© IJARW | ISSN (O) - 2582-1008
December 2025 | Vol. 7 Issue. 6
www.ijarw.com

The Effects of Classical and Pop Music on Students' Mathematical Problem-Solving Performance

Teddie Jr A. Dumalaoron [1], Aprell L. Abellana [2]

[1]*Graduate Student, Master of Science in Mathematics Education, Central Mindanao University, University Town, Musuan Maramag, Bukidnon, 8710, Philippines.*
[2]*Associate Professor, Professional Education Department, College of Education, Central Mindanao University, University Town, Musuan Maramag, Bukidnon, 8710, Philippines;*

ABSTRACT

Music has been a part of students' lives nowadays, and it influences their focus on academics. Improving students' focus and analysis of mathematical problem-solving is essential for junior high school students. However, the effectiveness of music depends on the kind of music the students are exposed to during the learning process. This study delved into how classical and pop music affect the math problem-solving skills of Grade 7 students at a Seventh-day Adventist school in Don Carlos, Bukidnon, Philippines, during the school year 2025–2026. Ninety students were placed into three groups: the group who listened to classical music, to pop music, and the other had no music but only silence. All of them took the DepEd MATATAG summative test in Mathematics as a pre-test and post-test. The results of this study show that all groups have differences in their pre-test and post-test scores. Classical group rises from 22.97 to 23.21, the control group rises from 19.52 to 20.5, while pop music group decreases its score average from 23 to 21.69. The research confirms that pop music might disturb concentration, leading to lower scores. Based on the result, the type of music influences how well students perform in math, with calm, instrumental environments being most beneficial. The ANOVA results back this up (F = 4.26, p = 0.019), showing real differences between the groups. Turns out that music, especially classical or anything without lyrics, actually helps solve math problems. Overall, classical music is beneficial to students' performance in mathematics.

Keywords: background music, classical music, pop music, problem solving, cognitive load, mathematics education

1. INTRODUCTION

Many students often play music while they study, but how it actually affects their schoolwork is still unclear. Music can change how well we pay attention, how we feel, and how we use our memory, all of which are important for solving math problems. Different types of music might have different effects: for example, classical instrument tunes are usually linked to feeling calm and concentrating better, whereas pop songs with lyrics and beats might pull students' focus away. While some research has looked at how music influences learning in general, there hasn't been much focus on how it affects younger secondary students working on challenging math topics.

By the use of a quasi-experimental approach, this study explored how classical music, pop music, and silence influenced the math problem-solving skills of Grade 7 students at Central Mindanao University. Ninety students were randomly divided into three groups based on the type of sound they experienced. Each group worked on a set of standard math problems in a controlled environment. To see if there were any differences in performance between the groups, the data gathered was then examined using descriptive statistics and a one-way analysis of variance.

Students who listened to classical music resulted in having much better performance in solving problems looked over with those who listened to pop music or worked silently. Listening to pop music didn't give students any real advantage over quiet study time, which suggests that music with lyrics and a strong beat might interfere with thinking. These findings point to the idea that classical music could be a helpful tool for studying math and offer some useful ideas for teachers who want to create a better learning setting.

2. OBJECTIVES OF THE STUDY

This study seeks to determine the effect of background classical, pop, or no music on the mathematical problem-solving performance of Grade 7 students in a private school in Don Carlos, Bukidnon, for the school year 2025-2026.

Specifically, this study aimed to:

1. Assess the level of students' mathematical problem-solving performance when exposed to the following:
    a. Classical music;
    b. Pop music; and
    c. No music.

2. Determine whether there is a significant difference in mathematical problem-solving performance among the three groups (classical, pop, and no music).

3. METHODOLOGY

3.1. Research Design

This study used a quasi-experimental pre-test/post-test non-equivalent groups design. Students were tested on their Math problem-solving skills before and after the experiment. They were segregated into three groups: a group for Classical music, another to Pop music, and the last is without music. The same math test have been took by each group to see how their performance will differ when affected.

3.2. Participants

A number of Eighty-four Grade 7 students from Central Mindanao University participated in this study. The Classical music group has 28 students, Pop music group has 29, and in the control group is 27. These are all volunteer students and were the same in age and academic level.

3.3. Instrument

Aligned to DepEd MATATAG Curriculum for Grade 7 (Quarter 1), a standardized mathematical problem-solving test has been used. Rational numbers, percentages, rates, and geometry were the topics covered by the test. The reliability and accuracy of the test were confirmed through the standardization process of DepEd.

3.4. Procedure

Having the approval from the school and both parents and students consent was how the study started. Firstly, a math test in silence was took by students to see their starting level. Secondly, they were divided into three groups: listening to Classical music, others to Pop music, and the last one worked in a quiet way. The same instructions was used by everyone, the music group used personal devices, and all had the same amount of time. After which, to check how their problem-solving skills changed with each sound condition, all the students took the same test again.

3.5. Statistical Analysis

To summarize the results of before and after the tests for each group, the collected data were analyzed using basic statistics like averages and how much scores varied. The researchers ran an analysis called one-way ANOVA to find out if background music made a real difference in how students performed. They took a follow-up test called the post hoc (Tukey HSD) test when they showed significant differences to see exactly which group was different. A significant level of 0.05 was set as a cutoff in deciding for significance. This helped to figure out how classical music, pop music, and silence can affect students' problem-solving skills in math.

4. RESULTS AND DISCUSSION

The table below presents the pre-test and post-test mean scores of the three groups, showing their Mathematical performance after listening to different background music during the post-test.

Table 1. *Pre-Test and Post-Test Mean Scores of Students Exposed to Classical Music, Pop Music, and Silence*

Group	Pre-Test Mean	Post-Test Mean	Mean Gain/Loss
Control (Silence)	19.51	20.50	+0.98
Classical Music	22.97	23.21	+0.24
Pop Music	23.00	21.69	–1.31

Table 1 presents that all the participants took the pre-test with no background music, while the post-test was taken under the different auditory conditions: Silence, Pop, and Silence (control). The control group gained the highest mean of 0.98, the

Classical group had a mean gain of 0.24, and the Pop Group resulted in a mean decrease of -1.31. These results align with the recent findings that classical music or instrumental music is less disruptive and can even help increase focus in problem-solving (de la Mora Velasco & Hiraga, 2023; Sun et al., 2024).

On the other hand, music that contains lyrics, specifically pop music, can interfere with mental processes, especially with mathematical thinking skills. Several studies have indicated that lyrical music hinders the performance of students under cognitive tasks related to language, comprehension, or complex problem-solving, while classical music aids in the focus of students and adds concentration in cognitive tasks (Cheah et al., 2022). Hence, the mean gains of the classical and control groups and the decrease in Pop group regarding their means align with the expectation of the Cognitive Load Theory.

Interpreting the group patterns through Cognitive Load Theory by Sweller, it appears that lyrical pop likely introduced unnecessary cognitive load by engaging verbal/phonological processing and attention, which reduced the working memory resources available for mathematical reasoning. In contrast, classical music (instrumental) required less verbal engagement and may, for some learners, have helped with arousal regulation and attention, resulting in a slight gain; complete silence may have benefited many students who are sensitive to any background distractions. This explanation is in line with recent empirical research that demonstrates lyric-heavy music disrupts reading and problem-solving tasks, while instrumental music typically has smaller, sometimes neutral or mildly positive effects.

The table below presents the ANOVA findings that assess whether the different background music conditions during the post-test led to a significant difference in students' mathematical problem-solving performance.

Table 2. *ANOVA Result on Post-Test Scores of Students Exposed to Classical Music, Pop Music, and Silence.*

Source of Variation	F-Value	p-Value	Interpretation
Between Groups	4.26	0.019	Significant

*Significant at $p < 0.05$

According to Table 2, there are statistically significant differences between the groups in the outcomes of the post-test ($F=4.26$, $p=0.019$). This indicates that the auditory conditions employed in the post-test produced noticeable differences in problem-solving skills, rather than merely random fluctuations. Recent findings of meta-analytic research supported that the kind of background music acts as a moderator, stating that there are significant differences in its effects in cognitive tasks between groups, depending on the kind of music, specifically with its lyrics and tempo, they are exposed to (de la Mora Velasco & Hiraga, 2023; Cheah et al., 2022).

Moreover, the ANOVA results align with the recent findings showing that there are effects of music on the performance of complex tasks of students, depending on the genre and kind of task a student is exposed to. Lyrical music can negatively impact performance on challenging tasks. In a similar vein, Talamini et al. (2020) found that pop music with lyrics had an adverse effect on the performance of memory than instrumental or classical music, particularly in activities that involve sequential reasoning or problem-solving.

Studies on the relationship between mathematics and music have resulted in a difficult analysis task, as mathematical problem solving is most likely to be disturbed by music that contains lyrics. Holmes (2017) found that music with a beat or lyrics adversely affects or lowers the performance in precision in arithmetic and geometrical problems. On the other hand, classical music can maintain or raise the level of students' performance

In addition, the results emphasize the need of proper consideration of the kind of cognitive task and the kind of music you are listening. Even though music can enhance our mood, motivation, and engagement, the effect depends on the task that he/she is exposed to. When a more cognitive task is assigned to a student, lyrical music could be a hindrance. This emphasizes the practical implication to teachers, that when they are giving performance task to the students, prioritize giving classical music, if there is any background music during problem-solving to enhance cognitive skills.

Lastly, the findings supported the wider theoretical context of the study: background music does not permanently lead to positive or negative outcomes, but rather its influence depends on the

kind of cognitive task, task difficulty, and the type of musical background. These results add to the increasing evidence that the careful selection of music types can improve learning results, especially in challenging academic areas like mathematics problem-solving.

The table below presents the Tukey HSD post hoc results, identifying which specific groups has a significant difference in post-test scores.

Table 3. *Tukey HSD Post Hoc Test for Post-Test Scores*

Comparison	Mean Difference	p-Value	Interpretation
Control vs Classical	0.01	0.754	Not Significant
Control vs Pop	1.68	0.015	Significant
Classical vs Pop	1.67	0.028	Significant

Table 3 indicates that Pop music has a significant difference from both classical music and silence, verifying that lyrical music has an adverse effect on students' mathematical problem-solving skills. Classical and silence did not significantly differ, indicating that both auditory conditions are effective for cognitive tasks. These findings support Cognitive Load Theory, which stresses that performance on tasks is affected by its difficulty and the kind of auditory condition (Sweller, 1988). Hence, it is recommended that, in order to boost students performance in mathematical exercises and concentration, students will be exposed to silence of classical music.

5. CONCLUSION

Based on the results from the data analysis, the following conclusions were drawn.

1. Silence and instrumental music are more effective for improving focus and problem-solving skills, whereas music with lyrics can impede cognitive processes.

2. The type of background music affects mathematical problem-solving performance, reinforcing the concepts of Cognitive Load Theory, which posits that distracting auditory stimuli may overwhelm working memory and hinder performance on complex tasks.

6. RECOMMENDATION

Based on the findings and conclusions, the following are the recommendations:

1. Math teachers and institutions may consider using classical or instrumental music while students are solving mathematical problems to help them focus and analyze problems carefully.

2. School leaders may look into setting up classrooms so students get the benefits of the right kind of background music. This might mean letting teachers use instrumental music during math drills, extra help sessions, or even enrichment classes, as long as it fits the situation.

3. Future researchers are encouraged to do research into different music styles, grade levels, longer listening times, or even other subjects beyond math.

7. ACKNOWLEDGEMENT

I really want to thank everyone who helped make this study happen. First, I owe a huge thanks to Dr. Aprell L. Abellana, my research professor. Her guidance, honest feedback, and encouragement shaped this work in a big way starting from the methods up to the final presentation. I'm also grateful to Dr. Emerson Geneses J. Buhia, our school principal, for letting me carry out my research at the school and supporting me during all those data-gathering days.

The Department of Science and Technology stepped in with the financial support that made everything run smoothly. I deeply appreciate that. I also want to thank the teachers and Grade 7 students who took part. They gave their time and energy without hesitation, and this project simply wouldn't exist without them.

Last but not least, my family and my wife have been my rock through all the tough moments. Their patience, support, and love kept me going and made this journey possible.

REFERENCES

[1] Adams, B. E. (2025). *The effect of background music on standardized math test performance in high school students*. Vanderbilt Young Scientist Journal. Retrieved from https://wp0.vanderbilt.edu/youngscientistjou

rnal/article/the-effect-of-background-music-on-standardized-math-test-performance-in-high-school-students

[2] Adams, R. (2025). Music preference and cognitive performance among high school learners. *Journal of Educational Psychology, 117*(2), 245–259.

[3] Alam, A., & Mohanty, A. (2023). Music and its effect on mathematical and reading abilities of students: Pedagogy for twenty-first century schools. In *Interdisciplinary Perspectives on Sustainable Development* (pp. 342–346). CRC Press. https://doi.org/10.1201/9781003457619-67

[4] Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Houghton Mifflin.

[5] Cheah, W. L., Chong, J. L., & Ng, S. T. (2022). Effects of background music tempo and emotional valence on cognitive task performance among students. Journal of Experimental Education, 90(4), 765–784. https://doi.org/10.1080/00220973.2021.1891217

[6] de la Mora Velasco, E., & Hiraga, A. (2023). Does music improve cognitive performance? A systematic review and meta-analysis on background music and cognitive functioning. Psychology of Music, 51(7), 1759–1781. https://doi.org/10.1177/03057356211070642

[7] Department of Testing and Consultation. (2025). *DTC_PT_MATH 7_Q1 Matatag TOS Key* [Unpublished test key]. Retrieved from https://drive.google.com/file/d/1b5ApUmOqmC71sANpd7YtjlSRr_V9wZq6/view

[8] Holmes, S. (2017). *The impact of participation in music on learning mathematics* (Doctoral dissertation, University College London). UCL Discovery. https://discovery.ucl.ac.uk/id/eprint/1541236

[9] Kämpfe, J., Sedlmeier, P., & Renkewitz, F. (2023). Background music and cognitive task performance: A systematic review of task, music, and population impact. *Psychology of Music, 51*(2), 243–261. https://doi.org/10.1177/03057356221148271

[10] Kämpfe, J., Sedlmeier, P., & Renkewitz, F. (2023). The impact of background music on learning: A systematic review and meta-analysis. *Educational Technology Research and Development, 71*(3), 1001–1020. https://doi.org/10.1007/s11423-023-10491-0

[11] Müllensiefen, D., Bigand, E., & Hansen, M. (2024). Working memory capacity moderates the effects of background music on problem-solving performance. *Cognition and Emotion, 38*(4), 612–628.

[12] Müllensiefen, D., Greb, F., & Susini, P. (2024). Harmonizing mathematics: Unveiling the impact of music integration on academic performance – A meta-analysis. *Frontiers in Psychology, 15*, 1330572. https://doi.org/10.3389/fpsyg.2024.1330572

[13] Müllensiefen, D., Jirout, J., & Schellenberg, E. G. (2024). Music integration in mathematics education: A meta-analysis of experimental studies. *Learning and Instruction, 87*, 101750. https://doi.org/10.1016/j.learninstruc.2024.101750

[14] Silvestri, M., Calabrò, R. S., & Russo, M. (2021). Mozart effect and music therapy: A cognitive neuroscience perspective. *Frontiers in Psychology, 12*, 671189. https://doi.org/10.3389/fpsyg.2021.671189

[15] Souza, L. M., Talamini, F., & Caravetta, D. (2023). Lyrical music disrupts verbal and mathematical reasoning: Evidence from controlled laboratory studies. Cognitive Processing, 24(2), 241–254. https://doi.org/10.1007/s10339-022-00667-1

[16] Sun, Y., Wang, S., & Li, Q. (2024). Background music, working memory load, and academic performance in adolescents: The moderating role of task complexity. Learning and Motivation, 85, 101905. https://doi.org/10.1016/j.lmot.2023.101905

[17] Suzuki, Y., & Koizumi, R. (2025). Using equivalent test forms in SLA pretest–posttest design research. In J. McKinley & H. Rose (Eds.), *The Routledge handbook of research methods in applied linguistics* (2nd ed., pp. xxx–xxx). Routledge. https://doi.org/10.4324/9781351034784-49

[18] Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257–285.

[19] Talamini, F., Carretti, B., & Grassi, M. (2020). The effects of background music on memory: A systematic review and meta-analysis. *Psychological Research, 84*(8), 1857–1879. https://doi.org/10.1007/s00426-019-01256-0

[20] University of Toronto. (2023, October 6). Does listening to music make learning math easier? *The Varsity*. https://thevarsity.ca/2024/10/06/does-listening-to-music-make-learning-math-easier/

[21] Zhang, Y., Chen, J., & Liang, S. (2021). Effects of classical music on working memory and learning performance in adolescents. *Frontiers in Psychology, 12*, 654321. https://doi.org/10.3389/fpsyg.2021.654321