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Using songs in mathematics instruction: Results from pilot application

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Abstract

In this research it was aimed to examine the effects of mathematics course that are supported by using songs on students' attitudes, achievements and multiple intelligences. In this study pre test-post test experimental design with control group and time series design were used. Sample of the study was composed of 286 third graders at primary schools. Scale of Attitudes towards Mathematics, Mathematics Achievement Tests for 5 units, Multiple Intelligences Inventory for Students were used as data collecting instruments. In this research meaningful differences in favor of experimental groups on attitudes towards and mathematics success in pre test post test comparisons were obtained.

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Keywords: Songs in mathematics; attitudes towards mathematics; mathematics achievement; multiple intelligences.

1. Introduction

Recently, there has been more emphasis upon teaching mathematical concepts and knowledge. The need has been increasing to establish a mathematics education in which students can relate the concepts to their own lives and to the other disciplines and which aims to have students acquire the basic skills and strategies at the primary school (MEB, 2004:4). The achievements of the Turkish students in mathematics are towards the end of the list of OECD countries according to TIMSS (EARGED; 2003) PISA (Dünya Bankası; 2005). Among 40 countries which participated in PISA 2003 Project Turkey is number 28 and ranks 33 among all the countries regarding the success of the students in mathematics. Turkish students rank the number 43 in mathematics among 57 countries in the group of 400.000 students at the age of fifteen in 2006 and is the number 44 considering the GPA of the students (<http://earged.meb.gov.tr/pisa/dil/tr/pisanedir.html>). These results highlight not only the academic achievements of the Turkish students but also their learning and teaching processes and methods. For most, mathematics is considered as difficult to understand and boring (Batdal, 2005).

Bohuslav (1980), Byrd (1982), Burton (1984), Greenwood (1984), Strawderman (1985), Williams (1988) hold that the traditional methods used in mathematics increase the anxiety level of the students. (Baloğlu; 2001:63-

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37). On the other hand, some researches show that there is a positive correlation between music and mathematics. In the studies conducted by Olanaf and Krishner (1969), Delehanty (as cited in Şendur and Akgül Barış, 2002) Gardner (1986) Gardner, Fox, Jeffery and Knowles (1996), Shoew, Rouscher, Levine, Wight, Dennis and Newcomb (1997), Yoshida (2005) it is found out that music increases the students' performances in mathematics and enhances their skills. It is possible to hypothesize that when music and mathematics are used together this might affect the attitudes of the mathematics students positively and increase their performance. Hence it is essential to probe into the processes that will utilize the multiple intelligences, develop the positive attitudes of the students towards mathematics and increase their mathematics performance in the primary education. In the other study conducted by Miles (1997), Jensen (2002), (Cavanaugh, 2005) it was found that music affected students' performance, attitudes, psychomotor skills, thinking and learning outcomes positively. In addition to these studies Ramey and Campbell found that when they taught musical game to the students in prep class at University of North Carolina, the students' mathematics scores were increase (www.menc.org). Song CD's that were applied and gathered positive affection called *We Love Mathematics With Miss Jenny* (<http://edutunes.com>) and *Musical Mathematics with Skip Counting* (<http://songsforteaching.com>) etc. Materials are used in USA by hundred of teachers and families.

It is possible to hypothesize that when music and mathematics are used together this might affect the attitudes of the mathematics students positively and increase their performance (Kocabaş, 2004). Hence it is essential to probe into the processes that will utilize the multiple intelligences, develop the positive attitudes of the students towards mathematics and increase their mathematics performance in the primary education

1.1. Purpose of the study:

In this research the aim was to examine the effects of mathematics course supported by using songs on students' attitudes, achievements and multiple intelligences.

2. Method

2.1. Design of the experiment:

In this study pre test-post test experimental design with control group was used which brings important data about the effects of independent variable on dependent variable. In addition to pre test- post test experimental design with control group, time series design was used during five units.

2.2. Sample of the study

Research was carried out with 4 experimental and 4 control groups which were randomly selected from the socio-economically medium and low level elementary schools in Buca-İzmir. The participants were 286 third graders students in these schools.

2.3. Procedural way

1. The achievements tests to be used as pre and post test were prepared considering the five units in the third grade mathematics course.
2. 4 control and 4 experimental groups were randomly selected in the pilot schools in Izmir
3. Scale for the Attitude towards Mathematics (Baykul, 1990) and the Scale of Multiple Intelligences were administered (Selçioğlu Demirsöz, 2006, Kocabaş, 2007) to the students at the beginning and at the end of the intervention.
4. After the administration of the scales and the pretest of the Unit I, mathematics course was taught with the songs composed for each objective. According to the manual prepared by Kocabaş (2007) modules were developed for each unit in the third grades for the control and experimental groups. Songs were especially composed for each objective and skill required by mathematics considering the musical development of the third graders. They were adjusted for the students having difficulty in learning (dyslexia). Songs were recorded on CDs. These songs were

sung by teachers and students line by line all academic term long. In a way, lessons were conducted through songs at the end of the lesson, everybody sang the song chorally. When students were successful and their choirs sang beautifully they were given Orff instruments as reinforcements. The same modules were studied without music in the control groups.

2.4. Data gathering instruments

2.4.1. Design of unit tests

1. Units were analyzed to prepare tests and 5 tests were designed for the research considering the objectives/learning outcomes of the course. The tests were in multiple choice formats. The experts opinion were taken for the validity and they were administered to 286 students in 8 different schools in Buca. The reliability of the first unit's KR-20 was found to be 0.78, for the second unit it was (KR 20) 0.75, the third unit's 0.90, the fourth unit's 0.87 and the fifth unit's 0.77.

2. The attitude scale developed by Baykul (1990) was administered to see the students' attitude towards mathematics and the Cronbach's Alpha reliability was 0.96.

3. The Multiple Intelligences Scale prepared by Selçioğlu Demirsöz (2006) and Kocabaş, (2007) was given to students and the Cronbach's Alpha reliability was found to be 0.92.

4. In this study 80 mathematical songs were composed of concepts, procedural ways, definitions and terms as musical materials. To see the practicality of the songs and to get the students' opinions on songs, The Song Evaluation Scale for the Teachers, The Song Evaluation Scale for the Student were developed (Kocabaş, 2007, unpublished scales).

3. Findings and interpretations

3.1. Findings and Interpretations Related to Pre Test–Post Test Scores of Experimental and Control Groups' Attitudes towards Mathematics

2X2 ANOVA analysis was applied to examine attitudes towards mathematics' variations depending on experimental-control groups and pre test-post test. According to the obtained findings pre test-post test major effects ($F(1,177) = .996, p > 0.05$) and group major effect ($F(1,177) = 2.04, p > 0.05$) were not significant even though pre test–post test and group interactions ($F(1,177) = 4.63, p < 0.05$) were found meaningful.

At the beginning of the study experimental groups' attitudes towards mathematics ($t_{(177)} = 2.38, p < 0.05$), were lower than the control groups' attitudes, at the end of the second work package meaningful differences were found among the scores ($t_{(177)} = .71, p > 0.05$). In another words experimental groups increased post test attitudes scores more meaningful than pre test scores ($t_{(92)} = 2.21, p < 0.05$), there were no meaningful differences in control groups' pre test-post test scores ($t_{(85)} = .83, p > 0.05$). It was seen that control groups' attitudes scores decreased when compared with their pre test scores.

According to gender in the experimental groups scores of male students' attitudes were higher than scores of female students' attitudes. It can be said that mathematics lesson supported by musical activities affected male students' attitudes positively more than female students.

3.2. Findings and Interpretations Related to Pre Test–Post Test Scores of Experimental and Control Groups' Multiple Intelligences Domains

2X2 ANOVA analysis was applied to examine total scores of Multiple Intelligences Scale's variations depending on experimental-control groups and pre test-post test. According to obtained findings ($F(1,218) = 7.07, p < 0.01$) pre test-post test major effects were found meaningful. There were not meaningful differences on group major effects and pre test post test group interactions. Both of the groups' post test scores were higher than the pre test scores but it was not meaningful but has minor differences ($\eta^2 = .031$). It was observed that increased scores were among visual, musical, kinesthetic and naturalistic multiple intelligences in the pre test and post test scores. According to gender there were no meaningful differences between the groups. It can be said that increase in scores can be due to maturity of students.

3.3. Findings and Interpretations Related to Pre Test–Post Test Scores of Experimental and Control Groups' 1st Unit Test

2X2 ANOVA analysis was applied to examine 1st unit test score variations depending on experimental-control groups and pre test-post test. According to the obtained findings only pre test – post test major effect ($F(1,261)=5.00$, $p<0.05$) was found meaningful. But both experimental and control groups increased their scores together. At the beginning of the study teachers were in 4th acquisition (objective behavior) so it may be a reason of this findings. There was no meaningful major effect and interaction belonging to gender variable.

3.4. Findings and Interpretations Related to Pre Test–Post Test Scores of Experimental and Control Groups' 2nd Unit Test

2X2 ANOVA analysis was applied to examine 2nd unit test score variations depending on experimental-control groups and pre test-post test. According to obtained findings only pre test – post test major effect ($F(1,241)=68.42$, $p<0.01$), and group major effect ($F(1,241)=1.36$, $p<0.01$) found meaningful. Examined scores showed that differences were meaningful relating to 2nd unit's point of experimental groups ($t_{(116)}=10.82$, $p<0.01$) and control groups ($t_{(128)}=5.72$, $p<0.01$). Experimental groups and control groups increased their scores together, but there were meaningful differences in favor of experimental groups. It can be said that developed music materials affected on mathematics achievement in positive direction. There were no meaningful findings relating to main effects and interactions of gender variables between experimental and control groups.

3.5. Findings and Interpretations Related to Pre Test–Post Test Scores of Experimental and Control Groups' 3rd Unit Test

2X2 ANOVA analysis was applied to examine 3rd unit test score variations depending on experimental-control groups and pre test-post test. According to obtained findings only pre test – post test ($F(1,278)=230.80$, $p<0.000$) effects were found meaningful. Pre test–post test and group interaction ($F(1,278)=14.17$, $p<0.000$) were found significant. Experimental groups and control groups increased their scores in achievement test together. However, the post test scores of experimental groups were higher than significantly post test scores of control groups. In this condition it can be said that developed music materials affected to 3rd unit achievement. Developed music material showed similar impression on male and female students' achievement.

3.6. Findings and Interpretations Related to Pre Test–Post Test Scores of Experimental and Control Groups' 4th Unit Test

2X2 ANOVA analysis was applied to examine 4th unit test score variations depending on experimental-control groups and pre test-post test. According to obtained findings pre test – post test ($F(1,264)=433.53$, $p<0.000$) main effect was meaningful. Pre test –post test and group interaction were found meaningful ($F(1,264)=23.55$, $p<0.000$). In this situation experimental groups and control groups increased their scores. But an increase of experimental groups' scores compared to the control groups' scores was meaningful. Due to similar impression of developed music material, there were no meaningful findings relating to main effects and interactions of gender variables in 4th unit scores.

3.7. Findings and Interpretations Related to Pre Test–Post Test Scores of Experimental and Control Groups' 5th Unit Test

2X2 ANOVA analysis was applied to examine 3th unit test score variations depending on experimental-control groups and pre test-post test. According to the obtained findings only pre test – post test ($F(1,107)=321.13$, $p<0.000$) effects were found meaningful. Pre test –post test and group interaction ($F(1,107)=0.22$, $p>0.000$) was not found significant. Experimental groups and control groups increased their scores but there were no meaningful differences. There were no meaningful interactions and major effect between genders. Music material affected similar both genders as in other units.

4. Conclusions, Discussion and Recommendations

4.1. Conclusions and discussion

In this research it was found that there were meaningful differences in favor of experimental groups on attitudes of mathematics course in pre test post test comparisons. Findings of this research in relation with attitudes are similar to Miles's (1997) research results. This study has supported to research's results about mathematics anxiety realized by Bohuslav (1980), Byrd (1982), Burton (1984), Greenwood (1984), Strawderman (1985), Williams (1988). As a conclusion from this research, it can be said that developed mathematical songs decreased mathematics anxiety and increased positive attitudes towards mathematics which results in an increase in students achievements. According to gender it was found that male students' attitudes were higher than female students' in the experimental groups. There were meaningful differences in favor of experimental groups at Mathematics Achievement Tests, but also there were no meaningful differences according to gender at Mathematics Achievement Tests. Gardner (1986), Nature (1996), Gardner, Fox, Jeffery and Knowles (1996), Shoew, Rouscher, Levine, Wight, Dennis and Newcomb (as cited in Şendur and Akgül Barış, 2002) Yoshida (2005) research's results were supported by this study results. It was seen that visual, musical, kinesthetic and naturalistic multiple intelligences domain's have increased, but there were no significant differences between experimental and control groups. It can be said that this study supported Rauscher, Shaw and Ky's (1993) studies on visual domain, Miles's (1979) research on kinesthetic domain, Selçioğlu's (2006) findings on visual, musical, kinesthetic, naturalistic, social, intrapersonal multiple intelligences domain's.

4.2. Recommendations

The developed songs for mathematics course should be used first of all in primary schools. Due to the spiral structure of the mathematics syllabus, the developed songs show functional construction from 1st to 5th grades. Class teachers should be trained on using songs for mathematics course. Mathematical songs should take place in the content of "Teaching Mathematics" and "Teaching Music" courses in the Elementary Teacher Training Programme in the faculty of educations.

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