CHAPTER I: INTRODUCTION

1.1 Research Background

Mathematics anxiety is a pervasive issue that affects students worldwide, and Indonesia is no exception. Research has shown that math anxiety, characterized by intense fear or stress in relation to math-related tasks, can significantly impair students' cognitive functioning and academic performance in mathematics. According to SEMERU World Research, Indonesia ranks among the lowest in mathematical academic achievement among OECD countries, a position it has held even before the global disruption caused by the COVID-19 pandemic. This learning loss has further exacerbated the challenges faced by Indonesian students, raising concerns about the long-term impacts on national educational outcomes.

The issue of poor math performance in Indonesia can be traced back, in part, to math anxiety, which is known to cause avoidance of math-related activities and contribute to a cycle of failure and negative attitudes toward the subject. Despite efforts to improve math education in Indonesia, such as reforming curricula and enhancing teacher training, there has been limited focus on addressing the psychological barriers—like math anxiety—that hinder students from reaching their full potential in mathematics.

A growing body of literature has explored the potential of music as a tool to enhance learning, particularly in the context of the Mozart effect, which suggests that listening to certain types of music may temporarily improve cognitive function. More

recently, studies have begun to investigate the impact of Lo-fi music, a genre characterized by its calming, ambient soundscapes, as a means of helping students concentrate and reduce anxiety. However, most of the existing research on Lo-fi music has yielded inconclusive results and relied primarily on quantitative methods, leaving gaps in our understanding of its effectiveness.

This study seeks to fill this gap by exploring the use of Lo-fi music as a tool to reduce math anxiety and improve mathematical performance specifically among Year 5 primary students in Indonesia. By employing a quantitative approach that will take into consideration previous qualitative analyses, this research aims to provide deeper insights into how Lo-fi music might be used as a therapeutic intervention to alleviate the negative effects of math anxiety. Ultimately, the study aims to offer practical recommendations for educators and parents in Indonesia, contributing to both the academic literature and the development of new strategies to improve students' engagement with mathematics.

1.2 Problem Identification

The core problem addressed in this study is the prevalence of mathematics anxiety among primary school students in Indonesia, and its detrimental effect on mathematical academic achievement. According to PISA 2022 and other global assessments, Indonesia consistently ranks among the lowest in terms of mathematical performance among OECD countries (OECD 2022, 15). This underperformance has been a persistent issue, further aggravated by the impact of the COVID-19 pandemic,

which disrupted learning processes and increased academic challenges for students nationwide (OECD 2022, 18).

Mathematics anxiety, which involves feelings of tension, apprehension, or fear during math-related tasks, has been identified as a significant contributor to poor performance in mathematics. This condition creates a cycle where anxiety leads to avoidance of math activities, which in turn reduces math proficiency and reinforces the anxiety. Although this phenomenon has been studied extensively in Western countries, its prevalence and impact in Indonesia have received less attention. However, considering the low math achievement levels in Indonesia, it is highly likely that math anxiety is a widespread issue among Indonesian students, contributing to their poor performance.

Efforts to address this problem have included reforming teaching strategies and adjusting the learning environment. Some schools have attempted to reduce anxiety by encouraging a more relaxed and supportive atmosphere, where teachers adopt positive reinforcement and reduce pressure on students. Additionally, changes have been made to promote a more comfortable physical learning environment. However, these approaches have yielded limited results, and math anxiety remains a critical barrier to improved math performance. The potential of Lo-fi music as a tool to alleviate anxiety in students represents a novel approach that has yet to be explored in depth, particularly within the Indonesian context.

In a prior qualitative research phase in March 2023, the researcher conducted interviews with five students after a two-week period of exposure to Lo-fi music during math lessons. These students were selected to assess the perceived effectiveness of the intervention on reducing math anxiety and improving academic performance, based on their varying levels of math anxiety, as well as varying levels of mathematical academic achievement. However, the results from the interviews were somewhat vague, with most students expressing mixed feelings about the impact of the music. One common theme that emerged was that the two-week duration may not have been sufficient to observe significant changes, suggesting that a longer intervention period might be necessary to draw clearer conclusions.

Within the coding system of MAXQDA24, the researcher has deductively established some codes that contextually and in verbatim, categorize interview results and utterances into groups of effective/ineffective indicators in Lo-fi music intervention effects as a mathematical study companion to reduce math anxiety. The codes established are based on terms found within literature, and additional findings that are not to be included in deductive reasoning, but are included as a supplemental element within analysis.

Code	R1	%	R2	%	R3	%	R4	%	R5	%	TOTAL
PRE-INT-MA-TIME	6	60.0%	1	10.0 %	1	25.0%	1	10.0%	2	66.7 %	11
PRE-INT-	0	0.0%	1	10.0	0	0.0%	3	30.0%	0	0.0%	4

MA-SOCIAL				%							
PRE-INT-MA-ACA	4	40.0%	6	60.0 %	3	75.0%	5	50.0%	1	33.3 %	19
PRE-INT-MA-PHYSICAL	0	0.0%	1	10.0 %	0	0.0%	0	0.0%	0	0.0%	1
PRE-INT-BHV-DISTRACTED	0	0.0%	1	10.0 %	0	0.0%	1	10.0%	0	0.0%	2
TOTAL	10	100.0 %	10	100.0 %	4	100.0 %	10	100.0 %	3	100.0 %	37

Table 1.1, Thematic Frequency Tabulation: Pre-Existing Behavior

The interviews revealed that, while students generally enjoyed the process of listening to Lo-fi music, its effectiveness was conditional. Students reported that the music was helpful in creating a calm learning environment, but only in specific circumstances. For example, when the classroom was noisy or disruptive, the music provided a much-needed sense of retreat. However, in quieter spaces, such as when studying at home, the music did not seem to have the same positive effect. Additionally, optimal benefits were reported only when the music could be clearly heard, indicating that the volume and quality of the audio played a role in its effectiveness.

It was also revealed that students experienced varying effects of Lo-fi music, with "calm" and "focus" emerging as the most common themes. The intervention was more effective when a calm space was needed, such as in noisy environments, but less so in quiet settings like home. Students reported that while the music improved their mood and created a more pleasant study experience, it did not necessarily improve academic performance. Additionally, parental involvement was identified as crucial for maximizing the intervention's effectiveness, with students showing more progress when their parents were engaged in their study routines. Other themes identified in the study included pre-existing behaviors related to math anxiety, such as time pressure and socially induced anxiety, which played a role in how the students responded to the intervention.

Another notable finding was that Lo-fi music did not necessarily lead to improved academic achievement; instead, it contributed to a more enjoyable learning experience. While students appreciated the calming atmosphere, there was no clear evidence that the music had a direct impact on their math performance. Furthermore, it became evident that parental involvement played a critical role in achieving the best results. Students whose parents were engaged in their study routine tended to benefit more from the intervention. However, this level of involvement is not always feasible for every student, which limits the generalizability of the results.

In light of the mixed and conditional responses gathered from the qualitative data, it becomes evident that while Lo-fi music may create a more pleasant study experience for some students, its true effectiveness in reducing math anxiety and

improving academic performance remains uncertain. The subjective nature of these findings highlights the need for a more objective and definitive approach. Thus, it is essential to examine quantitative data to accurately measure the impact of the intervention. By utilizing statistics and numerical measurements, we can better assess whether Lo-fi music yields significant improvements in math anxiety and academic achievement, allowing us to draw more reliable conclusions about its overall effectiveness.

1.3 Scope & Limitations

This research is limited to being executed in a private school in South Jakarta, Indonesia, with subjects from a year 5 class of an IB curriculum-based mathematical study, whom at the time of this research, would be in the age of middle childhood (ranging from 9-11 years old), and would belong in the last remaining age group of the Gen Z generation. An experiment will be carried out, which will involve subjects partaking in the routine of listening to lo-fi music during their daily classroom math sessions in order to assess their math anxiety and mathematical academic achievement, which was carried out for a month (four weeks of academic time). Data collection will follow privacy protocols that will include parental consent to protect the emotional and cognitive developmental growth of subjects.

All students of the year 5 batch that academic year partook in the experiment, with two classes randomly chosen as the control groups, and the other two as experiment groups. Due to random sampling, students have more or less equal

knowledge and familiarity of lo-fi music, as well as math anxiety and academic achievement. Students with learning intellectual disabilities or neurological disorders were not included in the study. Students listened to lo-fi music throughout their daily math classroom sessions through a speaker. The classrooms were asked to stay "zero volume" when the experiment took place, in order to ensure the most optimal effects.

Subjects will be tested through several mathematical tasks under the topic of fifth grade arithmetics, PEMDAS, Pre-Algebra, LCM and GCF, as well as word problem variations of some topics due to its relevance within the year 5 learning objectives in the IB curriculum. A pre-test was conducted to assess the initial state of students prior to the experiment, and a post test was also conducted to assess the state of students after the experiment has been conducted. Careful measures were taken to not affect the subjects' cognitive and developmental growth. Subject's age range is also meticulously selected to take into consideration their susceptibility and sensitivity towards being affected mentally.

The scope will be limited to testing the math-anxiety levels limited to math-anxiety (not covering grounds of other defined psychological conditions of anxiety) and academic achievement of the students within the mathematics tasks within one learning month, at the beginning of the academic year. All done under the exposure to Lo-fi music (specifically calm, lyric-less, and tracks specifically geared to study-sessions and relaxation-sessions) during the task, and will only be in comparison with themselves, before and after the experiment has been completed. Math-anxiety levels

were measured and judged based on self-assessments that students independently fill (labeled as Section B Survey, modeled after the MARS-E Math Anxiety Test), as well as teacher observations during the testing period. Academic achievements were measured through the pre-tests and post-tests (labeled as Section A Survey) and graded based on the amount of correct answers, with the IB School Grading Scale.

1.4 Research Questions

This study aims to investigate the following research questions:

1. Does Lo-fi music have significant effect to reduce math anxiety (MA) in year 5 primary students in an IB-curriculum private school in Indonesia?
2. Does Lo-fi music have significant effect to increase mathematical academic achievement (AA) in year 5 primary students in an IB-curriculum private school in Indonesia?

These questions will guide the study in determining the effectiveness of the intervention and whether Lo-fi music can serve as a viable strategy for improving both emotional well-being and academic outcomes in mathematics.

1.5 Research Objective

The main aim of the study is to look into the extent of Lo-fi music effects in relation to a year 5 student's math anxiety and mathematical academic achievement. With that, this study specifically aims to investigate how students can successfully be

aided by Lo-fi music as a study companion through music therapy in order to alleviate and reduce math anxiety.

1.6 Research Benefits

This study hopes to inspire further innovations in the lanes of decreasing math anxiety with the help of music as a study companion in order to maintain student engagement, motivation, thus affecting their mathematical achievement within their learning journey. Respectively, this research can benefit developments within the topic of instructional technology, in academic mathematical performance, academic anxiety alleviations, and to sustain practices of teaching and learning.. This study is able to assist teachers in aiding classroom sessions to be alleviated from math anxiety, to add enjoyment to student learning journey by utilizing it as a study companion, and to enhance parents' convenience in accompanying their children's study sessions and increasing their independence in at-home review or homework sessions. Teachers can successfully utilize Lo-fi music as a form of music therapy and study companion by making sure of certain aspects within individual learners in order to optimize this method. As each individual learner differs, details that teachers should be paying extra attention to include the student's learning environment, the amount of time students should be listening to Lo-fi music, as well as student's backgrounds and attitudes regarding both Lo-fi music as well as mathematical tasks.

1.7 Thesis Outline

This thesis is structured into five chapters, each of which addresses a specific component of the research process and outcomes:

1. Introduction: This chapter introduces the research topic and its background, highlighting the significance of addressing math anxiety in Indonesia. It outlines the specific problems the study aims to address, the scope and limitations of the research, the research questions, objectives, and the potential benefits of the findings.

2. Theoretical Framework and Research Hypothesis: This chapter provides a theoretical foundation for the study. It begins with an in-depth explanation of the dependent, experimental, and moderating variables involved in the research. Additionally, it reviews relevant literature and previous studies related to math anxiety and the use of Lo-fi music as a learning aid. The chapter also presents a framework for understanding the interaction of variables and the formulation of the research hypotheses.

3. Research Methodology: This chapter explains the methodology used to conduct the research. It outlines the research design, location, and subjects involved, along with a detailed description of the procedures used to gather data. It also includes a breakdown of the instruments used to measure both the dependent and independent variables, ensuring the validity and reliability of the data. This

chapter concludes with a discussion of the data analysis techniques employed, including the statistical methods for hypothesis testing.

4. Results and Discussion: In this chapter, the results of the research are presented and analyzed. It includes descriptions of the data, testing for assumptions like normality and homogeneity, and the results of the hypothesis testing. The discussion section interprets the findings in light of the research questions and theoretical framework, and examines the broader implications of the results. Any limitations encountered during the research process are also addressed.

5. Conclusion, Implications and Suggestions: The final chapter summarizes the key findings of the study and offers conclusions based on the research objectives. It also provides implications for educators and policymakers, particularly concerning the use of Lo-fi music as a tool for addressing math anxiety in primary education. Lastly, the chapter includes suggestions for future research and potential improvements to the methodology.