



Investigating the Music and Melodic Teaching Impacts on the Math Learning Progress of Elementary School Students

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Abstract

Inventing and applying motivational, highly efficient, and engaging strategies for teaching elementary school students is a concern that has always occupied the minds of teachers and experts in this field. Meanwhile, using music as an easy and accessible, low-cost, and popular solution in creating and promoting creativity, self-confidence, motivation, and cognitive skills and students' self-directed learning has been considered an important and effective strategy. To this end, the present research investigated the music and melodic teaching impact on the math learning progress of the third-grade elementary school students in Tehran. The research adopted a quasi-experimental design with the experimental and control group. The statistical population included about 20,000 third-grade students in region 1 of Tehran that were selected as available sampling from two Rastar and Meysam Tamar schools, from which 30 students were randomly assigned to the experimental and control groups (15 in each group) as the study sample. Both groups learned the same and the specified concepts. However, the experimental group learned these concepts using music and melodic teaching while the control group learned these concepts using the lecture-based teaching method and the final math scores of the students were used in the analyses. As the instrument, a demographic information questionnaire, the mathematics motivation questionnaire, a progress test and an achievement test were used in this study. The results of covariance analysis showed that teaching math using music and melodic method has a significant positive impact on elementary school students' math learning (70.8%) and more motivated learning (86%). Therefore, it can be concluded that by using melodic teaching in teaching math concepts can be more effective than traditional teaching methods.

Keywords: Elementary School, Learning, Math, Melodic teaching, Music

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Introduction

Nowadays, lack of effectiveness of educational efforts in schools, lack of expected internalization of values, lack of the morale of generating creativity, innovation and

thinking in students, lack of efficiency and knowledge of the learners, the continuing request for education, and the high expectations of families from the education system to provide educational services, and in a word,

the low quality of education in the context of the educational system of a society, have concerned many educational scholars and executors of educational issues. However, the controversial issue of learning has taken over the mind of society during numerous educational stages and levels, one after another, as significant and vital competition (Vali Puri, 2016).

Promoting learning is the purpose of any educational activity. Learning is the acquisition of knowledge and information about different habits, various skills and different ways of solving problems (Garzón & Acevedo, 2019). Teaching involves a teacher and student interaction to make changes in student behavior based on teacher regular and purposeful design (Lewis et al., 2017). Teaching comprises a variety of concepts such as attitudes, tendencies, beliefs, habits, and behaviors, and generally the types of changes we want to make in students. In guiding students' learning, the teacher's role is to provide context and conditions for learners to understand the contents. Media and educational tools are facilities that will help students greatly in conceptualizing and generating knowledge if appropriately used in the teaching-learning process.

In contemporary society and the digital age of the third millennium, traditional and teacher-centered methods and the so-called soliloquy discourse are certainly not practical. Therefore, teachers try to use the best ways to educate students by involving them in different ways of presenting the contents and providing them with opportunities to strengthen their motivation and self-confidence. In the quality of the learning and teaching process, many factors are directly and indirectly involved. Some of them accelerate the process, and others negatively affect it. A large percentage of children at school age have problems in the math learning process, and the number is almost equal to those who have trouble reading. It is also shown that even some students with natural intelligence have problems in calculating the numerical process known as a failure account (Esteki et al., 2007).

On the other hand, music training is one of methods that, with a very positive impact on facilitating learning and facilitating the teaching process, can have a very significant effect, especially in the early stages of education, such as preschool and elementary school. Adding music to the elementary education curriculum will be beneficial and fun due to its charm and sweetness, and it will help concepts teaching and easy understanding (Barkhoda et al., 2015).

The relationship between music and math goes back to at least 500 years BC. This relationship has been monitored through common interpretations such as the relation and pattern. Pythagoras used math to understand musical concepts to expand his opinion in the field of

music. Math, music, and their communication say that: the music and math evoke the 'deep level' of the understanding of nature and human beings. Music shows a sensational impact, and math shows a logical impact of nature. The math purpose is not only to follow the accuracy of a problem but also to understand the reason for its correctness. The mode of playing a piece of music is just like understanding a math problem; meaning is associated with valid symbols, which include all essential information. The existence of such a relationship has led many researchers to examine the impact of teaching music and the ability to learn math in elementary school students. The results of studies show that rhythmic education dramatically increases math learning ability (Qasim Tabar et al., 2011). It has also been shown that art and music use at the lowest cost can bring the teacher and student to the desired result (Dehghani & Amara, 2018). Education with music can improve and facilitate children's learning skills. A rich musical experience, including singing, listening, and moving, creates excitement in children and provides the basis for their progress in reading, writing, thinking, and other skills.

Over the past decades, researches have yielded significant results on the positive impact of music education on the behavior and the development of cognitive skills (attention, language, reasoning, logical thinking, critical and mathematical thinking, planning, emotion control, and working memory) at all stages of human development. According to research results, music activities can help children create awareness and multisensory response to sounds (Sala & Gobet 2020). Moreover, learning with music is effective in processing lexical skills, improving voice recognition abilities, phonology, speech, and reading in children (Moreno et al., 2009). Anthony et al. (2018), in their experimental intervention study, found that teaching music skills is a valuable strategy to help children with reading difficulties. According to Tai et al. (2018), there is a clear relationship between music education and general academic achievement. Furthermore, Kamankesh and Salehi Omran (1399), in their research, concluded that the learning model based on music is effective in students' self-directed learning and has led to an increase in self-directed learning scores, and its components include self-control, self-management and tendency to learn.

Similarly, Ghasem Tabar et al. (2011), in a study entitled "*The effect of music teaching on the basic math skills of preschool children*", concluded that Orff music training increases the preschool learners' ability to classify skills, identify similarities and differences, and mentally retain numbers and geometry. Nowadays, a new topic discussed is the effect of melodic teaching and

music on students' learning, which has received less attention (Villamizar, 2021). Unfortunately, despite the above mentioned literature and the effect of music on learning, music and its functions are not officially used in our country's educational system. It is necessary to monitor and prove the effectiveness of music from different perspectives through practical research in school classrooms and based on the obtained results, the authorities can make a correct and appropriate decision. Therefore, this study aimed to investigate the effect of music and melodic teaching on elementary school students' math progress and learning. Regarding the objectives of the study, the following hypotheses were formulated:

First hypothesis: Music and melodic teaching have a significant positive effect on more motivated math learning of elementary school students.

Second hypothesis: Music and melodic teachings have a significant positive effect on better math learning of elementary school students.

Method

Research Design

Considering that the sampling was not random in this study, the research design was quasi-experimental with the experimental and control group. The quasi-experimental design requirements, such as pre-test and post-test, and delayed post-test, were included.

Participants

The statistical population included all students in region 1 of Tehran studying in third grade in 2020-2021 from which thirty students were selected as a statistical sample from two schools (Rastar and Meysam Tamar). They were then randomly assigned to two experimental and control groups (15 members in each). The entrance criteria to this study included normal intelligence, lack of disabilities in the auditory area, the informed consent of the parents, and lack of learning disorders while the exclusion criteria included using other methods for learning mathematics as well as the participants' or their parents' dissatisfaction with the continued cooperation with the research group. In this study, the history of audio-musical, and theological-cultural differences were disturbing variables, whose results were not controlled on the results, but intelligence was evaluated using Children Wexler-Test as an interventional variable at the beginning of the study.

Instruments

For gathering data, a demographic questionnaire, Mathematic Motivation Questionnaire, a progress test and an achievement test (the post-test) were used.

The Mathematic Motivation Questionnaire included 18 articles and three subscales: 'math interest', 'mathematical self-esteem', and 'internal motivation'. In the mathematical motivation questionnaire, the lowest score was 18 while the highest score was 82. Items 1 to 10 were related to the subscale of interest in mathematics, developed by Nemati (2009). At the subscale of interest in mathematics, the lowest score was 10 and the highest score was 50. Items 11 to 15 were related to the subscales of 'mathematical self-esteem' and items 16 to 18 in the 'internal motivation' subscales were taken from the Kurter (2005) study titled 'Motivation, Independence and Math Performance.' In the subscales of internal motivation and mathematical self-esteem, a 4-point Likert scale was used. Massoudi (2012) confirmed the validity and reliability of this questionnaire and its subscales.

Moreover, a progress test was used to assess participants' learning designed by the educational groups of the Tehran Education Department, in the form of multiple-choice questions which were scored from 1 to 20. Also, an achievement test used as the final exam (the post-test) was devised by one of the experienced teachers considering the content learned in the second-semester and the difficulty level from easy to hard.

Procedure

After selecting the participants, in the experimental group, a specific method of combining music and rhythm was used for learning mathematical concepts, and the control group experienced routine teacher lecture-based teaching method. The researcher practiced teaching math in the experiment group classes (concepts such as numbers, addition, subtraction, multiplication, multiplication table, etc.) through various methods such as rhythmic and melodic expression of the lesson, playing musical videos containing pictures of math concepts voiced-over with a selection students' favorite music (popular cartoons), inviting students to accompany in singing and keeping the rhythm by shaking hands while teaching and playing the clip, asking them to repeat the lesson in the form of rhythmic and melodic expression by shaking hands, and similar cases.

Statistical Analyses

To test the research hypotheses, univariate analysis of covariance was used. Before performing the analysis of covariance, its assumptions were examined (Kolmogorov Smirnov test, Levene test, similarity of regression slope), and the results are reported as follows.

Findings

In this section, the research sample's demographic information and statistical description (mean, standard deviation, etc.) of the study variables are analyzed.

Moreover, the results of inferential data analyses are presented considering the hypotheses of the study. The demographic information of the participants' parents are presented in Table 1.

Table 1.

Description of Research Participants in Terms of Parental Education

Education	Group	Mother Education		Father Education	
		Frequency	Percentage	Frequency	Percentage
Diploma and Lower	Control	1	6.7	2	13.3
	Experimental	12	0	1	6.7
Bachelor Degree	Control	9	60	5	33.3
	Experimental	3	80	11	73.3
Master Degree and Higher	Control	5	33.3	8	53.3
	Experimental	15	20	3	20
Total	Control	15	100	15	100
	Experimental	15	100	15	100

As Table 1 shows, most parents had a bachelor's degree.

Table 2.

The Statistical Description of the Research Variables

Variables	Group	Pre-Test		Post-Test	
		Mean	SD	Mean	SD
Math Motivation	Control	45.33	13.10	45	12.61
	Experimental	49.13	12.71	68.33	8.97
Math Learning	Control	15.20	3.72	15.33	3.79
	Experimental	13.93	2.98	1833	1.44

As Table 2 shows, the average of "math motivation and math learning" of the experiment and control groups in the pre-test is not much different. However, the average of "math motivation and math learning" in the post-test of the two groups were significantly different, and in all the dimensions, the mean of the experiment group increased more than that of the control group.

Inferential Data Analysis

According to the present research design consisting of a pre-test and a post-test, univariate analysis of covariance was used to analyze the data and control the effect of pre-test and post-test. In this type of analysis, the following conditions must be met to be sure of the results. One of the assumptions of the test is the normality of the data. The results of the Kolmogorov-Smirnov test are presented in Table 3.

Table 3.

Results Obtained from the Kolmogorov-Smirnov Test

Component	Test Time	Kolmogorov-Smirnov	Sig.
Learning Motivation	Pre-Test	0.111	0.200
	Post-Test	0.149	0.200
Math Learning	Pre-Test	0.200	0.070
	Post-Test	0.211	0.072

The results indicate that the p-values in the above test are greater than 0.05 which shows that the available data is normal. The second assumption is the homogeneity of

the groups' variance. The Levene test is used to evaluate the homogeneity of variance of groups. The data analysis is presented in Table 4.

Table 4.

Evaluation of Groups' Homogeneity through Levene Test

Variable	Test Time	Levene test	DF1	DF2	Sig.
Math Motivation	Pre-Test	0.181	1	28	.675
	Post-Test	3.074	1	28	.090
Math Learning	Pre-Test	0.819	1	28	.373
	Post-Test	0.956	1	48	.353

Considering that the significance level in the Levene test was more than 0.05, it can be claimed that the groups' variance was homogeneous. Another assumption to be observed is regression homogeneity. The homogeneity assumption of regression slope was examined to investigate lack of interaction between the groups and pre-test scores. The results are shown in Table 5.

The result showed that calculated F at the level of 0.05 was not significant ($p > 0.05$). Therefore, the regression slope in the variable of learning dimensions is the same, and there is no interaction between the groups and the pre-test.

Table 5.

Evaluation of Regression Slope Homogeneity

Source of Change	F	Sig.
Math Motivation	15.49	0.123
Math Learning	20.16	0.116

Hypotheses Testing

In order to test the first hypothesis stating that "Music and melodic teaching affect more motivated learning of math", the Analysis of Covariance was used.

Table 6.

Results of the First Hypothesis Covariance Analysis

Math Motivation	Sum of Squares	DF	Mean Square	F	Sig.	Eta Squared
Pre-test of Math Motivation	2886.134	1	2886.134	166.082	.000	.860
Group	15.20	1	3033.787	174.579	.000	.866
Error	469.199	27	17.378			
Total	103772.000	30				

Table 6 shows that the average effect of melodic teaching on students' more motivated learning increased significantly in the post-test phase. However, to eliminate the effects of the pre-test, analysis of covariance test was used, and the results showed a significant difference between students' learning in the post-test phase. Accordingly, the hypothesis of music and melodic teaching effect on more motivated learning

of math is confirmed. The effect size in the post-test stage is about 86%. In other words, about 86% of students' learning motivation improvement was due to the effect of music intervention and melodic teaching.

Also, for the examining the second hypothesis of the study saying that: "Music and melodic teachings affects the better learning of math", the analysis of covariance was applied.

Table 7.*Results of the Second Hypothesis Covariance Analysis*

Math Learning	Sum of Squares	DF	Mean Square	F	Sig.	Eta Squared
Pre-test of Math Learning	183.900	1	183.900	160.172	.001	.797
Group	113.412	1	113.412	65.477	.001	.708
Error	46.767	27	1.732			
Total	8799.000	30				

As shown in Table 7, the average effect of melodic teaching on students' better learning increased significantly in the post-test phase. However, to eliminate the effects of the pre-test, analysis of covariance test was used, and the results showed a significant difference between students' learning in the post-test phase. Accordingly, the second hypothesis was confirmed. The effect size in the post-test stage is about 70.8%.

Discussion

The present study examined the impact of music and melodic teaching on the math learning progress of elementary school students in Tehran. The findings of the study showed that teaching integrated with music and melodic method has a significant positive impact on more motivated learning (86%) and better learning (70.8%) of math in the third-grade elementary school students. Considering this result, using music as an easy and accessible, low-cost, and popular solution can be regarded as an essential and effective strategy for quality teaching of math to children. The results of this study are in agreement with the findings of Mazlum Shahraki et al. (2019) and Goodarzi and Mahmoudzadeh (2018) who found that using music had a positive impact on teaching and learning of elementary school curriculum. Also, the results are in line with results of research by Ghasem Tabar (2012) who concluded that the use of music in education can enhance preschoolers' ability to classify skills, identify similarities and differences, and mentally retain numbers and geometry.

Researchers who study math teaching have identified numerous drawbacks in traditional methods of teaching and the used curriculum to teach math to students worldwide, including students who generally show low mathematical progress since they often create anxiety related to math learning (Wiener, 1997). Traditional math education, including the same way of teaching for all students and lectures on textbooks, insists on one correct way to solve problems and ignores students' conceptual understanding. The studies recommend some strategies such as using problem-solving activities to develop learners' conceptual understanding, challenging the game-subject activities, and using models and

simulations to encourage discovery, which may include the potentials to increase students' success in math and positive motivation to learn (Tobias, 1998).

Conclusions

The integration of music in teaching is an effective method which can bring about significant changes in education through facilitating the learning process, especially in the early stages of education, such as preschool and elementary school. Interdisciplinary activities such as music that integrate math education into attractive areas provide students with an opportunity to understand and apply math knowledge. New studies have shown that there are many links between music and math. Math concepts such as numerical relationships, ratios, integers, logarithm, arithmetic operations, trigonometry, and geometry are related to music elements such as melody, rhythm, intervals, scales, harmony, and adjustment (Ann et al., 2014). These natural overlaps between music and math provide teachers with opportunities to show math concepts and processes through music themes (Ann et al., 2011).

Over the past two decades, researchers have followed a research line on the results of the inclusion of music activities in math education. These studies have shown empirical evidence that music has the potential to improve math progress and students' attitudes. Research has shown that music activates the left and right hemispheres of the brain simultaneously (Sammler, Koelsch, & Friederici, 2011). Activating both hemispheres can maximize learning and enhance memory. Moreover, listening to music releases endorphins, a neurotransmitter to enhance feelings of joy and excitement, which boosts temper and calms students (Dunbar, Kaskatis, Macdonald, & Barra, 2012). This relaxation can eventually lead them to study more efficiently and better, resulting in better and more motivated learning. According to the results of this study, the students' learning motivation enhanced as they were greatly passionate and enthusiastic before entering the class each session. What is interesting is that there were even some participants from adjacent classes willing to take part in the experimental class due to the use of music.

Like all other studies, the present research suffers from some limitations. The study sample size, participants' gender, and their educational level were among these limitations. Other studies with a larger sample size, using both genders, and other educational levels can provide more comprehensive results. Also, music can be used in teaching other subjects to pave the way for more comparisons of the results. Due to the limitations of using music in our country educational system, more research must be done on the scientific and practical evidence of music benefits in this field. Recognizing the possible capacities, functions, and effects of music on the learning process will pave the way to the practical application of music in various fields of education, especially in schools.

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Conflicts of Interest

No conflicts of interest declared.

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