Faculty of Cognitive Sciences and Human Development

THE EFFECTS OF MUSIC AND GENDER ON LEARNING MATHEMATICS AMONG STUDENTS

Hashimah binti Junaini

Bachelor of Science with Honours

(Cognitive Science)

2020/2021

UNIVERSITI MALAYSIA SARAWAK

Grade: A-

Please tick one

Final Year Project Report ☒

Masters ☐

PhD ☐

DECLARATION OF ORIGINAL WORK

This declaration is made on the 13 day of AUGUST year 2021.

Student's Declaration:

I, HASHIMAH BINTI JUNAINI, 66093, FACULTY OF COGNITIVE SCIENCES AND HUMAN DEVELOPMENT, hereby declare that the work entitled, THE EFFECTS OF MUSIC AND GENDER ON LEARNING MATHEMATICS AMONG STUDENTS is my original work. I have not copied from any other students' work or from any other sources with the exception where due reference or acknowledgement is made explicitly in the text, nor has any part of the work been written for me by another person.

13 AUGUST 2021

HASHIMAH JUNAINI (66093)

Supervisor's Declaration:

I, Dr. NOREHAN BINTI ZULKIPLY , hereby certify that the work entitled, THE EFFECTS OF MUSIC AND GENDER ON LEARNING MATHEMATICS AMONG STUDENTS was prepared by the aforementioned or above mentioned student, and was submitted to the "FACULTY" as a *partial/full fulfillment for the conferment of BACHELOR OF SCIENCE WITH HONOURS (COGNITIVE SCIENCE), and the aforementioned work, to the best of my knowledge, is the said student's work

Received for examination by: _____ Date: 15.8.2021

(DR. NOREHAN BINTI ZULKIPLY)

I declare this Project/Thesis is classified as (Please tick (√)):

☐ **CONFIDENTIAL** (Contains confidential information under the Official Secret Act 1972)*****

☐ **RESTRICTED** (Contains restricted information as specified by the organisation where research was done)*****

☒ **OPEN ACCESS**

I declare this Project/Thesis is to be submitted to the Centre for Academic Information Services (CAIS) and uploaded into UNIMAS Institutional Repository (UNIMAS IR) (Please tick (√)):

☒ **YES**

☐ **NO**

Validation of Project/Thesis

I hereby duly affirmed with free consent and willingness declared that this said Project/Thesis shall be placed officially in the Centre for Academic Information Services with the abide interest and rights as follows:

- This Project/Thesis is the sole legal property of Universiti Malaysia Sarawak (UNIMAS).
- The Centre for Academic Information Services has the lawful right to make copies of the Project/Thesis for academic and research purposes only and not for other purposes.
- The Centre for Academic Information Services has the lawful right to digitize the content to be uploaded into Local Content Database.
- The Centre for Academic Information Services has the lawful right to make copies of the Project/Thesis if required for use by other parties for academic purposes or by other Higher Learning Institutes.
- No dispute or any claim shall arise from the student himself / herself neither a third party on this Project/Thesis once it becomes the sole property of UNIMAS.
- This Project/Thesis or any material, data and information related to it shall not be distributed, published or disclosed to any party by the student himself/herself without first obtaining approval from UNIMAS.

Student's signature: _____ Supervisor's signature: _____

Date: 13 AUGUST 2021 Date:

Current Address:
Jln Datuk Mohammad Musa, 94300 Kota Samarahan, Sarawak

Notes: ***** If the Project/Thesis is **CONFIDENTIAL** or **RESTRICTED**, please attach together as annexure a letter from the organisation with the date of restriction indicated, and the reasons for the confidentiality and restriction.

ACKNOWLEDGEMENT

I thank God for bringing this work to completion. I thank Him for giving me the strength when I felt weak, courage when I was afraid, and wisdom when I lacked clarity. I am grateful to Him for giving me a stellar team of doctoral committee members who have laid the necessary foundation for me to complete my dissertation successfully.

To my supervisor, Dr Norehan binti Zulkiply, I appreciate the time, effort, and guidance that you have invested in me throughout this process. Thank you for believing in me and for encouraging me throughout this journey. You have nurtured the potential in me so patiently all these years.

To my parents, Junaini bin Ibon and Rosni binti Eni, thank you for your unfailing love and support. To my sister, Norfarhatul Walidaini binti Junaini, thank you for your love. I hope I have been a positive role model for you to follow. To my relatives, friends and family, I appreciate your prayers and timely words of encouragement. The completion of the entire bachelor's degree is possible because of your love for me. I am so blessed to have you in my life.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract

The present study examined the effects of gender and different types of music on learning mathematics among students. Forty secondary school student participated in this study. In an experiment, forty participants were asked to read and understand the matric topic, which is one of the topics in Mathematics for the upper secondary level. Half of the participants learned mathematics (i.e., the Matric topic) while listening to the classical music, whereas another half learned mathematics while listening to the pop music. Further, there were an equivalent number of female and male participants in each music condition. Results showed that there was no significant difference in learning mathematics between genders. In terms of learning mathematics between the two types of music (classical vs. pop), no significant difference in mathematics performance was observed. Nevertheless, the mean scores revealed that participant's performances in listening to classical music were slightly better than pop music, suggesting that participants may have benefited a bit more from classical music. The present findings shed further light on the effects of classical music and pop music on learning mathematics.

Chapter I Introduction

This chapter discusses the background of the study, the objective and hypotheses of the study, the problem statement, the definition of terms, the conceptual framework and the significance of this study.

Background of the Study

Music is the reflection of people's life, thoughts, and wisdom. If people don't live it, it will not come out of their horn as written by Charlie Parker, an American saxophonist (Paglusch, 2017). Alperson (2010) also told music as the universal language which the language of emotion. It brings forward the development of language, increased IQ, spatial-temporal skills, and improved test scores (Brown, 2012). Due to the roles of music in life, many studies have been carried out to examine the effect of music in learning, including academic performance and vocabulary (Savan, 1999; Johnson, 1999; Wolff, 1969). Recently, several studies have been conducted to examine the influence of music in learning Mathematics (Lipsey, 2019; Ahmad et al., 2018; Holmes & Hallam, 2017). A typical experiment that examines the effect of music on Mathematics learning involves the participants listening to different types of music such as classical music and pop music. Later, participants are tested on their performance in learning Mathematics by answering some questions based on the task or learning materials given.

In Ahmad et al.'s (2018) study on mathematics students, significant differences were observed across the different types of music assigns concerning the score achieved from the

cognitive test. Ahmad et al. (2018) concluded classical music (non-vocal instrumental) has a positive effect on the memorization process compared to students who do not use music and another two types of music (rock alternatives and electro house). Classical music without a lyric appears to have a positive relationship with math quiz scores, whereas rap and rock seem to have minimal influence in Maas's (2013) study. Lipsey (2019) examined the youngest children, middle children, and high school students in terms of demonstrating that students' views of their course load, grades, and overall attitude in math classes are influenced by familiar music. The results from Lipsey's experiment showed when the youngest participants listening to classical music, they seem to calm down, better behavioral reports, and a slight improvement in daily grades, while middle and high school students did show less extreme actions when listening to the music, but this was short-lived due to a lack of interest. Nevertheless, when the high and middle school students were tested using pop music, there was an improvement in the students' behavior as well as their academic performance.

According to Holmes & Hallam (2017), music psychologists have discovered that certain types of musical activity improve cognitive performance, spatial-temporal reasoning, and other learning skills. As spatial-temporal capabilities are regarded as advanced mathematical abilities, participants were observed for the puzzle test and there were statistically significant differences between the intervention and control groups, with the music groups achieving higher levels of success (Holmes & Hallam, 2017). Same goes in teacher perspectives, Tezer et al. (2016) has claimed a student's memories was found to be "outstanding" in mathematics and music lesson. Also, their ability to apply numbers and visual intelligence effectively in music instruction was deemed "outstanding" (Tezer et al., 2016). Furthermore, parents also believe in the significance

of mathematics in music education because it has been shown to be conventional in part (Group & Education, 2013). It is argued in Matrixmath's (2021) article where a previous study has found a piece of music activates the same parts of the brain that are used to solve spatial-temporal reasoning difficulties where certain types and frequencies of sound are processed differently by the left and right sides of the brain. Thus, science has indicated the left side of the brain performs tasks linked to logic, such as science and mathematics, while the right side performs tasks linked to creativity and the arts, including music, which has a variety of positive effects on the brain (Ahmad et al., 2018).

Conversely, as mentioned in Ahmad et al. (2018), classical music has been discovered to be the most effective in aiding memorization but Geist et al. (2012), reported that some of the participants that listening to pop music able to use music to explain a math concept in some way. It is argued that the value of music in the home and the classroom is becoming increasingly apparent (Geist et al., 2012). Music is a child's first exposure to patterning and can help them engage in mathematics even if they don't perceive the activities as mathematics. Lipsey (2019) has support the students were more likely to perform well in their performance while listening to pop music especially the age of middle children and high children. It seems like those ages are the fan of modern lyric music compare to the youngest children. Most of the previous studies found were experimenting the pop music with a lyric while classical music without a lyric (Ahmad et al. 2018; Lipsey, 2019; Holmes & Hallam, 2017). Unfortunately, when trying to concentrate and study, songs with lyrics are a risky choice. Clifford Nass a professor at Stanford University has warned when people listening music with lyrics, it is very likely to cause problems during their writing or reading (Goodwin, 2015). Besides the liking of pop music,

students perceive learning without music may be slightly less of their motivation rather than the students who listen to music (Ahmad et al., 2018; Maas, 2013).

Specialist et al. (2012) observed participants in their research were able to respond well to math-related music. However, the result from the study also showed music that was related to mathematics was not a viable intervention because when comparing the pre and post-test scores of students in the treatment group (with music), it did not make a significant gain compared to the pre and post-test scores of the control group. It can conclude students who took music classes did better in their academic achievement (Specialist et al., 2012). In another research, Cox and Stephens (2006) examined the mathematical achievement in high school students, with the intention of determining whether listening with some music and without music resulting in a different experience in high school students. The results showed that there were no statistically significant differences in math GPAs or total GPAs between students who had some music credits and those who had none (Cox & Stephens, 2006). Even if the differences are not substantial, individuals who have taken at least two music credits at each grade level have a higher mean math GPA and mean cumulative GPA than the rest of the students.

In terms of the gender issue, only a few types of research have looked into the differences in mathematics learning performance between men and women but does not found specifically studied in terms of listening to music. In Mcpherson et al. (2015), it was found that female participants viewed music as more significant and useful than males in their learning. Analysis by grade level revealed the females in upper primary school felt substantially more competent in music and thought it was more essential. In lower secondary school levels, they still thought it

was more significant and useful but there were no gender differences in music motivation at the senior secondary school level (Mcpherson et al., 2015). In another study, Lee and Gwee, (2019) investigated gender differences in attention and memory while listening to music and the results show there is no significant difference between males and females. This statement has been supported by Barrimi et al. (2013) where there was also no substantial difference between male and female background factors in attention and memory. However, a significant gender effect was discovered particularly in reading comprehension and mathematical computation in Chen and Wen's (2015) study. Female individuals seemed to do better with any type of background music than without but for the male, they had a better performance with rock background music and poor performance with soft background music (Chen & Wen, 2015). Additionally, a survey by examining college students revealed a substantial difference between genders in total mathematics achievement scores in favor of female students (Rhonda & Porter, 1999).

Problem Statement

With all of the contradictory findings from previous studies that looked at mathematics learning performance using various types of music, it's clear that further research is needed to investigate the effects of different types of music on mathematics learning and to find out if there any gender differences in mathematics learning between the two types of music. It is important to note that, past studies have been using pop music with a lyric (Lipsey, 2019; Geist et al., 2012) and classical music without lyrics (Ahmad et al., 2018; Maas, 2013) during the experiment. For example, Lipsey (2019) shows a positive effect for both music but it has been distinguished by the result that the elderly are more inclined to pop music while the younger are inclined to classical music. The intention of the present study to further investigate mathematics learning

performance and the different types of music that a new generation preferred, such as pop music by Billboard (2020) and classical music by Classic FM (2020) without a lyric. This will help the researcher to know if it without a lyric give a slightly significant result compared with a lyric that said can be distracting when writing or reading which the language processing region of the brain becomes conflicted as mentioned by Clifford Nass a professor at Stanford University (Wong, 2016). For the control group (no music), the previous study (Ahmad et al., 2018; Cox & Stephens, 2006) found a consistent result that no issues at all and it has claimed when listening to music, students would be motivated more compared to not listening to music.

In addition, the present study aimed to further explore the role of pop music and classical music in mathematics learning, especially among secondary school students. Most of the students in this era generally preferred a piece of modern music such as pop music to listen to because it creates a sense of familiarity for listeners. Therefore, they may achieve better mathematics scores when listening to the latest selected pop music rather than the latest classical music. Pertaining to the gender factor, this is a well-known fact that female viewed music as a significant issue when learning mathematics compared to male (McPherson et. al, 2015). Chen and Wen (2015) also found females were better at listening to any type of music during a study phase rather than the male that shows much better with soft music. While Lee and Gwee (2019) and Barrimi et al. (2013) disagree with it because they found no significant difference between males and females. In mathematics learning, a type of music may be perceived differently by males and females in comprehending their acceptance with the type of music that suitable to improve their performance. It would be interesting to know how would males and females differ in their learning mathematics especially when the use of the latest of pop music and classical without the lyric.

Objectives & Research Questions

Objectives

The present study aims to investigate the effects of music and gender on learning in secondary school students:

a) To investigate the effect of gender (or gender differences) on mathematics learning in students.

b) To investigate the effect of different types of music on mathematics learning in students.

Research Questions

Below are the research questions in this study:

a) Are there any significant differences in terms of mathematics learning between genders?

b) Are there any significant differences in terms of mathematics learning between the two groups (Pop Music and Classical)?

Definition of Terms: Conceptual and Operational Definition

1) Music

Conceptual definition: Music is sounds that are arranged in a way that is pleasant or exciting to listen to (Hornby, 2010, p. 973). Alperson (2010) stated that music was told as the universal language which the language of emotion. It brings forward the development of language, increased IQ, spatial-temporal skills, and improved test scores (Brown, 2012).

Operational definition: The different types of music that will be used in the present study are A (classical music) and B (pop music). Specifically, the classical music used in this study was "Symphony No. 6" by Tchaikovsky, while the pop music used was "How You Like That" by Blackpink. Both types of music were presented to the participants without the lyrics.

2) Mathematics learning

Conceptual definition: Learning mathematics can be characterized as the development of new knowledge, abilities, and feelings about quantity, space, and structure (Verschaffel, Van Dooren & De Smidth, 2012). Verschaffel, Van Dooren, and De Smidth (2012) claimed humans, along with some animals and machines, have the ability to acquire mathematics to some level.

Operational definition: In this study, the mathematics learning focused on the learning of the Matric topic. The learning material about the Matric topic were obtained from the Mathematics textbook for form 5 (How, Kee, & Haur, 2020).

3) Gender

Conceptual definition: Gender is a sociocultural understanding of our biological sex that is, how biology is interpreted in daily life, whereas "male and female" are biological differences, "masculine" and "feminine" are gender differences (Wood, 2018).

Operational definition: In this study, gender refers to the female and male students.

Conceptual Framework

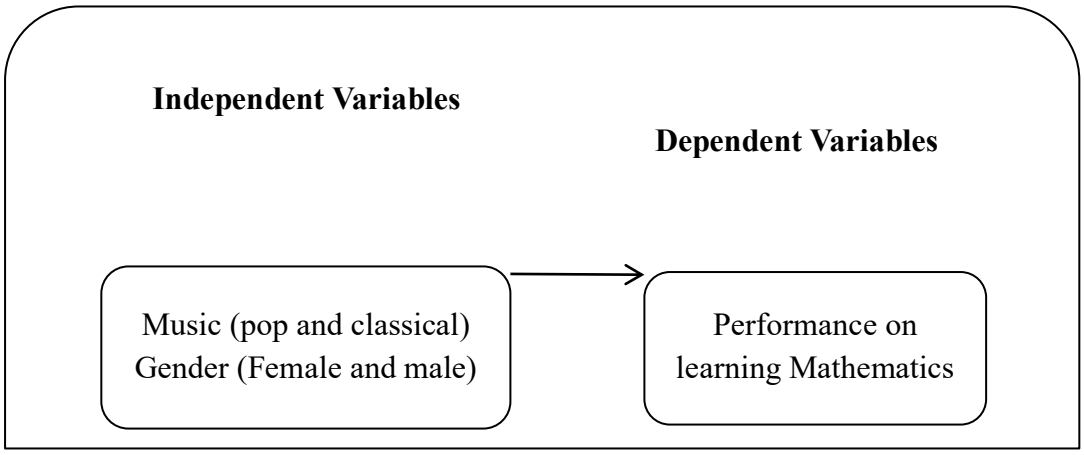

Figure 1 Conceptual Framework

Figure 1 shows the variables involved in this study. The independent variables were Music and Gender, whereas the dependent variable was the performance on mathematics learning.

Significance of the Study

Early, a study found classical music could enhance the performance of students but another study claims pop music that could help in learning mathematics. Different music has a different impact on academic performance in learning Mathematics. When individuals, particularly students and educators, try to use music as a tool to improve learning, expanded research on different types of music would be helpful. A previous study found mixed findings regarding the type of music genres use in learning mathematics. This research will provide society with solid data on what types of music and promote the benefits of improving the performance of students in learning Mathematics.

In addition, the research by Malaysian undergraduates can lead the study to provide an internal glimpse to students with more detailed information and understanding that stimulates performance in learning Mathematics in the field of music or no music. It also presented a clear example of a cost-effective way of enhancing the teaching during lectures that remains the main way of teaching at universities or schools. Last but not least, there a little study and lack of examination of gender gaps in activities conducted with or without the use of background music. A study on gender is an important factor because it is a way of looking at how social roles and power dynamics influence the lives and resources available to various male and female classes. Therefore, the purpose of this study is to provide potential researchers with a rich source of funding.

Chapter II Literature Review

Music has been proven to help students did well in their performance and it has an effective effect on relieving stress (Antony et al., 2018). A literature review that related to this study was about the type of music, music effect in learning, and also gender differences.

Type and Effect of Music on Learning Mathematics

It is important to look at a study of music's influence on performance because music has a wide range of psychological effects (Cherry, 2019). Cherry (2019) also stated music therapy is a treatment that is occasionally used to improve emotional health, stress management, and psychological well-being. It has been revealed in Isa et al. (2014) study's that music influenced the human stress response, particularly the autonomic nerve system Those who had listened to music recovered more quickly after being exposed to a stressful situation. Thus, further research on the type of music and the effect of music in problem-solving (mathematics learning) has been described in some articles.

The preference of students in music plays a role in the overall perception of music in terms of studying. For instance, Ahmad et al. (2018) investigated the effectiveness of the memorization process using four types of music. It consists of classical music, rock alternatives music, electro house music, and no music which are considered as a treatment in this study. 102 students of University Utara Malaysia were enrolled in the School of Quantitative Sciences were participated. Each participant has three minutes to learn all forty English words from the word list and one sort of music is played. The result has found significant differences among the type of music but it's impossible to say if the effect is beneficial or negative. Therefore, further analysis through multiple comparison tests was conducted and found background music has a

positive effect on the memorization process compare to without music. Overall, classical music without lyrics was found as the most suitable genre to improve memorization when compare to rock alternative and electro house music.

Maas (2013) also discussed the genre of classical music appears to have a positive effect on math test scores, whereas rock and rap genres appear to have little impact. This experiment was tested the effect of different types of background music on math test performance. It has been conducted on 102 students and around 95 to 100 students participated each week whereby the researcher used the Latin Square technique to sort all the repeated measures (students) so that each class gets the same treatment. The result proved that classical music had the highest beneficial link with math quiz scores even though most students admitted that they do not generally listen to classical music while doing their homework (Maas, 2013). While the t-scores for rock and rap music were low, indicating that the music was just as distracting as the distractions seen in a normal test environment (Maas, 2013).

A study by Lipsey (2019) reported the impact of music on the brain in mathematics education, with a focus on cognitive thinking based on the age of participants. It included youngest children (4 to 6 years old), middle children, and high school subjects as a participant. The researcher demonstrates how music affects students' perceptions of their course load, grades, and overall attitude in math classes by evaluating body language, musical taste, and stimulation. The study's findings show that music has both beneficial and negative effects on the brain (Lipsey, 2019). The youngest students that listening to classical music appeared to calm down and seemed to be occupied because the researcher didn't see any needless behavior during group work, which resulted in improved behavior reports and a little rise in daily grades. While the middle and high school respondents did exhibit less extreme behavior when listening to classical

music but work efficiently with pop music on their behavior and academic achievement. Thus, when it comes to learning and memorization, the correct song can stimulate and catalyze the process, while the wrong song can have the opposite impact, as seen when evaluating grades over time.

Holmes and Hallam (2017) claimed the development of spatial-temporal skills is affected by music education. Over two years, 178 children aged 4 to 7 participated in music programmed in a quasi-experimental design. In this study, mathematics was analyze based on the difference between groups of pre and post-intervention by using a puzzling test. The music group shows statistically significantly lower scores at the start of the program, but no such differences were seen after the intervention. However, in repeated measures analysis, the magnitude of this difference was not large enough to be statistically significant. Further research looked into the differences in progress between the two groups and it revealed that children in the youngest intervention groups made statistically substantially more progress than their classmates in the control group (Holmes & Hallam, 2017).

From the teacher's perspective, research done by Tezer et al. (2016) has examined the spatial-temporal reasoning states of primary school children between the ages of 8 and 11 who play an instrument concerning mathematics lectures. This study used a mixed-method of qualitative and quantitative to investigate by using two different measuring instruments. Semi-structured interview questions were used. However, two separate scales were created for the quantitative method. According to the teachers, these children's memory of mathematics and music courses was determined to be "outstanding." Moreover, their "excellent" use of arithmetic and visual intelligence in music courses was discovered. As a result, it was observed that there was a significant but weak association between the spatial-temporal reasoning states of children

who played an instrument and their ability to play an instrument in relation to the mathematics lesson (Tezer et al., 2016).

Csikos and Dohany found in the year 2013, a study on parental beliefs in mathematics and music being conducted (Group & Education, 2013). This study aims to know the connection between math and music learning, as well as how they view music and mathematics in the context of their entire lives. Participants involved included parents in four classes (music, environmental studies, humanities, and one without topic specialty) at an upper secondary school in the county capital town were given a self-administered questionnaire. The results mentioned parents recognize the value of mathematics in music. The significance of music and mathematics in various aspects of life proved to be stereotypical in some ways, but surprising and worrying in others such as mathematics' relative lack of relevance in private life and creativity when compared to music.

Based on Lipsey's study as stated above, the findings were not consistent with Geist et al. (2012) in terms of music genre. This study involved interviewing 3 and 4-year-old children about math activities in their schools at the Ohio University Child Development Center in Athens, Ohio (some with pop music and some without music). The researcher develops the capacity to create and utilize three sorts of patterns which are repeating patterns, growing patterns, and relationship patterns. It patterns was more complicated and numerical during the observation. All but one of the children mentioned the music-related activities, and these children utilized pop music to illustrate a math idea to the interviewer (Geist et al., 2012). Patterns play an increasingly important part in the development of literacy and mathematics. It's becoming evident how important patterns are in the development of reading and mathematics. Thus, music

is a child's first exposure to patterning, and it can help the participant engage in mathematics even if they don't recognize the activities even so.

It has been arguing in Specialist et al. (2012) about the impact of mathematics-related music on third-grade kids' achievement, attitudes, and interest in fundamental math fact fluency. The study included two third-grade classes, designated as Group A (control group) and Group B (treatment group). There is tree type of instruments being used in the treatment group to analyze an impact on participants which are Students Mathematics Computational Fluency scores, Student Instructional Attitude Survey and Students Engagement Walkthrough Checklist. The finding shows the effect of math-related music on basic math fact fluency and engagement was not significant. When comparing the mean scores of Group A and Group B, there was very little difference between the two groups. However, when students were in a regular music class, the data revealed a positive impact on their attitudes toward math-related music education.

Cox and Stephens (2006) emphasize that there was no relevant connection between math and music. A study on students in high schools was carried out, comparing those with such credits for music to those with none. In their cumulative GPAs or their mean math grade point averages (CGPA), no statistically significant distinction was found. According to the number of credits for music, students were then divided into two classes. Group A was placed with students who per grade level had earned at least two music credits. There were ninth-graders with two or more music credits in this category, 10th graders with four or more music credits, 6 or more music credits for eleventh graders, and twelfth graders with eight or more music credits. The leftover students have been grouped into Category B. Students of Group A performed better than group B. However, the variations were not statistically substantial. Scatter plots in GPAs, a slight