Turner, 1977, as cited in Callahan and Kaufmann, 2003). These people also have problems with memory. The stronger the intellectual disability, the stronger memory failure will be (Ghobari Bonab & Khanzadeh, 2009). Active memory is considered as the ability to store information in mind until the end of an activity (Barkley, 2000) or as a mental system responsible for temporary information storage and processing for doing a series of complex cognitive task (Moradi, 2010). Today, it is assumed that performance in different cognitive tests such as reading perception, auditory perception, and logical thinking generally depends on active memory capacity (Bekman et al, 2007). Frequent failures of children with low memory in satisfying active memory demands in classroom environment is at least one of the reasons accounting for their weak educational progress. To secure educational goals, the child has to succeed in many learning assignments, which can result gradually in promoted knowledge and skill. This knowledge and skill are necessary in various curriculum areas. If children fail in individual learning situations simply by not being able to store and manipulate information in the active memory they will act weakly in obtaining knowledge and complex skills required on daily basis in life such as reading and writing (Gathercol and Alovey, 2004, as cited in Arjmandnia, 2010). Also, extensive studies have been conducted regarding the effect of music on memory. Chi Ho and Chun (2003) see music as systematically and regularly effective on active memory processing. Collier and Logan (2004) believe that memory performance

using rhythmic stimulations in alternative audition is better than when visual stimulations are used. It is suggested that music leads to memory boost via mental visualization (Rah Nejat, 1999).

Given that the most significant characteristic of slow-paced people is their little ability for learning and given that memory plays a considerable role in learning process and knowing that educational advancements should be based on accurate planning and desired educational planning is based on sufficient knowledge of target group's traits and various trainings and considering stated topics, clearly the relationship between teaching music and active memory stands out. Now, the question this study seeks to answer is, "can teaching music, considering special characteristics of slow-paced children affect active memory improvement in these children?" On the other hand, doing such studies can result in identifying most memory systems in this group of people, leading to more accurate identification and their education. This allows educators and teachers to introduce changes in teaching and educational programs, which results in improved memory performance and, generally, better learning.

Purpose of the study The purpose of the present study is to identify the effect of teaching music on active memory of mentally retarded children.

Hypothesis of the study

Main hypothesis

H1: Teaching music has a positive effect on active memory of mentally retarded children.

Minor hypothesis

H2: Teaching music influences the digit span of educable mentally retarded children.

H3: Teaching music influences digit-letter sequence in educable mentally retarded children.

H4: Teaching music influences educable mentally retarded children's arithmetic.

Methodology

Since in this study the effectiveness of teaching music on active memory of educable mentally retarded children has been considered, we are dealing with an experimental study in which a pretest-posttest plan with control group has been used. As it was already mentioned, for teaching music, eighteen 60-minute teaching music sessions with a predefined program was considered. During these sessions, different techniques with emphasis on active music therapy, e.g. playing music pieces and children's imitation of educator's moves and practices that had been integrated into music to improve students' skills were used to promote children, and the extent of the resulting effect is determined by performing pretest and comparing the results with posttest scores.

The statistical population consists of all educable mentally retarded children studying in Tehran special schools in the academic year of 2014-2015.

In the present study, random sampling was used for sampling. On this basis, according to input criteria, 20 educable mentally retarded children who had referred to the Association for Supporting the Mentally Retarded in order to receive special educational programs and who were studying in first to fifth elementary school grades, were selected for training and then were distributed randomly in two 10-people groups of intervention and control.

To conduct the study, letter of introduction was received from the Department of Psychology and Social Sciences of Islamic Azad University – Tehran Central Branch and then the authors referred to the Association for Supporting the Mentally Retarded and after presenting the study plan, arrangements were made for conducting the intervention. Then, given existing cases of clients, a 20-people sample group was selected randomly considering required conditions for taking part in educational program, and then, the sample group was put in two 10-people groups of intervention and control. Next, pretest was taken on both groups and the intervention group underwent eighteen 60-minute music-education sessions, and after the sessions, posttest was conducted to evaluate

effectiveness of the exam. In this study, descriptive statistics such as frequency, percentage, mean, and diagram) and inferential statistics were conducted for data analysis.

Data analysis and results

Hypothesis 1:Teaching music influences active memory in educable mentally retarded children.

To investigate the effect of teaching music on active memory scores for maintaining the effect of active memory pretest scores in two groups of intervention and control and comparing posttest active memory scores, analysis of covariance (ANCOVA) was used. Results are shown in table 1.

Table 1: Results of ANCOVA for active memory scores in experimental and control group

Variation sources	Sum of squares	df	Mean squares	F	Sig.	Eta coefficient
Pretest	473.683	1	473.68	346.83	0.001	
Group	172.756	1	172.75	126.49	0.001	0.882
Error	23.217	17	1.36			
Total	626.950	19				

Table 1 shows that given significance of the difference of active memory pretest scores (F(17,1)=346.83, P<0.01), value of calculated F for active memory posttest scores in experimental and control group after keeping constant the effect of pretest is significant (F(17,1)=126.49, P<0.01). Therefore, there is a significant difference between mean of active memory pretest scores of educable mentally retarded children in experimental and control group by keeping constant the effect of active memory pretest scores. Comparing adjusted means of the two groups shows that mean of active memory scores in educable mentally retarded children of the intervention group (M=22.89, SD=0.37) is higher than that in control group (M=17.01, SD=0.37). Square eta calculated is equal to $E\tau\alpha^2$=0,882 which shows the great effect of music on active memory of mentally retarded children. According to Cohen (1998), if square eta is equal to 0.01, it shows a small effect, 0.06 denotes an intermediate effect and 0.138 shows a great effect. Therefore, teaching music has influenced active memory of educable mentally retarded children in the intervention group who have undergone this test more than that of control group who have not undergone this training, leading to increased active memory scores of the intervention group. To assess the effect of teaching music on each of the scores of the active memory subscales, the following three hypotheses were investigated:

Hypothesis 2: Teaching music influences digit span scores of educable mentally retarded children.

ANCOVA was used to consider the effect of teaching music on digit span scores, in order to keep constant the effect of digit span pretest scores in the intervention and control groups and compare post-test digit span scores. Results are presented in table 2.

Table 2: ANCOVA result for digit span scores in two groups of intervention and control

Variation sources	Sum of squares	df	Mean squares	F	Sig.	Eta coefficient
Pretest	87.636	1	87.636	277.71	0.001	
Group	9.825	1	9.825	31.13	0.001	0.647
Error	5.364	17	0.316			
Total	109.200	19				

Table 2 shows that given the significance of the difference of digit span scores (F(17,10)=277.71, P<0.01), the F value calculated for digit span posttest scores in experimental and control group after preserving the pretest effect is significant (F(17,1)=31.13, P<0.01). As a result, there is significant difference between mean digit span pretest scores of educable mentally retarded children in experimental and control group by preserving the effect of digit span pretest scores. Comparing adjusted means of the two groups shows that mean digit span scores in educable mentally retarded children in the intervention group (M=8.90, SD=0.178) is higher than those in the control group (M=7.49, SD=0.178). Square eta calculated is $E\tau\alpha^2$=0,647, showing great effect of music on digit span of educable mentally retarded children. According to Cohen (1998), if square eta is 0.01, it indicates a small effect, 0.06 shows intermediate effect, and 0.138 shows strong effect. Therefore, this teaching music has influenced digit span of educable mentally retarded children who have received this training compared with those in the control group who have not received this training, leading to increased digit span scores in the intervention group.

Hypothesis 3: Teaching music influences digit-letter span scores of mentally retarded children.

ANCOVA was used to investigate the effect of teaching music on digit-letter sequence scores for preserving the effect of pretest digit span in the experimental and control group and comparing posttest digit-letter sequence scores. Results are shown in table 3.

Table 3: Results of ANCOVA for digit-letter sequence scores in two intervention and control groups

Variation sources	Sum of squares	df	Mean squares	F	Sig.	Eta coefficient
Pretest	36.566	1	36.566	48.43	0.001	
Group	33.167	1	33.167	43.93	0.001	0.721
Error	12.834	17	0.755			
Total	78.200	19				

Table 3 shows that given the significance of the different pretest digit-letter sequence scores (F(1,17)=48.43, P<0.01), the F value calculated for posttest digit-letter scores in the experimental and control group after preserving the effect of pretest is significant (F(1,17)=43.93, P<0.01). As such, there is significant difference between mean posttest digit-letter sequence scores of educable mentally retarded children in the experimental and control group by preserving the effect of pretest digit-letter sequence scores. Adjusted means of the two groups show that mean digit-letter sequence scores in educable mentally retarded children in the intervention group (M=5.99, SD=0.275) is higher than those in the control group (M=3.40, SD=0.275). Square eta calculated is $E\tau\alpha^2$=0,721, suggesting the great effect of music on digit-letter sequence of educable mentally retarded children. According to Cohen (1998), if square eta is 0.01, it shows a small effect, 0.06 shows intermediate effect and 0.138 shows a high effect. Therefore, teaching music has influenced digit-letter sequence of educable mentally retarded children from the intervention group who received this training compared with children of the control group who did not receive this training, leading to increased digit-letter sequence scores for the intervention group.

Hypothesis 4: Teaching music influences arithmetic scores of educable mentally retarded children.

ANCOVA statistical test was used to investigate the effect of teaching music on arithmetic scores when preserving the effect of pretest digit span scores in the experimental and control group and comparing pretest arithmetic scores. Results are presented in table 4.

Table 4: ANCOVA results for arithmetic scores in the two groups of intervention and control

Variation sources	Sum of squares	df	Mean squares	F	Sig.	Eta coefficient
Pretest	77.276	1	77.276	172.31	0.001	
Group	16.475	1	16.475	36.73	0.001	0.684
Error	7.624	17	.448			
Total	88.950	19				

Table 4 shows that given the significance of different pretest arithmetic scores (F(1,17)=172.31, P<0.01), F value calculated for posttest arithmetic scores in the experimental and control group after preserving the effect of posttest is significant (F(1,17)=36.73, P<0.01). As a result, there is significant difference between mean posttest arithmetic scores of educable mentally retarded children in the experimental and control group by preserving the effect of pretest arithmetic scores. A comparison of adjusted means of the two groups shows that mean of arithmetic scores in mentally retarded children in the intervention group (M=7.98, SD=0.215) is higher than that in the control group (M=6.11, SD=0.215). Square eta calculated is $E\tau\alpha^2$=0,684, showing great effect of music on arithmetic of educable mentally retarded children. As a result, teaching music has influenced arithmetic of educable mentally retarded children in the intervention group who underwent this training compared with those in the control group who did not receive this training, resulting in increased arithmetic scores of the intervention group.

Broadly speaking, comparing square etas calculated for each active memory subscale it becomes clear that although teaching music greatly influences all three active memory subscales, it has the biggest effect on digit-letter sequence subscale ($E\tau\alpha^2$=0,721) and the smallest effect on digit span subscale ($E\tau\alpha^2$=0,647).

Discussion and Conclusion

First hypothesis: Teaching music influences active memory in educable mentally retarded children.

Given ANCOVA results and their significance when compared with adjusted means of the two groups, it was determined that mean of active memory scores in educable mentally retarded children shows a significant difference between pretest and posttest scores in the intervention group, confirming the main hypothesis. This finding is in line with results of various studies that have considered the effect of music therapy on cognitive processes such as attention, memory, and learning of mentally retarded children (e.g Rasher et al, 2007; Gregory, 2002, Kim, Wigram and Gold, 2008; Lizali, Pasha and Akhavan, 2004; Muhammadi, 2004; Karimi Zare' and Hadian Fard, 2011; Moradian, 2004, Mirzamani, Hodavand Khani, 2008, Khalaf Beigi, 2004).

On other hand, the findings of this study endorse the theory of Glickson and Cohen (2000) concerning the effect of music on memory. These two believe that music leads to constructing and reinforcing inter-neuronal link in cerebral cortex over a process resembling evolution process in brain, boosting higher parts of the neural system dealing connected to memory (cited by Husseini Tonekaboni, 2003). Musical activities such as playing an instrument also undergo the same pattern in the mind, therefore, these two processes i.e. memory and music can improve each other by repetition and rehearsal (Bilhartz et al, 1999).

Second hypothesis: Teaching music influences digit span of educable mentally retarded children.

Given the results obtained from ANCOVA of groups and comparing the resulting mean, adjusted means of the two groups show that mean of digit span scores in educable mentally retarded children in the intervention group is higher than that in the control group, showing significant difference between pretest and posttest in the intervention group and confirming the hypothesis.

Findings of the present study are in line with studies of Lam and Price (1998), who investigated music effect on mathematical progress of students suffering from behavioral problems and found that all students aged 9 to 10 for whom calming music was played exhibited a significant improvement in their mathematical skills.

Third hypothesis: Teaching music influences digit-letter sequence scores in educable mentally retarded children.

Considering the groups' ANCOVA results and comparison of the obtained mean, it becomes clear that mean of digit-letter scores in educable mentally retarded children in the intervention group is higher than that in the control group, showing a significant difference between pretest and posttest scores of the intervention group compared with the control group, thus confirming the hypothesis.

Shaw et al who considered the effect of teaching music on math learning found that teaching music leads to increased thinking capability and distance detection awareness, with the two skills being highly important in mathematics (as cited in Jensen, 1950, translated by Omrani Gargari, 2007), which has a positive and significant relationship with the present study.

Findings of the present study are consistent with those of Whitehead (2001), who considered the effect of Orff-Schulwerk teaching music on middle school and high school math scores.

Fourth hypothesis: Music therapy influences arithmetic scores of educable mentally retarded children.

Given the results obtained from the groups' ANCOVA results and their significance, it is found that mean arithmetic scores in educable mentally retarded children of the intervention group are higher than those of the control group, showing significant difference between pretest and posttest of the intervention group and control group, thus proving the study hypothesis.

Also, it is consistent with findings of Gregory (1988) whose study results showed that classes integrated with teaching music showed more significant progress compared with the control group classes.

With regard to studies consistent with this study's findings, works such as Babo (2001), Cardley (2003), Cobb (1997), Cox (2001), Freaks (1984), Hang (2004), Lynch (1993), Miranda (2001), Michel (1994), Perish (1984), Sneider and Claus (2000), Anderwood (2000), Zanoto (1997) can be named, who have emphasized the effect of teaching music on students' educational progress. However, Heiness (2000) has not reported in his study significant with regard to the effect of teaching music on reading and math. McKelvie and Law (2002) also found no significant results when considering the effect of Mozart music on students' memory and intelligence.

As a general conclusion of these findings, it could be noted that teaching music leads to better performance of active memory in all three subscales of Wechsler Intelligence Scale for Children (WISCIV), thus, it can be concluded that teaching music improves active memory performance in mentally retarded children.

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