



Opinions of Preschool and Classroom Teachers on Using Music in Mathematics Teaching*

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ABSTRACT

Purpose: The present study aims to examine the opinions of preschool and classroom teachers about the use of music in mathematics teaching. **Research Methods:** This research was conducted using a case study method and the data were obtained through semi-structured face-to-face interviews consisting of open-ended questions. In this study, 30 teachers, of whom 15 were classroom teachers and 15 were preschool teachers participated. The obtained data were analysed using a content analysis method. **Findings:** Findings obtained in this study showed that students' attitudes towards mathematics were high. However, teachers faced difficulties in teaching abstract topics in maths and they suggested that

music could have positive effects on mathematics lessons. Results indicated that most teachers used music in mathematics lessons yet did not consider themselves competent to utilize music in mathematics lessons. **Implications for Research and Practice:** Findings obtained in this study suggest that the use of music in mathematics teaching has positive contributions concerning motivation, permanence, participation in class and the elimination of prejudices and negative attitudes towards the lesson. It is suggested that courses, in-service training and seminars for the use of music in mathematics courses can be organized. Finally, mathematics teaching activities with music can be designed and applied, and whether these activities affect students' attitudes and achievement can be investigated by experimental methods.

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Introduction

In line with the current developments in technology and scientific aspects, innovation in the education system is constantly needed. Depending on the modernization efforts, it is an important task to arrange the education and training programs, which constitute an important strategic dimension within the education system, according to the needs of the age in terms of providing social and individual development (Fabry & Higgs, 1997; Gunes, 2016; Yildiz, 2020). The realization of the learning activities taking place within the education system and providing an environment for the development of individuals from every aspect also requires approaching education within a wide frame, that is, from different angles (Benešová & Tupa 2017; Yavuz & Coskun, 2008; Yildiz, 2020. In the light of this logic, it is essential that in the face of the dynamics of the changing world, one should not be indifferent to this change in education and training and should benefit from this change in a positive way. At this point, it is necessary to present education and training not only with the subject areas of interest, but to transfer different subjects in a more meaningful manner by creating a synthesis, that is to say, from a disciplinary structure to an interdisciplinary structure, and to handle them in an interdisciplinary perspective. According to Edelson and Johnson (2003), today, it is observed that education and other sciences can meet on common ground and that they are influenced by and contribute to each other in this way. The use of an "interdisciplinary" teaching style has recently become a new term in the educational community.

In the process of revealing new ideas and products, to further develop human creativity, the power and thought of establishing a bond between the disciplines is an approach that needs attention. When examining the lives of people who are recognized by others in various aspects and whose work can be spoken about even today, it is seen that they have characteristics by which they can behave and think in multiple ways and integrate these into their working lives. For example, what makes Leonardo da Vinci known as a genius is the result of his work as a painter, musician, inventor, sculptor, engineer, geologist and astronomer. Even centuries later, Albert Einstein considered philosophy and music as a way of discovering physics, although he was primarily a physicist (James, 1991). Music contains an important structure and supporting power to look at life from a scientific and artistic perspective. It is also understood that the power of music is used for certain purposes; especially in education, it has an important place in the existing sciences and has been associated with mathematics since ancient times (Harkleroad, 2006; Johnson & Edelson, 2003; McDonel, 2015; Wilson et al., 2003).

In this context, mathematics and music had a strong bond in ancient Greece. When number relations, ratios and proportions are considered, music is considered as a real mathematical discipline. There is also a term, "quadrivium", which constituted the curriculum of the Pythagorean School and formed an important part of the teaching in ancient Greece. The discipline of music had a similar place to the branches of arithmetic, geometry and astronomy in the quadrivium.

According to Wollenberg (2006), mathematics and music are characteristically closely linked. The 17th century is seen as an important turning point for music by historians due to the transformation of music from a scientific to an artistic discipline and to its transition from a theoretical to a practical subject. There were many connections between science and music in this period. In the 19th and 20th centuries, the development of the science of music and the mathematical approaches in composition widened the connections between the two fields. Music has a special position within the existing link between art and music. In this connection between music and art, mathematics also plays an important role (Papadopoulos, 2014).

When the general definitions of mathematics and music are compared, it is understood that these two disciplines are in different structures. When they are examined, it can be seen that while mathematics is a scientific subject that is full of rules, can be counted and can be calculated; music can assume the duties of being artistic and a way of expression within it. Although these two disciplinary frameworks show a separate structure, they are actually interdependent, and this connection has been maintained for more than two thousand years. In fact, music is very mathematical, and mathematics is one of the basic structures within music theory. Like other disciplines, music theorists use mathematics to develop, express, and communicate ideas (Shah, 2010).

In support of the view of interdisciplinary education, it is seen that the National Council of Teachers of Mathematics, which is an important mathematical institution in the world and supports the process of teaching and learning high-quality mathematics, calls on teachers to help students make mathematical connections in contexts other than mathematics, and emphasizes that these mathematical connections may be related to other subject areas and disciplines as well as to students' daily lives (National Council of Teachers of Mathematics [NCTM], 2000). In this study, it is stated that the school should provide the students with materials that allow mathematics to be learned through calculation, measurement, playing, story listening, drama, music and art activities. Although teachers of children in the early childhood period have been teaching with an interdisciplinary approach for many years, it is clear that the link between two separates but fundamentally common disciplines, such as mathematics and music, needs to be further strengthened. By linking music and mathematics, teachers will be able to play a role in helping children achieve national and state learning standards in the field of mathematics through creative arts (Edelson & Johnson, 2003). Childhood is a period when development is very rapid in the field of mathematics as in every field. This period is a very critical period when the child actively acquires many basic concepts, such as counting, patterns, measurement, shape, time and space for mathematics (Erdogan & Baran, 2005). In the relevant literature, it is seen that there are studies stating that the basic concepts of mathematics can be taught to children through musical activities in this critical period (Aysu et al., 2018; Dogan & Tecimer, 2019; Kabatas, 2017; Shilling, 2002; Volchegorskaya & Nogina, 2014). According to Karsal (2004), musical activities positively affect children's math performance. According to Dikici (2002), music education given by the Orff method contributes positively to the development of children's mathematical ability. It is

possible to see patterns and the relationships between patterns, which are important concepts of mathematics education in early childhood, in music and art (Akman, 2002). Again, Arslan (1997) stated that music activities provide suitable opportunities for children to support basic mathematical skills and that mathematical thinking can be improved by supporting children to use the language of mathematics through music activities. He highlighted that games with songs, finger games and rhythm exercises are very suitable for teaching basic mathematical concepts. He also stated that many mathematical concepts, such as number, shape, time, spatial concepts, matching and sequencing can be taught through song and rhythm. Aktas (2002) noted that there are many songs that contain mathematical concepts and that teaching numbers with rhythm and melodies can make it easier for the child to learn the concept of numbers. In this vein, in order for the mathematics lessons included in the early childhood education curricula to be carried out in a more efficient and memorable way, the use of music, which is at the core of the mathematics discipline, should be considered in classroom activities. This interdisciplinary perspective, using the mathematical dynamics of music to make mathematics more understandable in early childhood education, can be the equivalent of an innovative and contemporary teaching style.

Students need an effective and experiential learning style to develop complex thinking skills and problem-solving behaviors. In this respect, teachers can use music to increase students' understanding of difficult mathematical concepts and increase their mathematical skills (Edelson & Johnson, 2003). Mathematical thinking and musical perception can be supported by mathematical elements embedded in music. In this sense, the rhythmic elements of music provide rich opportunities for exploring mathematical concepts through the experience of musical components, such as beat, measure, duration of sounds, rhythmic patterns and tempo (Aktas, 2002; Arslan, 1997). These opportunities offered to students to explore mathematical concepts through music will take place in a musical perception system, such as beat, measure, duration of sounds, rhythmic patterns and tempo. Thus, this may pave the way for students to be interested in mathematical concepts and skills. These musical experiences can be used as concrete tools to discover, transfer and transform meanings and relationships in music and mathematics.

According to Hamilton et al. (2018), one of the issues that support the relationship between music and mathematics is fractions. Fractions are closely related to musical rhythms. Musical rhythm can be produced using clapping and percussion instruments that do not require special training to play. The rhythm is easily accessible and is accessible at all levels of studies related to music. In addition, the mathematics teacher is not obliged to have professional music education in order to use rhythms in the lessons. Figure 1 illustrates how the semibreve, which is the longest note in general use in music, is divided into a "circle," a geometric figure, and music staff by simulating mathematics and music.

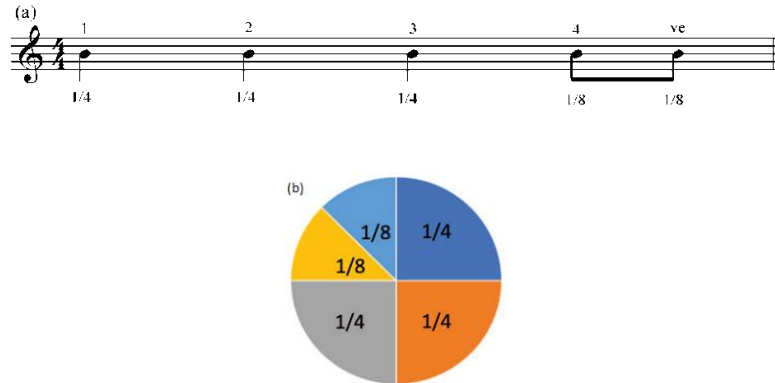


Figure 1. Expressing the Semibreve Value in Fractions by Division in the Staff and Circle (Hamilton et al., 2018, p. 927).

When examined in Figure 1 (a), a measure can be divided into multiple beats according to the musical notation system in music. A single measure represents the whole. Each beat or half-beat divides the whole into pieces. In the above measure, the eighth note represents $1/8$ of the semibreve value, while each quarter note represents $1/4$ of the semibreve value. When examined in Figure 1 (b), the mathematical equivalent of the semibreve value in music is taken as a circle and this circle is divided into $3 \times 1/4$ and $2 \times 1/8$ ratios. Using the simulation of dividing a whole into fractions, it is ensured that the fractions are taught to students who participate in the production of fractions and rhythms by playing percussion instruments both in visual and auditory terms (Hamilton et al., 2018).

Music can be seen as one of the branches that can be used in interdisciplinary studies since it contains melodic and rhythmic elements and thus facilitates teaching. Teaching mathematics more effectively with different approaches will make it easier for students to understand this subject. The type of example in Figure 1 above can be applied in a variety of dimensions during the teaching of mathematical concepts. In this respect, it may be appropriate to make use of musical support in the field of education. As Shilling (2002) states, the natural inclusion of musical activities into children's studies of mathematics provides a way to develop children's logical/mathematical and musical/rhythmic intelligence in a dimension that may previously have been unthinkable.

As can be understood from the ideas mentioned above, music and mathematics have been associated with each other since ancient times and the connection between them has been tried to be revealed. This relationship between music and mathematics is reflected in today's education and training programs and has an important place in interdisciplinary literature. As seen in the examples given above, it is thought that the use of music, which has an important place in the literature, in childhood mathematics education environments may be functionally beneficial. Thus, in this study, it was tried to determine the opinions of pre-school and classroom teachers regarding the use of music in mathematics teaching. The determination of these opinions is considered

important in terms of revealing the use of music in mathematics teaching in educational environments, determining the problems that may arise during use, and developing curricula for the use of music in mathematics teaching.

The main purpose of this study is to investigate the opinions of preschool and classroom teachers about the use of music in mathematics teaching. In the light of the general purpose of this research, answers to the following questions were also sought in the research:

1. What are the teachers' opinions about students' attitudes towards mathematics?
2. What are the problems faced by teachers in mathematics teaching and the solutions to these problems?
3. What are the opinions of teachers about the use of music in mathematics teaching?
4. What are the views of teachers about the influence of using music in mathematics lessons on students' learning?
5. What are the opinions of teachers about their competence in using music in mathematics lessons?

Method

Research Design

A qualitative research approach was used in this study, in which pre-school and classroom teachers' opinions on the use of music in mathematics classes were examined. Qualitative approaches are often used to discover new events and to obtain individuals' thoughts, feelings, or interpretations about meaning and process (Given, 2008). Thus, a qualitative approach was used to examine and make sense of teachers' experiences, emotions, thoughts and interpretations regarding the use of music in mathematics classes.

The case study method was used to obtain in-depth information about the subject to be examined in this research. This requires careful and complete observation of a social unit, a person within that social unit, a family, an institution, a cultural group and even the whole society. The case study method attaches importance to the full analysis of a small number of events, situations and their interrelationships. As a result, case study method is based on a detailed examination of a unit under investigation (Kothari, 2004). Since this research was conducted in pre-school and primary schools, and due to the in-depth analysis of the use of music in mathematics teaching, the case study method was preferred in this research.

Research Sample

The "purposeful sampling method" was used to determine the study group of this study. According to Ekiz (2009), the purposeful sampling method is not the direct

generalization of the research results to the population for the purpose of the different sample types in this sampling method within the scope of the population and sample relationship; on the contrary, it is an in-depth description and understanding of the people or situations under investigation. The purposeful sampling method is divided into sub-groups. In this study, the “homogeneous sampling method” was used. The homogeneous sampling method describes the selection of a similar subgroup, situation, and case related to the research problem from the population (Buyukozturk et al. 2016). From this perspective, in this study, in which only preschool and classroom teachers' opinions on the use of music in mathematics education were examined, the teachers were selected according to the homogeneous sampling method.

This study was conducted with 30 teachers, of whom 15 were classroom teachers and 15 were preschool teachers, who were working in public schools in the 2018-2019 academic year. Demographic information about the teachers participating in this research is given in Table 1. To protect the confidentiality of information about the teachers, who have an important place in research ethics in transferring data, the classroom teachers were coded as CT1, CT2, CT3CT15, and the preschool teachers were coded as PT16, PT17, PT18PT30. Demographic information about the teachers participating in this research is as follows:

Table 1

Demographic Information About the Teachers Participating in This Research

Code	Gender	Professional experience	Music education in BA	In-service training seminars and music lessons	An instrument in their lessons
CT1	Male	18	Not received	Not attended	Not used
CT2	Female	22	Not received	Attended	Used
CT3	Male	12	Received	Attended	Used
CT4	Male	34	Received	Not attended	Used
CT5	Male	22	Not received	Attended	Used
CT6	Female	41	Received	Not attended	Used
CT7	Female	8	Received	Attended	Used
CT8	Female	29	Received	Not attended	Used
CT9	Male	18	Received	Attended	Not used
CT10	Female	4	Received	Attended	Used
CT11	Male	14	Received	Attended	Not used
CT12	Female	21	Not received	Attended	Not used
CT13	Female	10	Not received	Not attended	Not used
CT14	Female	30	Not received	Attended	Not used
CT15	Female	8	Received	Not attended	Not used
PT16	Female	15	Received	Not attended	Used
PT17	Female	10	Received	Attended	Used
PT18	Female	8	Received	Attended	Used
PT19	Female	15	Received	Attended	Used
PT20	Female	10	Received	Attended	Not used
PT21	Female	18	Received	Attended	Not used
PT22	Female	4	Received	Attended	Not used
PT23	Female	3	Received	Attended	Used
PT24	Female	6	Not received	Not attended	Not used

PT25	Female	12	Received	Not attended	Not used
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Table 1 Continue

Code	Gender	Professional experience	Music education in BA	In-service training seminars and music lessons	An instrument in their lessons
PT26	Female	10	Received	Attended	Not used
PT27	Female	10	Received	Attended	Not used
PT28	Female	10	Received	Not attended	Not used
PT29	Female	3	Received	Attended	Not used
PT30	Female	2	Received	Attended	Not used

Research Instruments and Procedures

In this study, the data were collected by semi-structured interview technique, which is one of the qualitative data collection techniques. In the semi-structured interview technique, the interviewer has an interview guide that includes a checklist of topics related to the scope, default statements and the order of the questions. However, in general, the sequence of statements and questions is shaped by the flow of the interview. In addition, to continue what the interviewee says, unplanned questions may be asked (Robson, 2017). This technique combines both fixed-choice questions and in-depth exploration of the relevant field. The semi-structured interview technique has advantages, such as ease of analysis, the possibility of self-expression by the interviewee and providing in-depth information as needed (Buyukozturk et al. 2016).

The semi-structured interview form was prepared by the researchers by searching the related literature. The interview form consisted of two parts. In the first part of the form, teachers were asked questions about demographic information, such as the school they graduated from, their education levels, the school they worked in, their terms of duty and job descriptions, their state of receiving music education in undergraduate education, their state of taking part in any in-service training, seminars or private lessons related to music, and their state of playing instruments and using the instruments they played in lessons. Then, in the second part of the form, the teachers were asked questions about the purpose and sub-objectives of the research. Face-to-face interviews were recorded on a voice recorder and then written down by the researchers.

Data Analysis

The data obtained from this research were subjected to content analysis. Using content analysis, it is aimed to identify the data and reveal facts that may be hidden in the data. The main process of content analysis is to bring together similar data within the framework of certain concepts and themes and to interpret them in a way that the reader can understand (Yildirim & Simsek, 2013). In content analysis, categories and sub-categories are created by applying a series of codes (Ekiz, 2009). In this context, the data obtained from this study were coded concerning similarities and presented

under various categories. The following steps were followed in the data collection and analysis processes:

1. In accordance with the main and sub-objectives of this research, the interview questions were developed by the researchers.
2. The pre-school and classroom teachers to participate in this study were selected.
3. The interviews were conducted with the teachers and recorded.
4. The recorded interviews were written down to be analyzed.
5. The answers related to the same subject were written one under the other and coded.
6. The codes were categorized and presented in the form of tables.
7. The data presented in the tables were supported by direct citations from teachers' speeches.

Validity and Reliability Studies

Taking the necessary measures to access the right information (validity) and describing the research process and data in a clear and detailed manner, i.e., in a way that allows another researcher to evaluate them (reliability), are among the important criteria that should be included in a qualitative research study. Given that validity significantly guarantees reliability, the importance given to validity should also be perceived as a measure to ensure reliability (Yildirim & Simsek, 2013).

In qualitative research, validity and reliability can be provided by various methods. In this study, a semi-structured interview form was used. While preparing the semi-structured interview form, the opinions of five experts consisting of assessment and evaluation, language and field experts were consulted on whether the appropriate language was used, whether the interview questions covered the subject being researched, and the response time. Presenting the research findings with rich descriptions and direct quotations from teacher conversations can be considered as the measures taken to increase the reliability of the study.

Results

In this section, the findings and interpretations obtained from the interviews with the preschool and classroom teachers about the use of music in mathematics teaching are given. The findings were examined in eight themes under subheadings, which were elucidated below.

Teachers' opinions on students' attitudes towards mathematics

Firstly, the teachers were asked what their opinions about students' attitudes towards mathematics were. The findings for the teachers' opinions on this subject are presented in Table 2 below.

Table 2

Teachers' Opinions About Students' Attitudes Towards Mathematics

Student attitudes	Teachers	f
High attitude	CT1, CT2, CT3, CT5, CT7, CT8, CT10, CT11, CT13, CT14, CT15, PT17, PT18, PT19, PT20, PT21, PT22, PT23, PT24, PT25, PT26, PT27, PT28, PT29, PT30	25
High-class level	CT2, PT16, PT19, PT20, PT21, PT27	6
Visual way	CT1, CT3, CT5, CT15	4
Negative attitude	CT4, CT9, CT12	3
In math, boys are more successful than girls.	CT13, CT15	2
No cognitive increase	CT6	1
New math curriculum	CT3	1
Effective teacher	CT11	1
Prejudice about mathematics	CT12	1

Although Table 2 reveals different opinions, most of the teachers stated that their students' attitudes, interests, motivation and liking towards mathematics were generally good. Examining the table further, teachers stated that students' attitudes towards mathematics increased when drama, Orff, games and materials supporting the subject were used. Accordingly, it can be said that using different methods and techniques other than traditional methods increased the positive attitude towards mathematics. According to some teachers, the mathematics lesson was based on visuality and not focused on reading increased students' positive attitude. According to this opinion, today's students utilize visual-based technological tools in their learning habits and show less interest in reading may cause them to be interested in mathematics courses with more visual content. Apart from these statements, a few teachers stated that boys were more successful in mathematics than girls. Students were interested but failed to solve problems. The new curriculum and course were effective in improving students' attitudes, and that prejudices against mathematics had negative effects on attitude. Some of the teachers' opinions about students' attitudes towards mathematics are as follows:

My students are very positive about mathematics. I can even say it is their favourite lesson. They are very interested and highly motivated. I can say that the most successful course in the 3C class that I attend is mathematics. How do we know that? We have measurement and evaluation activities as a group after completing the topics to cover the whole year, once a month or every 40 days, and periodically to cover the whole group, we carry out measurement and evaluation activities for the achievements. I

say this according to the results; the sentence I have established is not a sentence I say for no reason. The success of my class is up to 85%, 86% or even in the 90 (CT5).

My students are very good, interested, and their motivation is also very good, and they love it because I try to make it as enjoyable as I can. I think that games and Orff activities help in mathematics (PT19).

There is a lot of difference between the mathematics lessons I took in my own time and the mathematics lessons of our time. Students now love mathematics more because they think it's not based on reading, and there are more visuals. They already love the math lesson, which is visually rich because it is a generation of tablets. The best course for my own students is mathematics, but they cannot use these skills when asked a diffuse understanding problem (CT1).

The Problems Encountered by Teachers in Mathematics Teaching and Solutions to These Problems

Participant teachers were asked the following questions: “How do you think your students' attitudes (interests, motivations, love) towards mathematics lesson? Can you explain briefly?” In response to these questions, teachers expressed their opinions as presented in Table 3 below.

Table 3

The Problems Encountered by Teachers in Mathematics Teaching and Solutions to These Problems

Problems encountered	Solution offers	f
Abstract concepts (Length measurements, rhythmic counting, multiplication tables, geometry) (CT1, CT2, CT3, CT4, CT7, CT10, CT11, CT13, PT18, PT20, PT30)	Concretization (CT1, CT4, CT7, CT10, PT18, PT20, PT30)	7
	Dramatization (CT1, CT4, CT7)	3
	Making use of videos (CT7, CT10, PT20)	3
	Plenty of practice (CT11, CT13)	2
	Doing group work (CT7)	1
	Using different examples and materials for thinking (CT13)	1
	Producing appropriate songs (CT2)	1
	Approach from simple to difficult (CT3)	1
	One-to-one work (PT19, PT22, PT23)	3
Individual differences of students (PT17, PT19, PT21, PT22, PT23, PT25, PT26)	Approach from simple to difficult (PT17, PT23)	2
	Gamification (PT21, PT26)	2
	Nursery rhymes (PT21)	1
	Awareness-raising and education of families (PT25)	1
Problems requiring judgment (CT1, CT3, CT6)	Concretization (CT1)	1
	Dramatization (CT1)	1
	Approach from simple to difficult (CT3)	1

	Increasing course hours (CT6)	1
	Using different examples and materials for thinking (CT6)	1

Table 3 Continue

Problems encountered	Solution offers	f
Writing numbers (PT24, PT24)	One-to-one work (PT24, PT28)	2
Society's prejudice about math (CT9, CT12)	Concretization (CT9)	1
	Using music (CT12)	1
Transferring what is learned to daily life (CT5)	Plenty of practice (CT5)	1
Ensuring the permanence of what is learned (CT14)	Gamification (CT14)	1
Program-sourced problems (CT15)	Concretization (CT15)	1
	Nursery rhymes (PT16)	1
	Rhythm exercises (PT16)	1
	Using different examples and materials for thinking (PT16)	1
Subject that attracts attention (e.g., connecting the dots and robotic coding) (PT29)	Plenty of practice (PT29)	1

When Table 3 is examined, most of the teachers stated that the main problems faced by students in mathematics were abstract subjects, such as length measurements, rhythmic counting, multiplication tables and geometry. The solution suggestions that teachers stated for them included concretization, dramatization, making use of videos, performing group work, plenty of practice, using different examples and materials for thinking, producing songs suitable for the subject and approach from simple to difficult. According to this, it is understood that most of the teachers used practices that enable the learning to be permanent and centered on the students. Again, most of the teachers stated that the individual differences of the students were one of the problems encountered in mathematics. Teachers presented solutions to this problem, such as approach from simple to difficult, one-to-one work, gamification, nursery rhymes, family awareness and education. Accordingly, the proposed solutions can be seen as an aid in overcoming the problems arising from the individual differences of the students. Some teachers also stated that problems that require reasoning, being able to write numbers, social prejudice, transferring what is learned to daily life, ensuring the permanence of what is learned, problems arising from the program, vocabulary weaknesses and difficulties in attention studies (such as connecting the dots, robotic coding) were the problems they faced. Teachers proposed solutions to these problems, such as concretization, dramatization, approach from simple to difficult, increasing the course hours, using different examples and materials for thinking, one-to-one work, using music, plenty of practice, gamification, practicing nursery rhymes, practicing rhythm and using different examples and materials for thinking. One of the opinions of the teachers on the problem of teaching abstract

concepts, which were one of the problems they faced in mathematics teaching, and the solution of this problem, is as follows:

We have some difficulty in relating mathematics to everyday life, so it is more difficult for children to learn things because there are many abstract concepts. Teaching mathematics using concretization and gamification makes it more permanent for the children. We solve problems by associating them with daily life. Then, we try to explain with visuals and do animation and drama activities (CT4).

One of the opinions of the teachers towards the problem of individual differences, which was one of the problems that teachers face in mathematics teaching, is as follows:

Mathematics is a critical issue for children, meaning that the mathematical level of each child and the mathematical threshold of each child do not develop at the same time. Some students learn mathematics very early, while others learn later. For this reason, we try to get to know the children, and mainly the individual differences between the children cause difficulties for us. We try to get to know the child in the first place to overcome these. Each child has a different level of learning, so we simplify the subject to determine how s/he understands the topic first, we work individually, then when we learn how s/he understands, and later we transfer the information to him/her that way (PT23).

Teachers' Views on the Use of Music in Mathematics Teaching

"Do you think music can be used as a tool in mathematics teaching? How? What are your views on this? Please explain briefly." These questions were directed to teachers in this study. The findings obtained from the opinions of the teachers on this subject are presented in Table 4 below.

Table 4

Teachers' Opinions on the Use of Music in Mathematics Teaching

Teacher opinions	Teachers	f
Improve learning and permanence	CT7, CT9, CT10, CT11, CT13, CT14, CT15, PT18, PT20, PT21, PT25, PT26, PT28, PT30	14
There is a relationship between rhythms and mathematics.	CT3, CT2, CT5, CT8, PT16, PT17, PT19, PT26, PT27	9
There is a pattern in music.	CT2, CT7, CT12	3
It makes the lesson fun.	PT24, PT25, PT30	3
It has remarkable features.	CT1, PT29	2
It has a motivating side.	PT22, PT23	2
Math is related to note values	CT6	1
Mathematics should begin with music education.	CT2	1

When Table 4 is examined, teachers stated that music could be used in mathematics teaching in various ways. The most emphasized among these statements is using songs as a tool to ensure the realization and permanence of learning in mathematics. Again, according to teachers' opinions, learning could be realized by establishing a relationship between rhythms and mathematics. According to this, it can be thought that the rhythm element, which is an important element of songs and music, is an important factor in realizing learning and ensuring the permanence of learning. Some teachers stated that there was a pattern that includes mathematical concepts in music, that music made mathematics fun, that music had remarkable and motivating features, that note values were related to mathematics, and that mathematics should be started with music education. Some of the teachers' opinions on the use of music in mathematics teaching are as follows:

I think it can be used very much, it's very effective at that point. Let me give you an example from the multiplication table: when we passed on to the multiplication topic, I taught the multiplication table with music; that is, I taught it with rhythm. I told the children to study and come to school like that, but it didn't work, so we studied in the classroom, which also didn't work, and then we worked with music and they perceived it very nicely. The children perceive it better because the songs and rhythms are used at that point (CT15).

Music is used in mathematics teaching and can be used in all kinds of ways. We do mathematical operations, such as adding, subtracting, counting, and rhythmic counting using music and singing, and in this way, when we teach in this way, it becomes even more beautiful and fun (PT18).

Teachers' Opinions on Whether They Make Use of Music in Mathematics

Table 5 shows the findings of the questions asked to teachers about whether they make use of music in mathematics.

Table 5

Teachers' Opinions on Whether They Make Use of Music in Mathematics

State of making use of music	Teachers	f
I make use of it	CT5, CT2, CT12, CT13, PT16, PT17, PT19, PT20, PT21, PT22, PT23, PT24, PT26, PT28, PT30	15
I rarely make use of it.	CT6, CT4, CT7, CT9, CT10, CT11, CT14, CT15, PT25, PT27, PT29	11
I never make use of it.	CT1, CT3, CT8	3

When Table 5 is examined, it is seen that the teachers who use music in mathematics are predominant. In addition to this, it is determined that there are also teachers who rarely use music or who never use music in their classes.

Teachers' Opinions on When and How They Make Use of Music in Mathematics

Teachers were asked for their opinions on when and how they make use of music in mathematics. The findings of these opinions are given in Table 6.

Table 6

Teachers' Opinions on When and How They Make Use of Music in Mathematics

State of making use of music	Teachers	f
Music can be used for reinforcement in mathematics	CT2, CT4, CT5, CT6, CT7, CT10, CT11, CT12, CT13, PT25, PT26, PT27, PT28, PT29, PT30	15
I use music in the middle of the math class.	CT2, CT4, CT10, CT11, PT17, PT18, PT25, PT26, PT29	9
I use music to teach numbers.	CT10, CT14, PT16, PT17, PT20, PT22, PT24, PT28	8
I use music at the beginning of the mathematics lesson.	CT2, CT12, CT14, CT15, PT26, PT27, PT28	7
I use music towards the end of the math class.	CT2, CT12, CT15, PT24, PT27, PT28	6
I use music in rhythmic counting.	CT2, CT13, PT17, PT19, PT21, PT25	6
I use music to teach addition and subtraction.	CT14, PT17, PT21, PT24, PT30	5
I use music in geometry.	CT2, CT12, PT20	3
I use music according to the mathematics course.	CT5, PT18	2
I use music to teach multiplication tables.	CT4	1
I use music to teach fractions.	CT6	1
I use music to teach patterns.	CT12	1
I use related songs when solving problems.	CT7	1
I use music to teach length measurements.	CT14	1
I use music to teach the concept of quantity.	PT16	1

When Table 6 is examined, most teachers stated that they used music for reinforcement in mathematics lessons. When the opinions about the stage in which mathematics had been used were examined, it was seen that music was generally preferred in the middle of the lesson and then at the beginning and end of the lesson, respectively. Finally, when the opinions about the subjects in which music is used in the mathematics class were examined, it was seen that music is used in rhythmic counting, teaching addition and subtraction, teaching geometry, teaching

multiplication tables, teaching fractions, teaching patterns, solving problems, teaching length measurements and teaching the concept of quantity. Some of the expressions indicating teachers' state of utilizing music in mathematics classes are as follows:

Well, I use music in almost every lesson, and I am a teacher who believes in active learning. In active learning methods, the student must eventually produce a product and present it to the class or society. This is one of the principles of active learning. Since they are generally in a small age group, our products can be poems, songs, musical movements and displays. For example, at the end of a lesson, I can get a little nursery rhyme about what they understand and have it linked to the rhythm. It can be performed in geometry very well, as they can both use their bodies and the music, and music can be fully used in the pattern because when you create a pattern, you can make great things out of sounds or tools in the classroom. It can be used for reinforcing purposes; it can be used in every sense, especially in arousing curiosity, and at the application stage and evaluation stage (CT12).

I use it. When we have both mathematics and music periods, we do rhythm exercises and then we use them. We use them, especially in numbers. While teaching the concepts of quantity, we also use them. We adjust the use of music according to the subject of the course, I use some of them at the end of the course, others at the beginning, and I can also use it for reinforcement (PT21).

Teachers' Views on the Positive and Negative Effects of Using Music in Mathematics Lesson on Students

What kind of effects can the use of music as a teaching tool in mathematics lessons have on students' learning? Can you explain by giving an example?" The answers they gave to the question are presented in Table 7 and Table 8.

Table 7

Teachers' Opinions About the Positive Effects on Students of Using Music in Mathematics

Positive effects	Teachers	f
It ensures permanence.	CT8, CT10, CT14, CT15, PT20, PT25, PT29, PT30	8
They like the lesson more.	CT3, CT4, CT5, CT6, CT7, CT12	6
It has remarkable features.	CT1, PT23, PT26, PT27, PT28	5
It overcomes prejudice against mathematics.	CT9, PT18, PT19, PT21	4
It makes the lesson fun.	PT16, PT22, PT25, PT30	4
It facilitates the application of the course.	CT13, PT17, PT25	3
It increases motivation towards mathematics.	CT11, PT19	2
It enables lesson preparation through relaxation.	CT2, CT4	2

When Table 7 is examined, most of the teachers stated that the use of music in mathematics teaching might have positive contributions to the students. According to the teachers' opinions, music was a tool that enables permanence in mathematics teaching. From this point of view, the general opinion was that using music in mathematics teaching increases permanence, which is one of the important goals of learning and enables the use of knowledge throughout life. The teachers stated that with the use of music in mathematics classes, the student liked the lesson more, that his/her attention was concentrated, that prejudices against mathematics were eliminated, that the lesson became fun and easy to apply by the teacher, that motivation towards the lesson increased and that the preparation for the lesson became easier. Some of the teachers' opinions about the positive effects on students of using music in mathematics are as follows:

The students couldn't remember what they learned easily when I was teaching counting, but it was more memorable when I taught rhythmic counting, especially with funny words and songs, and they still say it that way (CT10).

I support teaching in the form of one-to-one transfer. I am more in favor of learning by doing and experiencing it with children. For example, when you mention mathematics, children have a question mark in their minds: "Is it difficult? Is it easy?" But the prejudices are destroyed when you teach it with music or with pictures and they are more motivated in this way (PT19).

Table 8

Teachers' Opinions About the Possible Negative Effects on Students of Using Music in Mathematics

Possible negative effects	Teachers	f
Teacher's lack of classroom management and command of the subject matter	CT3, CT5, CT11, PT23, PT25	5
Problems in special children (e.g., with autism) and children who do not like music	PT16, PT18, PT26	3
Distractions of non-related musical activities	PT27, PT29	2
Children's excitement when they see musical instruments	PT24	1

When Table 8 is examined, most of the teachers stated that the use of music in mathematics classes had no negative effects. From this point of view, it can be mentioned that there is a positive effect of mathematics teaching with music, which is handled concerning an interdisciplinary approach, by teachers. Further examination of the table, however, reveals the mentioned negative effects of the use of music in mathematics teaching, which are as follows: Negative effects due to teacher's lack of classroom management and command of the subject matter, possible problems in

special children (e.g., with autism) and children who do not like music, distractions of non-related musical activities and children's excitement when they see musical instruments. One of the opinions of the teachers who stated that the use of music in mathematics classes did not have any negative effects on the students is as follows:

I don't think it can have a negative effect. What could it be? Music is the beginning of everything; if there is music, everything is there. In my opinion, the child will be spiritually fulfilled and his/her motivation can be increased. Well, s/he can be more enthusiastic and more eager to learn (CT6).

One of the teachers' opinions that the use of music in mathematics classes might have negative effects on students is as follows:

The negative effects can be as follows: there are special needs children in the classroom. I have also worked with special children, and for example, children with autism or a different syndrome can sometimes react differently. For example, a child with autism will not like the music at that moment, maybe a child who has been traumatized will perceive that music as noisy, maybe s/he will not like it, that change will not be pleasant to him/her; I think maybe there might be differences about it. I think that different studies can be done about the children with special needs (PT16).

Teachers' Opinions on Their Competence in Using Music in Mathematics

In this research, teachers were asked for their opinions about their competence in using music in mathematics and the findings obtained from the teachers' opinions on this subject are presented in Table 9.

Table 9

Teachers' Opinions on Their Competence in Using Music in Mathematics

Their competence in using music	Teachers	f
I don't regard myself as competent.	CT4, CT5, CT8, CT15, PT16, PT17, PT18, PT20, PT21, PT22, PT24, PT29	12
In general, I consider myself competent.	CT11, PT19, PT23, PT25, OO,27, PT28, PT30	7
Better music education is required.	CT2, CT6, CT9, CT10, CT12, CT13, CT14	7
If I try, I can do this.	CT1, CT3, PT26	3
The intensity of the curriculum prevents me from doing things.	CT7	1

When Table 9 is examined, most of the teachers stated that they did not consider themselves competent enough to utilize music in the mathematics class. The reason for this is that the music education given to pre-school and classroom teachers in undergraduate education is far from being an interdisciplinary approach and that their

education is given within the framework of general music education. Regarding the second statement, the reason why teachers considered themselves generally competent enough to utilize music in mathematics can be individual efforts, in-service training and private lessons taken, according to the teachers' statements. In other statements, it is stated that teachers' competences can be increased by getting a better music education, that individual effort can be effective on this issue and that the intensity of the curriculum is an obstacle in this subject. Some of the teachers' opinions on their competence in using music in mathematics classes are as follows:

I don't regard myself as competent, I want to be more competent, I do not think that the music education we received in undergraduate education is fully sufficient, and the more I can develop myself, the more useful I will be to children, so I'm trying to get training (CT10).

I don't consider myself competent in anything, so I try to improve myself constantly because time passes so quickly, children's needs and desires are very different, and if we stay in the old times, we can't make progress, so we try to participate in in-service training and strive to learn (PT18).

If I had stopped my development at university, that is, if I were content with the information I received in undergraduate education, I certainly wouldn't be competent, but I developed myself through social networks, with the help of music teachers near me or through seminars. I'm not 100% competent, but I consider myself 40% competent, and if it was just university, I'd say absolutely not (PT27).

Discussion, Conclusion and Recommendations

In line with the findings of this study, most of the teachers stated that their students' attitudes, motivations, interest and love for mathematics were generally good. From this perspective, it can be thought that the lesson is not based on reading and is visually richer than before, as stated by teachers in the interviews, as the reason why students love mathematics.

Most of the teachers explained that the main problems that students faced in mathematics were abstract subjects, such as length measurements, rhythmic counting, multiplication tables and geometry. The teachers explained the reason for the difficulty in abstract concepts as that general information cannot be associated with daily life by the students. According to Hamilton et al. (2018), many students have difficulty in transferring mathematical concepts into their daily lives and cannot make sense of their symbolic nomenclature. Thus, this can be a major obstacle for many students to continue their mathematical studies. When the solution suggestions related to these abstract concepts are examined, it is seen that teachers implemented such things as concretization, dramatization, making use of videos, doing group work, plenty of practice, using different examples and materials for thinking, producing songs suitable for the subject, and approach from simple to difficult.

When the opinions of teachers about the use of music in mathematics teaching are examined, it is understood that teachers expressed positive opinions about using music in the lessons and that basically, they suggested that music makes mathematics learning more permanent. In line with the teachers' opinions, it is seen that the positive effects of using music in mathematics lessons are permanence, increasing love for mathematics and attracting attention. In the study by An, Capraro and Tillman (2013), it was concluded that music activities were applied regularly in the first and third grades of primary school for five weeks and that the lessons given in the relationship between music and mathematics had positive effects on multiple mathematics skills.

According to the opinions of most teachers, the use of music in mathematics teaching has positive contributions concerning motivation, permanence, participation in class and the elimination of prejudices and negative attitudes towards the lesson. In this sense, some of the opinions that support the results of the study are as follows: according to McDonel (2015), the use of music in mathematics teaching can affect the development of students' spatial-temporal skills (e.g., arithmetic, attention and focus). Brock and Lambeth (2013) stated that students' participation in mathematics teaching with music increased compared to the lessons not conducted with music. All these results show that teaching mathematics with music can make positive contributions to the students.

When the negative effects of using music in mathematics teaching by teachers were examined, most of the teachers stated that it would not have a negative effect. In addition, they stated that the negative situations that can appear may arise depending on the individual characteristics of the teacher and the student. Teachers think that the teacher's competence in classroom management and knowledge about the subject play a leading role, especially in the use of music in mathematics teaching, and specified that students' special situations (e.g., autism) affect the process.

In the opinion of most teachers, it is seen that they made use of music in mathematics classes. In addition to this opinion, a few teachers stated that they did not use music in mathematics classes. Teachers who made use of music in mathematics classes stated that they built up their experiences with various courses, seminars and in-service training. From these statements, it is seen that the pre-school and classroom teachers did not receive music education according to the interdisciplinary approach in their undergraduate education and that they mostly approached the subject with their individual efforts. Besides, it can be said that the teachers had a general idea about interdisciplinary music and mathematics teaching.

Teachers who used music in mathematics classes stated that they used music for reinforcing purposes, preferred it at every stage of the course and used it in subjects, such as rhythmic counting, addition and subtraction, geometry, multiplication tables, fractions, patterns, problem solving, length and quantity.

When the teachers' opinions about their competence in using music in mathematics were examined, it was determined that a relatively large number of them tried to do so but did not consider themselves competent. In addition, teachers emphasized that starting from undergraduate education, a music education program should be

maintained in accordance with the interdisciplinary education approach as well as general music education. This should be supported by in-service training in all teaching processes. An, Ma and Capraro (2011) stated that mathematics courses in which music is used have a positive effect on pre-service teachers' attitudes, beliefs, participation and self-confidence towards learning and teaching mathematics.

In this context, it is recommended that prospective teachers receive a bachelor's degree with an interdisciplinary approach. In addition to general music education, pre-school and classroom teachers can be trained to use music in other fields and classes. Within the Ministry of National Education, courses, in-service training and seminars for the use of music in mathematics courses can be organized. Similarly, teachers can be encouraged to participate in seminars, courses and in-service training aimed at using music in mathematics lessons to make mathematics learning more effective. Providing activities for using music in mathematics lessons in the Ministry of Education textbooks will guide teachers. Finally, mathematics teaching activities with music can be designed and applied, and whether these activities affect students' attitudes and achievement can be investigated by experimental methods.

Research and Publication Statement

The legal permissions required to conduct this research have been approved by the Trabzon Provincial Directorate of National Education with the letter dated 13/05/2019 and numbered 82434636-605.99-E9414027.

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Müziğin Matematik Öğretiminde Kullanılmasına İlişkin Okul Öncesi ve Sınıf Öğretmenlerinin Görüşleri

Atf:

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Özet

Problem Durumu: Matematik ve müzik hakkında yapılan genel tanımlar karşılaştırıldığında bu iki disiplinin farklı yapılarda olduğu anlaşılmaktadır. Matematik incelendiğinde, kurallarla dolu, sayılabilir ve hesaplanabilir bir bilimsel çalışma niteliğini taşıırken, müziğin ise bünyesinde, sanatsallık ve bir ifade tarzı olabilme görevlerini üstlenebildiği görülebilmektedir. Bu iki disiplin çerçevesine yapılan çalışmalar, her ne kadar birbirinden ayrı bir yapı gösterse bile aslında birbirleriyle bağlıdır ve iki bin yıldan fazla bir süredir de sürdürülmektedir. Aslında müzik, oldukça matematiksevidir ve matematik de müzik teorisinin içindeki temel yapıların içerisinde yer alır.

Öğretim programlarında yer alan matematik derslerinin daha verimli ve akılda kalıcı bir halde gerçekleştirilebilmesi açısından bakıldığında matematik disiplinin özünde var olan müziğin, derslerde kullanılması göz önünde bulundurulması gereken bir husustur. Aslında müzik ile birçok disiplinin dinamiklerinin öğrenciye kazandırılabilmesi bilinmektedir ve örnekleri uygulanmaktadır. Burada asıl olarak atlanmaması gereken nokta, eğer disiplinlerarası bakış açısı, bir probleme veya konuya farklı açılardan yaklaşabilmek ise, müziğin içinde barındırdığı matematiksel dinamikleri matematiği daha da anlaşılır bir yapıya büründürmede kullanmak yenilikçi ve çağdaş bir öğretim tarzının karşılığı olacaktır.

Müzik ve matematik tarihin eski çağlarından beri birbiriyle ilişkilendirilmiş ve aralarındaki bağ ortaya koyulmaya çalışılmıştır. Müzik ve matematik arasındaki bu ilişki günümüz eğitim-öğretim programlarına da yansımış ve disiplinler arası alanyazında önemli bir yere sahip olmuştur. Bu nedenle alanyazında önemli bir yer tutan müzik ve matematik ilişkisinin, eğitim-öğretim ortamlarında kullanılmasının işlevsel bakımdan faydalı olabileceği düşünülmektedir. Bu gerekçeyle, müziğin matematik öğretiminde kullanılmasına ilişkin okul öncesi ve sınıf öğretmeni görüşleri tespit edilmeye çalışılmıştır. Bu görüşlerin tespit edilmesi; eğitim-öğretim ortamlarında müziğin matematik öğretiminde kullanılma durumunu ortaya koyması, kullanım sırasında ortaya çıkabilecek problemlerin belirlenebilmesi ve müziğin matematik öğretiminde kullanılmasına yönelik programlar oluşturulabilmesi açısından önemli görülmektedir.

Araştırmanın Amacı: Bu araştırmanın temel amacı, müziğin matematik öğretiminde kullanılmasına ilişkin okul öncesi ve sınıf öğretmeni görüşlerinin tespit edilmesidir.

Arařtırmanın genel amacı ışığında arařtırmada ayrıca ařağıdaki sorulara cevaplar aranmuřtır:

1. Öğrencilerin matematik dersine yönelik tutumlarına ilişkin öğretmen görüşleri nelerdir?
2. Öğretmenlerin matematik öğretiminde karşılařtığı sorunlar ve bu sorunlara ilişkin çözüm önerileri nelerdir?
3. Müziğin matematik öğretiminde kullanılmasına ilişkin öğretmen görüşleri nelerdir?
4. Matematik dersinde müzik kullanımının öğrencilerin öğrenmesine etkisi konusunda öğretmenlerin görüşleri nelerdir?
5. Öğretmenlerin matematik dersinde müzikten yararlanma yeterliliklerine ilişkin görüşleri nelerdir?

Arařtırmanın Yöntemi: Matematik derslerinde müziğin kullanılmasına ilişkin okul öncesi ve sınıf öğretmenlerinin görüşlerinin incelendiğı bu arařtırmada nitel arařtırma yaklaşımı kullanılmıřtır. Arařtırmada incelenecek olan konu ile ilgili derinlemesine bilgi edinebilmek amacıyla, "özel durum yöntemi" kullanılmıřtır. Bu arařtırmanın çalışma grubunu belirlemede "amaçlı örnekleme yöntemi" kullanılmıřtır. Bu çalışma 2018-2019 eğitim-öğretim yılında devlet okullarda görev yapan 15'i sınıf ve 15'i de okul öncesi öğretmeni olmak üzere toplam 30 öğretmen ile yürütülmüřtür. Bu çalışmada veriler, nitel veri toplama tekniklerinden biri olan yarı yapılandırılmıř görüşme (mülakat) tekniğı ile toplanmıřtır. Arařtırmadan elde edilen veriler içerik analizine tabi tutulmuřtur. Bu bağlamda bu çalışmadan elde edilen veriler benzerlikleri bakımından kodlanarak çeřitli kategoriler altında sunulmuřtur. Bu arařtırmada, yarı yapılandırılmıř mülakat formunun hazırlanmasında uzman görüşüne başvurulup veri toplama aracının kapsam geçerliğı sağılanmıřtır.

Arařtırmanın Bulguları: Arařtırmada elde edilen bulgular doğırtusunda, öğretmenlerin çoğı öğrencilerinin matematik dersine karşı olan tutumlarının, ilgi motivasyon ve sevgilerinin genel olarak iyi olduđunu belirtmiřlerdir. Öğretmenlerin çoğı öğrencilerin matematik dersinde karşılařtıkları sorunların başında uzunluk ölçüleri, ritmik sayma, çarpım tablosu ve geometri gibi soyut konuların olduđunu açıklamıřlardır. Öğretmenler, soyut kavramlarda yaşanan zorluğun sebebini genel olarak verilen bilgilerin öğrenciler tarafından günlük hayat ile ilişkilendirilememesi şeklinde açıklamıřlardır. Arařtırmada müziğin matematik öğretiminde kullanılmasına ilişkin öğretmen görüşleri incelendiğinde öğretmenlerin; müziğı derslerde kullanma yönünde olumlu görüşler ifade ettikleri, temel olarak da müziğin matematik derslerini daha kalıcı kıldıđını öne sürdüğü anlařılmaktadır. Öğretmenlerin görüşleri doğırtusunda matematik dersinde müziğin kullanılmasının öğrenciler üzerine olumlu etkilerinin; kalıcılık, matematik dersine karşı sevgiyi arttırma, dikkat çekme gibi unsurlar olduğı görülmektedir.

Öğretmenlerin çoğunun görüşlerine göre; müziğin matematik öğretiminde kullanılmasının öğrencilere motivasyon, kalıcılık, derse katılım ve derse karşı olan tutum ve önyargıların kaldırılması anlamında olumlu katkıları bulunmaktadır.

Arařtırmada öğretmenlerin matematik öğretiminde müziğin kullanılmasının yaratacağı olumsuz etkiler incelendiğinde, öğretmenlerin çoğı olumsuz bir etkisinin olmayacağını belirtmiřlerdir. Bunun yanında doğıabilecek olumsuz durumların daha

çok öğretmenin ve öğrencinin bireysel özelliklerine bağlı olarak ortaya çıkabileceğini belirtmişlerdir.

Öğretmenlerin çoğunun görüşüne göre; matematik dersinde müzikten yararlandıkları görülmektedir. Bu görüşün yanı sıra az sayıda öğretmen de matematik derslerinde müzikten yararlanmadığını belirtmiştir. Matematik derslerinde müzikten yararlanan öğretmenler, bu konu hakkındaki birikimlerini çeşitli kurslar, seminerler ve hizmet içi eğitimlerle oluşturdıklarını ifade etmişlerdir.

Matematik derslerinde müzikten yararlanan öğretmenler, müziği daha çok pekiştirme amacıyla kullandıklarını, dersin her aşamasında tercih ettiklerini ve konular açısından bakıldığında ritmik sayma, toplama çıkarma, geometri, çarpım tablosu, kesirler, örüntü, problem çözme, uzunluk ve miktar konularında kullandıklarını belirtmişlerdir.

Öğretmenlerin matematik dersinde müzikten yararlanma yeterliliklerine ilişkin görüşleri incelendiğinde, nispeten büyük kısmının konu hakkında çaba gösterdikleri ancak kendilerini yeterli görmedikleri belirlenmiştir.

Araştırmanın Sonuçları ve Önerileri: Araştırmada ulaşılan sonuçlara göre, öğretmenler genel olarak öğrencilerin matematik dersine karşı tutumlarını olumlu olarak değerlendirmektedirler. Araştırmada öğretmenlere göre matematik öğretiminde özellikle soyut kavramların öğrenilmesindeki temel problem verilen bilgilerin öğrenciler tarafından günlük hayat ile ilişkilendirilememesidir. Araştırmada müziğin matematik öğretiminde kullanılmasına ilişkin öğretmen görüşlerinin olumlu yönde olduğu sonucuna ulaşılmıştır. Öğretmenlere göre matematik dersinde müziğin kullanılmasının öğrenciler üzerinde kalıcılık, matematik dersine karşı sevgiyi artırma, dikkat çekme açısından olumlu etkiler bırakmaktadır. Araştırmada ayrıca müziği matematik öğretiminde kullanan öğretmenlerin müziği daha çok ritmik sayma, toplama çıkarma, geometri, çarpım tablosu, kesirler, örüntü, problem çözme, uzunluk ve miktar konularında kullandıkları belirlenmiştir. Araştırmada son olarak öğretmenlerin büyük kısmının matematik öğretiminde müzikten yararlanma yeterlikleri konusunda hakkında kendilerini yeterli görmedikleri ancak kendilerini geliştirmeye yönelik çaba gösterdikleri sonucuna ulaşılmıştır.

Araştırmada ulaşılan sonuçlar doğrultusunda öğretmen adaylarına disiplinler arası yaklaşıma yönelik olarak bir lisans eğitimi verilmesi önerilmektedir. Milli Eğitim Bakanlığı'nın bünyesinde müziğin matematik derslerinde kullanılmasına yönelik kurs, hizmet içi eğitim ve seminerlerin düzenlenebilir. Benzer şekilde öğretmenlerin matematik dersini daha etkili hale getirebilmesi için onların müziğin matematik derslerinde kullanılmasına yönelik seminer, kurs ve hizmet içi eğitimlere katılımlarının desteklenmesi önerilmektedir. Milli Eğitim Bakanlığı ders kitaplarında müziğin matematik derslerinde kullanılmasına yönelik etkinliklerin bulundurulması öğretmenlere yol gösterici olacaktır. Son olarak müzikle matematik öğretimi etkinlikleri tasarlanıp uygulanabilir, bu etkinliklerin öğrencilerin matematik tutum ve başarılarına etki edip etmediği deneysel yöntemlerle araştırılabilir.

Anahtar Kavramlar: Müzik, öğretmen görüşleri, matematik eğitimi.