



Music and Melody-based Elementary School Mathematics Learning: Correlational Study of Student Learning Outcomes Achievement

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Pemilihan strategi pembelajaran sangat penting untuk mendapatkan hasil belajar yang optimal, memberikan motivasi serta ketertarikan belajar peserta didik dalam pembelajaran matematika di Sekolah Dasar. Implementasi musik dan melodi dalam pembelajaran dapat dijadikan strategi solutif memberikan dampak positif dalam pembelajaran dalam menciptakan dan meningkatkan kreativitas, kepercayaan diri, motivasi, dan keterampilan kognitif. Selain itu, strategi penggunaan musik dalam pembelajaran adalah strategi yang efektif diterapkan agar siswa dapat belajar secara mandiri. Untuk itu, penelitian ini menyelidiki dampak pengajaran musik dan melodi terhadap hasil belajar matematika Sekolah Dasar kelas rendah. Penelitian ini menggunakan desain eksperimen semu dengan desain eksperimental dan kelompok kontrol. Populasi statistik mencakup 120 siswa kelas tiga dipilih sebagai sampel penelitian. Kedua kelompok mempelajari hal yang sama dan konsep yang ditentukan. Namun, kelompok eksperimen mempelajari konsep-konsep ini menggunakan pengajaran musik dan melodi, sedangkan kelompok kontrol mempelajari konsep-konsep tersebut dengan menggunakan metode pengajaran berbasis konvensional dan nilai akhir matematika siswa digunakan dalam analisis. Angket, kuesional motivasi, tes hasil belajar digunakan dalam instrument penelitian. Hasil kovarians analisis menunjukkan bahwa pengajaran matematika dengan menggunakan metode musik dan melodi mempunyai dampak positif yang signifikan terhadap pembelajaran matematika siswa Sekolah Dasar, yaitu sebesar (87,3%) dan peningkatan motivasi belajar siswa sebesar (92%). Oleh karena itu, dapat disimpulkan bahwa dengan menerapkan pengajaran melodi dalam pembelajaran konsep matematika dapat lebih efektif daripada metode pengajaran konvensional.

Kata Kunci:*Pembelajaran Matematika, Pembelajaran Musik dan Melodi, Sekolah Dasar***Abstract**

Choosing a learning strategy is very important to get optimal learning results, providing motivation and interest in learning for students in learning mathematics in elementary school. The implementation of music and melodies in learning can be used as a solution strategy to provide a positive impact on learning in creating and increasing creativity, self-confidence, motivation and cognitive skills. Apart from that, the strategy of using music in learning is an effective strategy to implement so that students can learn independently. For this reason, this study investigates the impact of music and melody teaching on lower grade elementary school mathematics learning outcomes. This research uses a quasi-experimental design with an experimental design and a control group. The statistical population includes 120 third grade students selected as the research sample. Both groups

learn the same things and defined concepts. However, the experimental group learned these concepts using music and melody teaching, while the control group learned these concepts using conventional-based teaching methods and students' final mathematics scores were used in the analysis. Questionnaires, motivational questionnaires, learning outcomes tests are used in research instruments. The results of covariance analysis show that teaching mathematics using music and melody methods has a significant positive impact on elementary school students' mathematics learning, namely (87.3%) and increases student learning motivation by (92%). Therefore, it can be concluded that applying melodic teaching in learning mathematical concepts can be more effective than conventional teaching methods.

Keywords: *Mathematics Learning, Music and Melody Learning, Elementary School*

Introduction

Many education stakeholders currently focus on the lack of effectiveness of educational efforts in schools, the lack of internalization of expected values, the lack of knowledge of students, the ever-increasing demands for education, the high expectations of families on the education system to provide services, and the low quality of public education. The main aim of every educational activity is to encourage or facilitate the learning process (Nurlaeli & Saryono, 2018). Learning is the process of acquiring knowledge and information about various habits, skills, and different ways of solving problems (Garzón & Acevedo, 2019). The teaching process involves interactions between teachers and students to produce changes in student behavior, which is based on the teacher's orderly and purposeful teaching design (Lewis et al., 2017).

In the context of modern education, these interactions become increasingly complex as technology and new learning methods develop. Teachers not only act as sources of information, but also as facilitators who guide students through active and participatory learning experiences (Agung, 2017). Effective teaching design must be able to respond to students' individual needs and create a learning environment that supports their intellectual and emotional growth.

High-quality teaching requires teachers to develop strategies that not only convey lesson material but also motivate students to be actively involved in the learning process. This research aims to explore how interactions between teachers and students can be improved through innovative teaching design and focusing on clear learning objectives. By understanding the dynamics of these interactions, it is hoped that more effective ways can be found to create

positive changes in students' learning behavior, which will ultimately improve their academic results and overall well-being. In guiding learning, teachers play a role in providing context and conditions that enable students to understand the material being taught. Educational media and tools that suit the needs of the teaching and learning process are facilities that will really help students in conceptualizing and acquiring knowledge.

In contemporary society and the current digital era, traditional teacher-centered teaching methods or what is known as learning using the lecture method are no longer relevant to use. Therefore, teachers try to use the best way to educate students by involving them in various ways of presenting material and can increase their motivation and self-confidence. In a quality teaching and learning process, many factors are involved directly and indirectly. Some factors speed up the process, while others have a negative impact. Most school-aged children have difficulty learning mathematics, and almost the same number as those who have difficulty reading. Research conducted by Esteki also shows that even some naturally intelligent students experience problems calculating numbers, known as calculation disorders (Esdek et al., 2007).

On the other hand, learning using music is a method that has a very positive impact in facilitating the learning and teaching process. Music, as a universal and enjoyable medium, is able to attract students' attention and increase their learning motivation. This method is very effective especially in the early stages of education such as in kindergarten and elementary school. At this age, children are very responsive to sensory stimulation, and music can help them understand basic concepts in a more interesting and enjoyable way (Barkhoda et al., 2015).

Adding music to the basic education curriculum will not only make the learning process more enjoyable, but will also facilitate a deeper understanding of the subject matter. Music can be used as a tool to teach various concepts, from mathematics to languages, in creative and innovative ways. This research aims to explore how the integration of music in teaching can improve the effectiveness of learning at the primary education level, as well as to identify the long-term benefits of this approach on students' cognitive and emotional development.

The relationship between music and mathematics dates back to at least 500 years BC. The relationship between music and mathematics has been studied and understood through common interpretations such as relationships and patterns. Pythagoras used mathematics to understand musical concepts in order to expand his opinions in the field of music. Mathematics, music and communication they say that music and mathematics awaken a deep understanding of nature and humans. Music shows the emotional impact, while mathematics shows the logical impact of nature.

The goal of mathematics is not only to follow the correctness of a problem, but also to understand the reasons behind its correctness. This understanding is very important in developing critical and analytical thinking skills that can be applied in various aspects of life. Precision in mathematics provides a solid foundation for ensuring that the solutions produced are correct, however, a deep understanding of the reasoning behind those solutions allows students to apply the same concepts in different contexts. As stated by Skemp (1976), instrumental understanding (knowledge about how to do something) needs to be complemented by relational understanding (knowledge about why something is done) to achieve complete and meaningful learning.

Furthermore, understanding the reasons behind mathematical truths helps students develop more flexible and creative problem-solving skills. This is important because problems faced in real life often do not follow patterns that have been studied directly in mathematics classes. By understanding the basic principles and logic behind mathematical concepts, students can more easily adapt and find innovative solutions to new problems they may encounter. Polya (1957) in his book "How to Solve It" emphasizes the importance of

understanding the process in problem solving, where a deep understanding of the basic principles allows one to be more effective in finding solutions.

Playing a song is similar to understanding a math problem; the meaning is associated with a valid symbol, which includes all the important information. The existence of such a relationship has led many researchers to examine the impact of music teaching on mathematics learning abilities in elementary school students. Research results show that rhythmic education dramatically improves mathematics learning abilities (Qasim Tabar et al., 2011). Research also shows that the use of art and music at low cost can bring teachers and students to achieve desired results (Dehghani & Amara, 2018). Education with music can improve and facilitate children's learning skills. Rich musical experiences, including singing, listening, and moving, create joy in children and provide the foundation for their progress in reading, writing, thinking, and other skills.

Over the past several decades, research has produced significant findings about the positive impact of music education on behavior and the development of cognitive skills, including attention, language, reasoning, logical thinking, critical and mathematical thinking, planning, emotional control, and working memory at all stages of human development. According to Sala and Gobet (2020), musical activities can help children create awareness and multisensory responses to sound. Furthermore, Moreno et al. (2009) stated that effective learning with music can improve lexical skills, sound recognition, phonology, speaking and reading in children. Anthony et al. (2018), in their intervention study, found that teaching music skills was a valuable strategy for helping children who struggle with reading.

The research results show that music can be an effective tool in developing children's literacy skills, providing evidence that musical activities not only enrich artistic aspects but also support academic aspects. By integrating music into the curriculum, educators can provide a more holistic approach to the learning process. According to Tai et al. (2018), there is a clear relationship between music education and general academic achievement. Apart from that, Kamankesh and Salehi Omran (2020) in their research concluded that the music-based learning model was effectively applied in independent learning, increasing scores in self-

control, self-management, and the tendency to learn new things. These findings strengthen the argument that music can play an important role in the development of cognitive and emotional skills essential for academic success and daily life.

Despite this large amount of data showing the positive impact of music and its function on learning, it is not officially used in our country's education system. This requires monitoring or proving the effectiveness of music through practical research in school classrooms so that the results of the research can be used as material for making correct and appropriate decisions. Therefore, this research aims to determine the effect of teaching music and melody in elementary schools on students' mathematics learning outcomes.

Method

Research design

The research was conducted using a quasi-experimental design with experimental and control groups. A total of 120 students were sampled in this research. They were then randomly divided into two groups, experimental and control. Entry criteria for this study included normal intelligence, absence of hearing impairment, informed consent from parents, and absence of learning disorders. To collect data, demographic questionnaires, Mathematics Motivation Questionnaires, progress tests and achievement tests (post-test) were used.

Procedure

After selecting the research sample, the experimental group used a special method that combines music and rhythm to learn mathematical concepts, while the control group was given a routine lecture-based teaching method from the teacher. The researcher practiced teaching mathematics in the experimental group classes (concepts such as numbers, addition, subtraction, multiplication, multiplication tables, etc.) through various methods such as rhythmic and melodic expressions of lessons, playing musical videos containing pictures of mathematical concepts with music that students like, asking students to sing and follow the rhythm by shaking their hands while teaching and playing clips, asking them to repeat lessons in the form of rhythmic and melodic expressions by shaking their hands, and so on.

Statistic analysis

To test the research hypothesis, univariate covariance analysis was carried out. Before carrying out covariance analysis, a prerequisite test is carried out.

Result and Discussion

Result

Based on the research results, the pre-test and post-test data in the control and experimental classes were as follows:

Table 1 Pre-test and Post-test Results for Control and Experimental Classes

Variables	Group	Pre-Test	Post-Test
		Mean	Mean
Math	Control	45,33	45
Motivation	Experimental	49,13	68,33
Math	Control	15,20	15,33
Learning	Experimental	13,93	1833

Base on table 1, the average learning motivation and mathematics learning outcomes of the experimental and control groups in the pre-test were not too different. However, the means on the post-test of the two groups were very different, and in all aspects, the means of the experimental group improved more than those of the control group. Based on the research design consisting of a pre-test and post-test, univariate covariance analysis was carried out to analyze the data and control the influence of the pre-test and post-test. Before carrying out the analysis, a preliminary test was carried out, namely data normality using the Kolmogorov-Smirnov test. The results of the Kolmogorov-Smirnov test are presented in table 2.

Table 2 Results Obtained from the Kolmogorov-Smirnov Test

Component	Test	Kolmogorov-Smirnov	Sig.
Learning	Pre-Test	0,139	0,073
Motivation	Post-Test	0,121	0,201
Math	Pre-Test	0,211	0,071
Learning	Post-Test	0,201	0,072

The results show that the p value in the test is greater than 0.05, which indicates that the available data is normal. The second assumption is homogeneity of group

variance. Levene's test was used to evaluate homogeneity of variance between groups. Data analysis is presented in Table 3.

Table 3.
Evaluation of Groups' Homogeneity

Variable	Test	Test Levenmce	Sig.
Learning	Pre-Test	0,181	.675
	Post-Test	3,074	.090
Math Learning	Pre-Test	0,819	.373
	Post-Test	0,956	.353

Hypothesis test

To test the first hypothesis which states that "Teaching music and melodies has a significant influence on elementary school students' learning motivation in learning mathematics", using Covariance analysis.

Table 4 shows that the average effect of melody teaching on students' learning motivation increased significantly in the post-test phase. However, to determine the effect, a pre-test was carried out with a covariance analysis test, and the results showed significant differences between student learning in the post-test phase. Thus, the hypothesis about the influence of music and melody teaching on motivation to learn mathematics is confirmed. The magnitude of the effect at the post-test stage was around 86%. In other words, around 86% of the increase in students' learning motivation was caused by the influence of music intervention and melody teaching.

In addition, to test the second hypothesis of this study which states that "Teaching music and melodies has an effect on better mathematics learning", an analysis of covariance was carried out.

Table 4 Results of the First Hypothesis Covariance Analysis

Math Motivation	Sum of Squares	D F	Mean Square	F	Sig.	Eta Squared
Pre-test of Math Motivation	2936,241	1	2946,122	156,072	.000	.870
Group	16,10	1	3123,683	164,564	.000	.770
Error	457,2946	26	16,321			
Total	112755,000	30				

Table 7 Results of the Second Hypothesis Covariance Analysis

Math Learning	Sum of Squares	D F	Mean Square	F	Sig.	Eta Squared
Pre-test of Math Learning	172,9000	1	172,800	150,122	.000	.687
Group	122,322	1	125,322	58,279	.000	.607
Error	47,669	27	1,612			
Total	87887,000	30				

As seen in Table 5, the average effect of melody teaching on better mathematics learning increased significantly in the post-test phase. However, to determine the effect of the pre-test, a covariance analysis test was used, and the results showed significant differences between student learning in the post-test phase. Thus, the second hypothesis is confirmed. The magnitude of the effect at the post-test stage was around 70.8%.

Discussion

This study evaluates the impact of music and melody teaching on elementary school students' mathematics learning progress. The study findings showed that teaching integrated with music and melodic methods had a significant positive impact on learning motivation, with 93% of students showing increased motivation. In addition, 87.3% of third grade students experienced improvement in mathematics learning. These findings indicate

that the integration of music in mathematics teaching can not only increase learning motivation but also better understanding of mathematical concepts. The high increase in motivation reflects that music can create a more enjoyable and interesting learning environment for students, so that they are more motivated to be actively involved in the learning process. This high motivation contributes to students' greater engagement and participation in learning activities, which in turn has a positive impact on their learning outcomes.

The increase in mathematics learning outcomes shows that the use of music and melodies in teaching can help students understand mathematical concepts more easily. Music may serve as a cognitive aid that helps students remember and process information more effectively. Additionally, rhythms and melodies in music can help students internalize mathematical patterns, which are important in understanding concepts such as numbers and geometry.

Based on these results, the use of music as an accessible, inexpensive, and popular solution can be considered an important and effective strategy for teaching mathematics to children. The results of this study are in line with previous findings which found that the use of music has a positive impact on teaching and learning in the elementary school curriculum (Goodarzi and Mahmoudzadeh, 2018; Mazlum Shahraki et al., 2019; Desyandri, 2019; Aulia et al., 2022). This confirms that music is not only a teaching aid, but can also improve the overall quality of learning.

In addition, these results are in line with research by Ghasem Tabar (2012) concluding that the use of music in education can improve pre-schoolers' ability to classify skills, identify similarities and differences, and retain numbers and geometry mentally. This shows that the positive effects of music in education are not limited to one level of education, but cover various levels of education, from pre-school to elementary school. The use of music as an educational tool has broad implications. At the pre-school level, music can help children

develop basic skills that are essential for their cognitive development. For example, the rhythms and melodies in music can help children develop fine and gross motor skills, which are important for daily activities and further learning. Additionally, music can improve children's memory skills, helping them remember and internalize information better.

At the elementary school level, the integration of music in mathematics learning can make abstract concepts more concrete and easier to understand. Music can be used to introduce mathematical concepts through songs and games involving counting and patterns. This not only makes learning more fun but also improves students' ability to understand the subject matter. Research shows that multisensory approaches, such as the use of music, can improve students' information retention and conceptual understanding.

Additionally, music can play an important role in developing students' social and emotional skills. Through musical activities, students learn about cooperation, communication, and empathy, all of which are important for their social development. Music can also help students manage stress and anxiety, which in turn can improve their academic performance.

Thus, the findings of this study provide strong evidence that the integration of music in mathematics teaching can be an innovative and effective approach to improving student motivation and learning outcomes. Implementing this strategy in schools can make a significant contribution to improving the quality of mathematics education at the elementary school.

Conclusion

Integrating music into the learning process is an effective method that can bring significant changes to elementary school mathematics learning. Cross-disciplinary activities such as music that incorporate mathematics into the curriculum provide opportunities for students to better understand and apply mathematical knowledge. Recent

research shows that there are many connections between music and mathematics. This integration between music and mathematics provides teachers with the opportunity to teach mathematical concepts and processes through musical themes.

Like all research, this study has several limitations. The study sample size and their educational level were among these limitations. Other studies with larger sample sizes and different levels of education may provide more comprehensive results. Additionally, music could be used in teaching other subjects to allow further comparison of the results. Due to the limited use of music in our country's education system, more research needs to be done on the scientific and practical benefits of music in this field. Recognizing the capabilities, functions and possible influence of music on the learning process will pave the way for the practical application of music in various educational fields, especially in schools.

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