



Enhancing Pupils' Memorization in Mathematical Concepts Through Customized Song Adaptations

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ABSTRACT

Mathematics is often perceived by elementary pupils as a problematic and intimidating subject, leading to low engagement and poor retention of concepts. This study investigated the usefulness of modified songs in leveling up the memorization of concepts in mathematics among fifth-grade pupils at a public school in Ozamiz City (S.Y. 2024–2025). A quasi-experimental method was employed, with 40 carefully selected pupils participating. The data were collected using the pre-test and post-test. The investigation revealed a very low degree of memory before the songs were adapted, but a considerable increase was observed in their use. Statistical analysis confirmed a notable rise in test scores, while qualitative data revealed greater engagement, enjoyment, and confidence in learning mathematics. The findings suggest that integrating music-based strategies into instruction can effectively support concept retention and improve the overall learning experience in mathematics.

KEYWORDS: Customized songs, Mathematics, Memorization, Music-based learning, Retention, Modified songs.

I. INTRODUCTION

Classroom discussions are essential for deepening students' understanding and promoting critical thinking, yet engaging students in these discussions can be challenging. Traditional teaching methods often fail to capture the diverse interests and learning styles of students. Music, a universally recognized form of expression, has the potential to bridge this gap by making learning more engaging and memorable (Johnson, 2019). Dyscalculia is a specific type of mathematical learning disability. It is one of the most common learning problems affecting students' ability to do mathematics (Rajkumar & Hema, 2020).

Music is used throughout the lessons as a fun and engaging tool, featuring original songs that teach key ideas, vocabulary, and steps in solving addition, subtraction, multiplication, and division problems. Music is also used during short brain breaks, as calming background music while students work, and even in some assessments. Through this project, teachers can access unit plans, sample lesson plans, three complete lessons with slides and a teacher's script for each unit, and a document with the lyrics of the original songs. (Riebe, 2021). Traditional ways of teaching math are often connected to students feeling negative about the subject and becoming less motivated and interested during lessons. Using arts integration, especially pop music, helped improve fifth graders' attitudes toward math and increased their motivation and participation during math lessons. (Hook, 2022).

Students who struggle with math make progress on tests, but not as much as their peers. There is a strong and relatively stable correlation between the identification of mathematical difficulty and performance in later grades. Overall, this study shows that students who have trouble with math often keep struggling in the higher grades and may need special education support. (Nelson & Powell, 2018).

Math lessons that included music had a positive impact on students' attitudes and beliefs about learning math. (An & Ma, 2019). Incorporating music into mathematics instruction has proven to be an effective way to improve student engagement and comprehension of essential concepts. Incorporating music-based activities into math lessons enhances students' problem-solving skills and practical application by fostering interest and motivation. Songs serve as an innovative and memorable medium for teaching abstract ideas, such as equation solving, by using rhythm and melody to simplify complex topics (Capraro & Tillman, 2023).

This method has shown success in elementary education, promoting active involvement and a deeper grasp of mathematical concepts. For instance, teachers can use songs to break down the steps of solving equations, including identifying variables, executing operations, and verifying answers. Studies also highlight the cognitive advantages of music in learning, emphasizing its role in engaging students and improving understanding. By incorporating songs into math lessons, educators can employ a dynamic approach that accommodates various learning styles, making abstract concepts more approachable and enjoyable for young learners (Hidayat, 2019).

This study looked at how a series of classroom activities combining math and music could give teachers a new way to teach math. Teachers should use music as a tool to help all students learn math in both fun and challenging ways, improving their math skills, problem-solving abilities, and positive attitude toward the subject. (An, 2021). Teachers used different music activities to teach various math topics. These music-math lessons had positive effects on several areas of students' math skills. (Capraro & Tillman, 2022). Integrating music into mathematics instruction significantly benefits students, teachers, parents, and school administrators. For students, it enhances engagement, creativity, and retention of mathematical concepts while fostering positive attitudes toward learning (Cornett & Ganda, 2023). Teachers gain innovative tools to create dynamic lessons, improving classroom management and catering to diverse learning styles (Flohr & Dulabaum, 2023). Parents observe improved academic interest and problem-solving skills in their children, which can enhance home-study habits.

Additionally, schools adopting music-based interventions, such as the Opening Minds through the Arts program, report higher standardized test scores and reduced behavioral issues, showcasing the potential of music to transform educational outcomes (Cornett, 2021). As a result, the researcher discovered a gap in past studies about how using personalized song adaptations can help students remember math concepts better. Also, earlier studies did not focus on using music to help students memorize math concepts. This topic includes several unexplored areas that have recently caught the interest of researchers from other fields. The idea of combining subjects, especially using music in teaching, needs more study to understand why this method isn't often used in math education, particularly to help students remember math concepts. (Miles, 2017).

II. INTERVENTION

To address pupils' difficulties in memorizing mathematical concepts, the intervention integrated customized song adaptations into the learning process. By creating songs tailored to specific mathematical topics, such as multiplication tables and problem-solving techniques, pupils were able to engage with the content more enjoyably and memorably. Music has been proven to enhance retention and understanding through rhythm, melody, and repetition, serving as a powerful mnemonic tool (Cornett, 2023). Additionally, interactive sessions where pupils compose their own lyrics related to mathematical concepts further enhance creativity and collaboration, fostering a deeper understanding of the subject (Flohr, 2021).

On the positive side, music can significantly improve memory retention, enhance student engagement, and stimulate creativity, making abstract mathematical concepts easier to grasp and more enjoyable to learn. It also promotes a collaborative classroom atmosphere and alleviates math anxiety, contributing to a more favorable attitude toward the subject (Juni, 2020). The intervention consists of identifying essential mathematical concepts, creating tailored songs, integrating them into engaging lessons, and evaluating their effectiveness through assessments and feedback (Petrona, 2020).

To effectively implement this intervention, the teacher will integrate the customized math songs into daily mathematics lessons. At the beginning of each session, pupils will be introduced to a math concept through a catchy, easy-to-remember tune, followed by a guided discussion to clarify the ideas presented in the lyrics. After singing, pupils will engage in collaborative exercises, including group problem-solving, games, and worksheet activities, all of which are directly aligned with the song content. Regular review and repetition of the songs throughout the week will help reinforce retention and understanding of the mathematical concepts.

III. ACTION RESEARCH QUESTIONS

This action research aimed to improve pupils' memory of math concepts by using customized song adaptations in a public elementary school in Ozamiz City during the school year 2024–2025. Specifically, it aimed to answer the following questions:

1. What is the level of Grade 5 pupils' ability to memorize mathematical concepts before the implementation of music-enhanced learning?
2. What is the level of Grade 5 pupils' ability to memorize mathematical concepts after the implementation of music-enhanced learning?
3. Is there a significant difference in the level of Grade 5 pupils' ability to memorize mathematical concepts before and after the implementation of music-enhanced learning?

IV. ACTION RESEARCH METHODS

A. Research Design

The study used a quasi-experimental design with one group that took tests before and after the intervention. It aimed to find out how effective music-based learning was in helping Grade 5 pupils remember math concepts better. This design was suitable for examining the impact of the intervention by comparing pupils' performance in mathematics before and after the implementation of music-enhanced learning activities. By integrating music as a teaching tool, the study sought to enhance students' engagement, retention, and understanding of mathematical concepts. This approach allowed for the observation of changes within the same group of pupils, providing insights into how music influenced their cognitive and memory skills. The quasi-experimental design was deemed appropriate for the school year 2024–2025, as it aligned with the study's goal of improving classroom instruction through innovative strategies tailored to students' needs.

B. Research Setting

The research was conducted in one of the prominent public elementary schools in Ozamiz City. The school was dedicated to supporting students with diverse educational needs through its Special Education (SPED) programs, which catered specifically to learners requiring additional assistance. It also offered the Alternative Learning System (ALS) for out-of-school youth and adults, providing them with opportunities to gain vital skills and knowledge. Additionally, it implemented Special Support and Enrichment Services (SSES) aimed at enhancing the overall learning experience for all students. This inclusive approach reflected the school's commitment to fostering an environment where every learner could achieve their potential and succeed academically.

The school's initiatives were part of a broader commitment in the Philippines to enhance educational accessibility and inclusivity for all students, aligning with national education policies and programs aimed at improving learning outcomes across diverse learner populations. Purposive sampling was used to introduce and implement music-based teaching strategies, allowing the researcher to observe student reactions and gather data in a natural learning environment.

C. Participants of the Study

The study included 40 Grade 5 pupils from one section taught by the researcher. They were chosen on purpose using certain rules: they had to be enrolled as Grade 5 pupils for the school year 2024–2025 and taking Mathematics 5. The researcher made sure that all the pupils met these rules before starting the activity. Pupils from other Grade 5 sections were not included to keep the results clear and focused.

D. Instruments

The following instruments were used in this study:

A. Music-Enhanced Math Learning Assessment.

The Music-Enhanced Math Learning Assessment was a researcher-made questionnaire designed to assess pupils' memorization of mathematical concepts through the integration of customized songs. The assessment was divided into three parts: a Math Performance Task, a Reflection on Music Integration, and Teacher Feedback. The Math Performance Task required pupils to solve a series of math problems that directly related to concepts taught through the customized songs. This section evaluated their understanding and retention of mathematical concepts by measuring accuracy and problem-solving skills. The Reflection on Music Integration section consisted of open-ended questions prompting pupils to reflect on their experiences using music to aid their memorization of math concepts. The Teacher Feedback section gathered observations from teachers regarding student engagement and the overall effectiveness of the music-based approach in enhancing memorization.

In determining the test performance, the following rubric was used.

Table a. Rrubric for test performance

Score	Grade Equivalence	Interpretation
26-30	90-100	Outstanding
23-25	85-89	Very Satisfactory
21-22	80-84	Satisfactory
18-22	75-79	Fairly Satisfactory
1-17	Below 75	Did not meet expectation

B. Lesson Plan.

The researcher developed lesson plans aimed explicitly at enhancing pupils' memorization of mathematical concepts through the use of customized song adaptations. These lesson plans were designed to align with the Grade 5 mathematics curriculum and to integrate music as an instructional tool to support concept retention.

To ensure the quality, relevance, and appropriateness of the lesson content and strategies, the lesson plans underwent a thorough review process. First, the cooperating teacher, Mrs. Marjorie Rusiana, provided feedback on the instructional flow, content accuracy, and integration of musical elements. Additionally, the subject teacher, Mrs. Marites Jumalon, the Grade 5 Mathematics teacher of Section Cheerful at a public elementary school in Misamis Occidental, also reviewed the lesson plans. Her insights, based on classroom experience and familiarity with the pupils' learning needs, were incorporated to refine the instructional materials further.

Following the revisions based on both reviewers' feedback, the finalized lesson plans were implemented during classroom sessions with Grade 5 pupils. This ensured that the intervention was not only academically sound but also practical and responsive to the learners' context.

E. Data Collection**A. Pre-Implementation Phase.**

Before starting the study, the researcher looked into the common problems that elementary pupils face in remembering math concepts. These included having trouble retaining lessons, lack of interest, and difficulty recalling information when solving problems. A comprehensive review of literature on music-based learning strategies and

their application in mathematics was conducted to build a strong theoretical foundation for the research. The researcher then wrote a detailed research proposal and asked permission from the school principal and the division superintendent of Ozamiz City to carry out the study. During this phase, customized lesson plans were developed, incorporating the use of adapted songs to teach mathematical concepts. These songs emphasized key ideas, terminologies, and problem-solving steps in an engaging and memorable format. Pre-test and post-test assessments were also designed to evaluate pupils' ability to recall and apply mathematical concepts. The assessment tools focused on measuring accuracy in solving problems, use of mathematical vocabulary, and understanding of concepts. Additionally, observation tools were prepared to document pupils' engagement and participation during the intervention. Orientation sessions with teachers and pupils were conducted to ensure clear guidance and smooth implementation of the study.

B. Implementation Phase.

The implementation started with a pre-test to find out the pupils' initial ability to remember math concepts. The music-enhanced intervention was then conducted over four weeks. During this time, pupils engaged in structured learning activities using customized math songs. These activities included singing along to the songs, identifying key concepts from the lyrics, and applying the learned concepts to solve mathematical problems. During the intervention, the researcher observed and noted the pupils' participation, interest, and improvement. The pupils also joined group activities where they sang the songs together and talked about how the lyrics helped them remember math concepts. This method encouraged both individual and group learning. The researcher made changes to the lesson plans and songs based on observations and feedback to make the learning process more effective. After the intervention, a post-test was given to see how much the pupils improved in remembering and using math concepts. The results were compared with their pre-test scores to find out how effective the music-based learning strategy was.

C. Post-Implementation Phase.

After the intervention, the researcher will study and interpret the data collected. The analysis will focus on finding improvements in pupils' ability to remember math concepts, such as better recall, improved understanding of terms, and stronger problem-solving skills. Statistical tools will be used to compare the pre-test and post-test results, and the findings will be written in a detailed research report. The report will show how music helped pupils retain mathematical concepts and will suggest ways to use similar methods in classroom teaching. The results will be shared with teachers, school leaders, and curriculum developers through meetings, seminars, or workshops. Finally, the researcher will reflect on the entire study, noting what can be improved and suggesting future research directions to further explore the use of music in education.

F. Ethical Considerations

The study followed ethical standards based on Republic Act No. 10173, the Data Privacy Act of 2021, which protects personal information and privacy rights. To ensure this, participant data were kept anonymous using unique codes, stored safely with limited access, and reported in a way that did not reveal identities. The researcher recorded all data collection methods and changes accurately and fairly to maintain transparency and allow the study to be repeated. All communication during the research was done honestly and respectfully.

G. Data Analysis

Using Minitab statistical software, the following tools were applied: Frequency and Percentage were used to identify the pupils' retention levels based on their pre-test and post-test results. Mean and Standard Deviation were used to measure the pupils' ability to remember and apply math concepts before and after the music-based intervention.

A t-test was also conducted to determine if there was a significant difference in the pupils' performance before and after using customized math songs as a learning strategy.

III. RESULTS AND DISCUSSION

A. Pupils' Ability Level to Memorize Mathematical Concepts Before the Implementation of Music-Enhanced Learning

Table 1 presents the memorization levels of pupils in mathematical concepts before the implementation of customized song adaptations. The data reveal that the class generally struggled with retention, as evidenced by the majority of scores falling below the expected level ($M = 16.08$; $SD = 6.20$). A notable portion of the class fell into the lower categories of performance, with results indicating wide variability in their ability to recall and apply mathematical concepts ($M = 8.50$; $SD = 3.90$ and $M = 18.86$; $SD = 0.77$). Remarkably few learners achieved higher levels of mastery, and none reached the highest performance bracket.

This data indicates that before the integration of music-enhanced learning, pupils had considerable difficulty retaining mathematical concepts. The low average and wide spread of scores suggest inconsistent and generally poor retention across the class. These findings align with existing literature highlighting the challenges faced by learners in internalizing abstract mathematical ideas (Gargish et al., 2021). Students who struggle with retention may find it hard to recall prior knowledge, especially when solving problems that require following step-by-step procedures (Cominghud, 2021).

The lack of effective engagement strategies may have contributed to these results. Limited exposure to stimulating and context-based learning experiences can hinder learners' ability to build deep understanding and long-term memory in mathematics. Traditional methods, such as rote memorization without contextual aids, often fail to support pupils in forming meaningful connections with the content (Lange, 2021).

These findings underscore the need for innovative instructional interventions that can enhance cognitive engagement and memory retention. Music, particularly in the form of customized song adaptations, emerges as a promising tool. Embedding learning in multisensory and real-life contexts can help pupils better encode and retrieve information. Thus, before implementing the intervention, it was clear that new strategies were necessary to address the gaps in pupils' learning and performance (Kang et al., 2020).

Table 2: Pupils' Ability Level to Memorize Mathematical Concepts Before the Implementation of Music-Enhanced Learning

Ability Level	Frequency	Percentage	M	SD
Very Satisfactory	1	2.50	23.00	-
Satisfactory	11	27.50	21.55	0.52
Fairly Satisfactory	14	35.00	18.86	0.77
Did not Meet the Expectations	14	35.00	8.50	3.90
Overall Performance	40	100.00	16.08	6.20

Note Scale: 26-30 (Outstanding); 23-25 (Very Satisfactory); 21-22 (Satisfactory); 18-20 (Fairly Satisfactory); 1-17 (Did not Meet the Expectations)

B. Pupils' Ability Level to Memorize Mathematical Concepts After the Implementation of Music-Enhanced Learning

Table 2 shows the pupils' retention levels in mathematical concepts after using the customized songs. The results reveal a clear improvement in performance, with many pupils reaching higher levels of memorization compared to the pre-test. A large portion of the class performed at an outstanding level, showing a strong improvement in overall understanding and retention (62.5%, $M = 28.00$; $SD = 1.25$).

In addition, many pupils reached a very satisfactory level of performance, showing that the intervention helped improve not only the top performers but also those who previously had difficulties (30%, $M = 24.33$; $SD =$

0.98). Only a small number of pupils stayed in the “fairly satisfactory” category, and importantly, no one fell below expectations—unlike in the pre-test (7.5%, $M = 20.00$; $SD = 0.00$). The class average also improved greatly, showing better retention and more consistent performance among the pupils ($M = 25.80$; $SD = 2.75$).

Students often find it difficult to understand abstract concepts, which can affect how well they learn mathematical ideas (Pondai et al., 2020). Those who struggle with retention may also have trouble recalling what they have learned before, especially when solving problems that involve following a series of steps. (Rogers, 2023). Limited exposure to stimulating and context-based learning experiences can hinder learners' ability to build deep understanding and long-term memory in mathematics. Traditional methods, such as rote memorization without contextual aids, often fail to support pupils in forming meaningful connections with the content (Munoz, 2022).

The integration of customized song adaptations as a learning strategy addresses these issues by providing a multisensory and engaging approach to instruction. The rhythm and repetition inherent in songs may have facilitated deeper encoding of concepts, thereby enhancing memory retention (Tayes, 2021). This approach not only increased motivation and participation but also contributed to a more inclusive learning environment, enabling a broader range of pupils to achieve academic success.

Overall, the data from Table 2 underscore the potential of music-integrated instruction to significantly improve pupils' ability to retain and recall mathematical concepts, offering a promising avenue for enhancing mathematics education.

**Table 2: Pupils' Ability Level to Memorize Mathematical Concepts
After the Implementation of Music-Enhanced Learning**
($n=40$)

Ability Level	Frequency	Percentage	M	SD
Outstanding	25	62.50	29.40	1.00
Very Satisfactory	3	7.50	25.00	0.00
Satisfactory	3	7.50	22.00	0.00
Fairly Satisfactory	5	12.50	19.20	0.84
Did not Meet the Expectations	4	10.00	15.00	2.16
	101			
Overall Performance	40	100.00	25.80	5.30

Note Scale: 26-30 (Outstanding); 23-25 (Very Satisfactory); 21-22 (Satisfactory); 18-20 (Fairly Satisfactory); 1-17 (Did not Meet the Expectations)

C. Significant Difference in the Pupils' Ability Level to Memorize Mathematical Concepts Before and After the Implementation of Music-Enhanced Learning

Table 3 shows the pupils' memorization levels in mathematical concepts after using the customized songs. The results indicate a clear improvement in retention, with more pupils achieving higher performance levels compared to before the intervention. The overall class mean also increased, suggesting that pupils developed a stronger understanding of math concepts through the use of music as a learning tool ($M = 21.40$; $SD = 4.57$). Pupils who previously struggled showed notable gains, with performance scores reflecting more consistent and satisfactory levels of retention across the group ($M = 21.00$; $SD = 1.41$ and $M = 19.00$; $SD = 0.00$). Additionally, learners at the upper end of the performance scale began to emerge, indicating that the strategy not only supported those below expectations but also elevated overall mastery ($M = 27.00$; $SD = 0.00$).

These results affirm the effectiveness of using music as an instructional tool to support cognitive processing in mathematics. Incorporating auditory and rhythmic stimuli into instruction allows students to anchor abstract concepts in more memorable sensory experiences, thereby enhancing long-term retention (Rinwise et al., 2024). Traditional math instruction often lacks meaningful engagement, which hinders students' ability to form lasting connections with the content. Customized song adaptations address this by transforming complex ideas into lyrical and rhythmic

formats that promote active recall and concept reinforcement (Gonzales, 2019). Furthermore, the importance of contextual and creative strategies in supporting learners who struggle with internalizing abstract content is vital, something this musical approach clearly provided, as evidenced by the higher post-test scores (Llagass, 2023).

This improvement underscores not only the potential of music to improve recall but also its role in making mathematics more enjoyable and less intimidating. With increased confidence and interest, pupils were better able to engage with the material, resulting in more consistent performance and stronger memorization outcomes.

Table 3: Significant Difference in the Pupils' Ability Level to Memorize Mathematical Concepts Before and After the Implementation of Music-Enhanced Learning
(n=40)

Variables	M	SD	t-value	p-value	Decision
Before Implementing Music-Enhanced Learning	16.08	6.20	11.87	0.000	Reject Ho
After Implementing Music-Enhanced Learning	25.80	5.30			

Ho: There is no significant difference in the pupils' ability level to memorize mathematical concepts before and after the implementation of music-enhanced learning

Note: Probability Value Scale: **p<0.01 (Highly Significant); *p<0.05 (Significant); p>0.05 (Not Significant)

III. CONCLUSION

Based on the findings, the following conclusions were made:

1. Conventional teaching strategies may not be sufficient to support pupils in memorizing mathematical concepts effectively.
2. Integrating music-enhanced learning, such as customized song adaptations, can significantly improve pupils' ability to retain and recall mathematical concepts.
3. The significant improvement in pupils' performance after the intervention shows that music-based strategies have a positive effect on memory and learning in mathematics.

IV. RECOMMENDATIONS

The following are the recommendations based on the study's findings and conclusion.

1. To enhance the learning experiences of students, school administrators may organize workshops, in-service training, or professional development sessions focused on integrating music and other innovative teaching methods into subject instruction.
2. Teachers may utilize personalized songs in teaching math to strengthen engagement and retention of essential concepts and procedures.
3. Future researchers may investigate how music-enhanced activities such as singing and connecting lyrics to math tasks foster engagement and improve retention, offering more profound insights into music's role in learning.

4. Parents may support their children's learning at home by encouraging the use of educational songs and helping them practice through singing, reviewing lyrics, or even creating new ones together. This can reinforce classroom learning and promote a positive attitude toward mathematics.

ACKNOWLEDGEMENT

The following people deserve special recognition from the researcher for their unwavering support and direction, which have been very helpful to the completion of this study:

To Dr. Genelyn R. Baluyos, instructor and dean of the College of Education, for her guidance and knowledge.

To the principal of Ozamiz City Central School, Mr. Eugenio C. Bucog, for his approval and assistance.

Thank you to my cooperating teacher, Mrs. Marjorie P. Rusiana, for her steadfast assistance. The constant help provided by family and partner has inspired others to push beyond current efforts.

Thanks go to the friends and classmates who aided in the financial success of the project with their help and kind words, and a special thank you to the Grade 5 students who participated much to the research and worked with excitement. Most of all, the Almighty God is highly thanked for his graciousness and continuous guidance during this research process.

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