

# The Effects of Music Genre on Scores in Different Exam Types: A Pilot Study

Daphnnie Robyn A. Flores<sup>1</sup>

## Abstract

The Mozart Effect is a theory that suggests Mozart's music results in an improvement in spatial performance and a change in brain activity. Lo-Fi (or "Low-Fidelity") music is a new musical genre that incorporates elements from different existing musical genres (Casumbal et al., 2019; Jaušovec & Habe, 2005). While substantial research has been conducted on the Mozart Effect, little research has examined the impact of Lo-Fi music on cognitive performance. Using an experimental design with a sample of 86 participants, this study examined whether there were performance differences on both spatial ability and reading comprehension test under conditions of Classical music ( $n = 22$ ), Lo-Fi music ( $n = 32$ ), or no music ( $n = 32$ ). It was hypothesized that participants in both the Classical and Lo-Fi music conditions would have higher scores on both the spatial ability and reading comprehension tests compared to the no music condition. The results found no differences between musical genre groups for either exam type. This suggests that both conditions were neither better nor worse than the silent control. This also seems to imply that neither musical condition was too much of a distraction.

*Keywords:* Mozart Effect, Classical Music, Lo-Fi Music, Exam Performance, Reading Comprehension, Spatial Ability, Background Music

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## **The Effects of Music Genre on Scores in Different Exam Types: A Pilot Study**

It is very easy to access different kinds of media and entertainment today, and one great example of this is music. The consumption of music has been continuously increasing from about 1 hour and 48 minutes per day in 1999 to around 2 hours and 31 minutes per day in 2010 to probably much higher in 2021 (Harris, 2013). According to several studies, listening to music while studying and working is a common activity among students (Ballard, 2003; Casumbal et al., 2019; Harris, 2013). However, these studies show mixed results on whether listening to music while engaged in academic or cognitive tasks truly results in enhanced or negative effects on performance, making it difficult to determine its true effect.

### **The Mozart Effect**

The Mozart Effect suggests that listening to music by Mozart results in an improvement in spatial performance and a change in brain activity (Jaušovec & Habe, 2005). For quite some time, Classical music by Mozart (especially the Sonata K448) has been associated with improved performance in various tasks, including spatial ability (Jaušovec & Habe, 2005; Rauscher et al., 1994). However, other studies that have attempted to replicate the Mozart Effect have shown mixed results (Roth & Smith, 2008; Wilson & Brown, 1997). One study identified that listening to Mozart's Classical music did lead to increased performance on some spatial reasoning measures; however, increased performance was also found in the group that had listened to repetitive relaxation music (Wilson & Brown, 1997). This study concluded that although the effect of Mozart's music on spatial reasoning tasks was not as powerful as that of the findings of Rauscher and colleagues, it can result in some increase in performance on spatial-related tasks (Wilson & Brown, 1997). Another study by Roth and Smith (2008) found that both the groups that heard the musical (Mozart, rhythm, and melody conditions) and the non-musical stimuli (traffic condition) yielded better performance on the GRE's analytic section as compared to silence, which did not reflect the Mozart-Specific Effect.

Critics of the Mozart Effect argue that the positive findings are due to appreciation of the music by the participants or enjoyment arousal. To provide evidence against the of enjoyment arousal claim, researchers conducted animal experiments using rats (Jenkins, 2001). Rats were exposed to one of four conditions before their birth: Sonata K448 by Mozart, Philip Glass' minimalist music, white noise, or silence. These rats were then released into a maze and

examined for their ability to complete it. Rats exposed to Mozart's music completed the maze significantly faster and more accurately than the other groups. This finding suggests that enjoyment arousal is not likely to be the source of the Mozart Effect's influence on task improvement (Jenkins, 2001).

Some researchers found that music by certain musicians did not yield results resembling that of the Mozart Effect, such as the works of Philip Glass, but music by other musicians did, such as works by a Greek American musician called Yanni (Jenkins, 2001). Therefore, an assessment was conducted on what characteristics of music produce a similar result to the Mozart Effect's influence on task performance. Eventually, it was determined that one of these musical characteristics was high long-term periodicity—a musical event's repetition (Jenkins, 2001)—which appears to be a common characteristic found in Lo-Fi music.

### **Lo-Fi Music**

Lo-Fi, also known as low fidelity music, is a relatively new music genre that involves a synthesis of elements from other music genres, such as classical, jazz, light hip hop, and many others (Casumbal et al., 2019). It generally has limited use of vocals or spoken words, a slow tempo, and highlights soothing instrumental music from instruments such as piano, acoustic guitar, ukulele, violin, bongos, among many others (Casumbal et al., 2019; Winston & Saywood, 2019).

As Lo-Fi music is available in an online format for free; it is quick and easy to access this kind of music. In fact, when searched on YouTube, a vast array of Lo-Fi channels can be found from all over the world. Some examples include ChilledCow, which is France-based; College Music, which is from the United Kingdom; Ambition, which is from the United States of America; and Mellowbeat Seeker, which is from South Korea (Winston & Saywood, 2019). The most popular stream for Lo-Fi music is entitled “lofi hip hop radio - beats to relax/study to” from the YouTube channel, ChilledCow. This stream features an anime girl writing in her notebook with her wireless earphones on, implying she is also listening to music as she does her studies (ChilledCow, 2020). According to Winston and Saywood (2019), ChilledCow has over three million subscribers; however, as of writing this in 2021, the same channel currently has over seven million subscribers (ChilledCow, n.d.). This rapid increase in subscribers highlights the popularity of this kind of musical genre. However, given it is a relatively new genre, existing research on Lo-Fi music and performance is limited.

Casumbal et al. (2019) conducted a study to examine the effects of the presence of lyrics in Lo-Fi music and font types on recall through a 3 (Lo-Fi with Lyrics, Lo-Fi without Lyrics, and silence) x 2 (Arial and Sans Forgetica) factorial design. The results showed that Lo-Fi music without lyrics resulted in significantly better scores on recall as compared to the lyrical condition, while font alone showed no significant difference on recall.

Closer in similarity to the present study, Benzonana and de Dios (2020) examined the effects of different musical genres (Lo-Fi music, Classical music, and silence) on episodic memory and attention division. From this study, the researchers found no significant differences between the Lo-Fi music group on episodic memory and attention division in comparison to the other musical groups (Classical music and silence). Although the results show no significant results, it would still be interesting to see whether the present study will have the same results but with reading comprehension and spatial ability rather than episodic memory and attention division.

### **Background Music and Exam Types**

Research indicates that many students use music in the background as they engage in their studies and work (Chou, 2010; Harris, 2013). However, a report presented at the National Media Education Conference found that 80% of students polled believed the use of media while studying would decrease their academic performance. In addition, 40% of these students found that music can at times be a distraction from their work (Ballard, 2003).

When examining the effects of music on cognitive performance, spatial ability has been commonly used to measure performance (e.g., Jaušovec & Habe, 2005; Rauscher et al., 1994; Stephenson, 2001; Wilson & Brown, 1997). For instance, Stephenson (2001) conducted a study to assess spatial ability performance in different musical conditions, in which he found that all musical conditions had no significant difference as compared to a silent control. Additional studies have also assessed the effect of background music on reading comprehension (Adams & McNair, 2018; Anderson & Fuller, 2010; Chou, 2010; Freeburne & Fleischer, 1952; Harris, 2013). These studies have shown either a decline in performance (Anderson & Fuller, 2010) or no effect (Freeburne & Fleischer, 1952) when participants were exposed to background music. However, Chou (2010) identified that the type of music does influence performance on a cognitive activity. They found that hip hop music served more as a distraction in reading comprehension performance compared to both a silent control and light Classical music

condition. It was also to their surprise that the control resulted in better performance compared to the light Classical music condition, as they found opposite results from their own literature review. This study seems to indicate that background music acts as a distraction for some cognitive activities, particularly reading comprehension, though this effect is stronger for some genres and weaker for others.

### **Purpose of the Present Study**

As described previously, substantial research has been conducted on the Mozart Effect, particularly in the area of spatial ability performance, wherein participants were exposed to the music before taking the test (Rauscher et al., 1994; Jaušovec & Habe, 2005; Wilson & Brown, 1997). Given this, it is of interest to examine this but with the music being exposed during the exams instead of before. Also, unlike studies on the Mozart Effect, the musical genre of Lo-Fi is quite new in the music scene and limited studies on the topic currently exist. However, given some similarities between Classical and Lo-Fi musical styles, such as high long-term periodicity, one might expect them to have similar effects. Therefore, it was hypothesized that participants who were exposed to either musical condition (Classical music or Lo-Fi) would perform better on measures of spatial ability and reading comprehension compared to the silent control condition.

## **Methods**

### **Participants**

Participants were recruited through the research pool of a medium Western Canadian university and through snowball sampling via word of mouth, Reddit (r/SampleSize, r/SurveyExchange, and r/takemysurvey), and the Survey Exchange Facebook Group. A total of 112 participants were recruited; however, 26 were removed due to incomplete or blank responses, resulting in a final sample of 86 participants. The Classical group consisted of 22 participants, while both the Lo-Fi and control groups consisted of 32 participants each.

Among the 86 participants, 68.6% were female, 27.9% were male, 1.16% were non-binary, and 2.33% preferred not to say. The participants had various ethnicities with Asian (50.0%) and Caucasian (27.9%) as the majority. In addition, these participants came from different years in their studies: 15.1% were in their first year, 26.7% were in their second year, 26.7% were in their third year, 19.8% were in their fourth year, and 11.6% selected “other.” Students taking psychology courses were granted bonus credit toward eligible

courses for their participation. Students in non-applicable courses and community participants did not receive compensation.

### **Materials**

There were three conditions in the study: Classical music, Lo-Fi music, or No Music. Specifically, the Classical music used in this study was Mozart's "Sonata K. 448" (Classical Music, 2014) and the Lo-Fi music used was the live YouTube stream by ChilledCow called "lofi hip hop radio—beats to relax/study to" (ChilledCow, 2020). The control group completed the exams in silence.

The dependent variable of this study was participant performance on two types of exams: a spatial ability test (Newton & Bristol, n.d.a) and a reading comprehension test (Newton & Bristol, n.d.b). Three out of four passages from the original reading comprehension exam (Newton & Bristol, n.d.b) were presented in this study's questionnaire, making this section worth a total of 15 rather than 20 points. Each passage had five questions associated with it. After reading a passage, participants were to answer the questions by selecting one of three options: true, false, or can't say. The "can't say" option refers to when they believe there was not enough information within the passage to truly be sure whether the statement was true or false. Similarly, 15 out of the 45 questions were selected from the original spatial ability exam (Newton & Bristol, n.d.a); there were four sections. In the first section, participants were presented with five diagrams. They were instructed to find the diagram that was identical to the first but had been rotated. In the second section, participants were presented with four diagrams, and they decided which among them would form the shape from the reference image. In the third section, participants were presented with four images of a disassembled cube with different patterns, of which they were asked to select one that would match the assembled cube. In the last section, participants were shown a map of a small area, which they must use to answer a small set of questions. The reduction of questions from the original tests was done in order to have approximately the same amount of focus on each exam type on the questionnaire as well as to prevent the likelihood of high experimental mortality.

### **Procedure**

All data was collected anonymously and online through Qualtrics. After providing electronic consent, participants were directed to a set of demographic questions (age, gender, ethnicity, year in university, whether they listen to music while they study, and whether they

listen to music during online exams or tests for online classes). They were then randomly assigned to one of the three conditions and shown instructions about what to do with the embedded video (if they were in one of the two music conditions) and to prepare their earphones or headphones. The following was stated in the instructions:

Please prepare your earphones or headphones now. Once you click to proceed to the next page, you may see a video embedded at the very top of the questionnaire. If you do find a video, please play it and let it run with the audio turned on as you complete the rest of the questionnaire. If you do not find a video, please continue on with the questionnaire in silence.

You may continue to the next page when you are ready.

Once they proceeded to the next page, the questionnaire began. The order of the exam type was randomized, with some answering the reading comprehension exam first and others the spatial ability exam first. After answering the questionnaires, participants were brought to a page with a debriefing statement, informing them about the research study that they had just completed.

## **Results**

### **Analysis**

Data was analyzed using two one-way analyses of variance (ANOVA), one for each exam type (reading comprehension and spatial ability). All analyses were conducted in IBM SPSS Statistics (Version 24). Prior to analysis, the following assumptions were checked: normality and homogeneity of variance. Normality was checked by conducting a skewness and kurtosis analysis, while homogeneity of variance was assessed by running a Levene's Test of Homogeneity of Variances as well as Welch and Brown-Forsythe tests if the Levene's test failed.

The assumption for spatial ability's homogeneity of variance were met, whereas the assumption for reading comprehension's homogeneity of variance was not met. Given this, a Welch correction was used for the reading comprehension analysis. An examination of skewness and kurtosis indicated that all assumptions of normality were met.

### **Result of ANOVAs**

The results of the one-way ANOVA for the reading comprehension exam, with a Welch correction, showed no statistically significant difference between musical genre groups,  $F(2,$

46.8) = 2.27,  $p = .114$ ,  $\eta^2 = .08$ . However, the medium effect size suggested that there may be a difference and that the study did not have sufficient power to detect this. A follow-up Games-Howell post-hoc test was conducted due to its medium effect size. However, the results still showed no difference between the conditions ( $p > .10$ ).

The one-way ANOVA for spatial ability also indicated that there was no statistically significant difference between musical genre groups,  $F(2,83) = 1.28$ ,  $p = .285$ ,  $\eta^2 = .03$ . This analysis had a small effect size. See Table 1 for the means and standard deviations for the reading comprehension and spatial ability tests.

### **Discussion**

Overall, the hypothesis that Classical and Lo-Fi musical conditions would have increased music increases performance in spatial ability and reading comprehension were not supported. Based on the mean scores, there was a non-significant decrease in reading comprehension exam performance in the Classical music condition compared to the control and Lo-Fi conditions. There was also a non-significant increase in spatial ability exam performance from the control to the Lo-Fi conditions, and from the Lo-Fi to Classical conditions. However, the results indicate that these means are not statistically different enough to conclude a significant increase or decrease in performance. Therefore, it appears that both musical conditions (Classical and Lo-Fi) resulted in neither poorer nor enhanced reading comprehension or spatial ability performance, suggesting neither condition was better nor worse than the control. This seems to also indicate that neither musical condition was too distracting.

Altogether, the results of the present study support the findings of Freeburne and Fleischer (1952), Stephenson (2001), as well as Benzonana and de Dios (2020). As previously mentioned, Freeburne and Fleischer (1952) assessed reading comprehension performance between different musical genre groups, in which they found no significant differences between groups. Similarly, Stephenson (2001) conducted a study to look at the effect of background music on spatial ability performance, which did not indicate any statistically significant differences between musical groups either. The study by Benzonana and de Dios (2020), of which had consisted of the same musical groups as the present study (Lo-Fi music, Classical music, and silence), examined their effect on episodic memory and attention division, they also found no statistically significant differences.

Based on the results of this study, it appears that neither Lo-Fi music nor Classical music



led to a significant change in reading comprehension or spatial ability performance as compared to silence. However, this conclusion must be taken with a grain of salt as there are some limitations in this study.

### **Limitations**

A rather significant limitation of this study was the low control the researcher had over what the participants saw and how they responded due to the online nature of this study, which was mandatory due to the COVID-19 pandemic. This was a problem as the researcher did not know whether certain responses were taken seriously and answered properly, nor whether the audio was working properly on the participants' end. Although participants were instructed to use headphones or earphones during the study, the researcher had no way to be certain if all participants had the same listening experience, which also may act as an extraneous variable. Another limitation was experimental mortality, which may be due to the length of the overall questionnaire as well as its exam-like nature. In addition, this study may have been underpowered, possibly due to its small sample size. In future studies, it should be a goal to obtain data from a much larger sample. Additionally, the Lo-Fi music used in this study varied depending on when the participants completed the study as it was from a live stream video, which may have also affected the results. Although the Lo-Fi YouTube channel used here is the most popular, it might be best to utilize a single Lo-Fi song of the same length as the Classical music condition to maintain consistency for future replication studies. It must also be acknowledged that most of the previous research on the Mozart Effect exposed participants to the musical conditions before the exam (Rauscher et al., 1994; Roth & Smith, 2008; Wilson & Brown, 1997), whereas these were done simultaneously in the present study. The presence of background music during the testing might have served as a noise distraction for some individuals rather than the "Mozart Effect" in the brain's cognition if this effect is truly present.

Despite these weaknesses, there were also some strengths. For instance, previous studies typically focus on only one exam type, whereas this study compared two exam types. This is beneficial as it makes it easier to properly compare the performance on each exam type as everything else is kept constant, preventing possible alternative explanations.

**Tables****Table 1***Means and Standard Deviations for Reading Comprehension and Spatial Ability Exams*

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	<i>M</i>	<i>SD</i>
<hr/>		
Reading Comprehension		
Control	7.00	2.60
Lo-Fi	7.00	2.26
Classical	5.18	3.71
Spatial Ability		
Control	8.63	4.05
Lo-Fi	9.31	3.43
Classical	10.23	3.21

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