

The Effects of Different Musical Auditory Backgrounds on a High School Student's Comprehension Performance

Kaitlyn M Chrosniak^a, Patricia Talarczyk^a

The Mozart Effect is a phenomenon where it is believed that students benefit from listening to classical music while studying or completing a class task. Studies released about the Mozart Effect have proven to not be the most reliable or replicable of studies. Similarly, very few studies have been released using music other than classical to see how all genres of music impact a student's performance in the classroom. This research study began with a pre-assessment survey to determine characteristics of the population sample, 79 students varying from grades 10-12 in both Advanced Placement and College Prep English courses. The next part of the study included an experiment where students were to complete a portion of a released ACT reading excerpt. Students were to perform the task in silence, listening to a Mozart Sonata, or while listening to one of five pieces deemed to be the most popular of the year 2018. Upon completion, students were to complete a post-assessment survey in which they reviewed how they felt about the experience. Through an ANOVA, the scores from all students in the silent group, the classical group, and the popular group were compared in order to determine if any one treatment group performed significantly better or worse than others in terms of accuracy, as well as to see if different auditory factors were to blame. The results proved to be insignificant, showing how students do not perform better or worse on comprehension tasks when different auditory backgrounds are applied.

Keywords: Mozart Effect, Comprehension.

Music provides a wide assortment of different effects on an individual depending on the genre of music, the situation in which music is being played, the person's opinion on the music, and various other factors. The effects of music can be very positive in terms of personal expression as well as performance; however, depending on the situation and the type of music being played, the exact opposite can also be true. Many people have their own opinion on how they believe music impacts their life, and usually this changes depending on the environment. In an educational setting, individual teachers have different ways of incorporating music into their classroom. Some choose to play music while their students engage in a silent work activity, while others find it to be a distraction to their students. All people have their own opinion in terms of what types of music they prefer to listen to, as well as when they believe it is the best time to listen to music. Music can be chosen based on personal preference and what works best for a given student. The type of music person can vary in genre as well as the purpose behind the usage of it. There are a variety of different ways past researchers have attempted to discover how music can be of benefit to schools. In elementary schools, classical music has proven to help decrease the rate of bullying during recess when paired with a bullying prevention course (Ziv & Dolev, 2013). Meanwhile, studies have been performed for ages in regard to how music can affect students while taking tests. The music genre chosen in most cases is classical, as it is one of the oldest genres of music and has proven to change with the times over numerous centuries. For example, music teachers have begun to have students take personality tests while listening to classical music to determine what instrument a student should begin learning how to play. (Özdemir, G., & Dalkiran, E., 2017).

Classical music is the genre most selected for determining on how music affects people in different environments. In the 1990's, a phenomenon known as the Mozart Effect began to be researched. The Mozart Effect is defined as when Mozart's music influences an individual's academic performance and anxiety levels when played in the background or soon before a test, task, or studying session is assigned. There has been controversy surrounding the Mozart Effect due to the lack of ability to replicate some of the most popular studies as well as there being several other factors influencing how music influences people (McKelvie & Low, 2002). The Mozart Effect continues to be one of the main ideologies studied by researchers to this day partially since there are many discrepancies across published studies exploring this.

One of the most common issues with music influence in education studies is when studies identify the musical genre or category of focus as "popular music." Popular music is a very loose term identifying a basic classification of lyrical music with a strong rhythm that is enjoyed by many people ("Definition of Popular Music", n.d). Some forums classify popular music on an even broader scale, relating it to how each genre has its own form of popular music based on what is most popular in the category itself (IASA, n.d). Popular music in terms of this research study is music that is most popular within the last five to ten years or so among people of all ages, but focusing among generation z, individuals born since the year 2000. In today's day and age, popular music tends to be categorized by areas such as instrumentation, rhythm, melody, texture, harmony, and vocal style. This music also usually has some sort of connection to a past category of popular music from centuries prior ("Popular Music", 2018). Popular music has varied in style across history, but every genre, such as folk, rock, or rap, has their own varying characteristics that grasp the ears of the listener. In this research study, these other genre variations of popular music are not being investigated to determine how they impact a student. Popular music is determined based off charts of songs deemed as heavily requested on the radio and commonly listened to in recent time for this research study.

Researchers have identified popular music in different lights over the years, but many connect it back to classical/Mozart music. For example, a study was conducted in which researchers compared performance in a video game with the standard soundtrack to popular classical music tracks and found that the average person did perform better when the standard soundtrack

a. Mentor High School, Mentor, OH, 44060

was played (Cassidy et al). These early and less educational Mozart Effect studies paved the pathway for exploring how classical music impacts various areas of one's life when implemented. Studies such as these also can easily sway the reader into reading them because they use the phrasing "popular music" in their title, but do not provide context to show that the popular music is popular classical music. The Mozart Effect has been heavily researched with mixed results over the last two decades. The study by Cassidy et al is an example in which using Mozart music did not enhance a participant's performance when playing a video game (Cassidy et al); however, studies such as ones performed by Ziv et al, in which classical music was used to help decrease elementary school bullying, have shown where the Mozart Effect can be beneficial and accurate in describing how student's behavior was impacted by the music (Ziv & Dolev, 2013). Mozart effect studies deliver heavily conflicting results depending on what the area is being tested to see if classical music holds a substantial impact.

Some studies, however, have begun to indicate that research should be done on how modern-day popular music of adolescent interest can benefit or harm a student's learning. A study conducted at Stony Brook University demonstrated how individuals can be benefited from research on popular music affecting test taking abilities, despite how the study's own results showed that Mozart music had no major benefits or negatives (Yurtoğlu, 2018). Minimal research has been conducted regarding how modern popular music or music that students prefer influences academic performance. Popular music has been deemed as a difficult area to incorporate into studies due to the various interpretations of the term. Many researchers have assumed that popular music is more harmful than beneficial without truly taking the time to perform extensive studies on the subject. This has then led to the strong focus on Mozart effect studies as opposed to other genres of music and determining how they can impact different areas in both positive and negative ways. Studies that do incorporate popular music as a factor tend to not focus on music as the main variable. For example, a study done on a group of elementary school students tested to see how electronic reading affects comprehension and music is being played in the background during the research study, but not taken into consideration in terms of impact. (Su, 2017).

Out of the few studies available that focus on popular music as the main component, most of these comprehension studies focus on how popular music affects the comprehension and testing abilities of college students. A recent study conducted at Cardiff Metropolitan University showed how popular music when played during a comprehension task affects testing abilities negatively when compared to less popular and classical music (Perham, & Currie, 2014). This study showed that popular lyrical music does more harm than good when played in the background of an academic assessment. So, while there is some evidence supporting the idea of popular music not being the most helpful teaching aid, there is still a gap in how this would apply in a high school setting. The research conducted in this study will help to determine how popular music could have an impact on the comprehension skills of a high school student. The purpose of this study is to determine whether music has a place in the classroom when students are working on silent work, comprehension work in particular. By examining how students perform on a comprehension task in different auditory environments, researchers can determine how music affects a student's learning environment, as well as what genres of music are most influential on their work. Prior research on the Mozart Effect and how music is currently being utilized in schools prompts the idea of looking into whether popular music influences the way a high school student comprehends differently than classical music would. Many research studies also prove to be contradictory, where one study by Cassidy et al shows Mozart to be less beneficial in a video game than the basic soundtrack (Cassidy et al, 2007), yet a study by Perham showed a more positive outlook on how Mozart music effects a student in school with a negative light shined on how popular music affects students (Perham, N., & Currie, H., 2014). Comprehension skills have not been studied in high schoolers as much as college and elementary school students, therefore analyzing how music affects high school student's comprehension skills would provide evidence for a minimally explored area of research. In terms of secondary data, this study will also take a brief glimpse into whether different auditory backgrounds impact students differently depending on if they fall into college prep or Advanced Placement courses.

Method

The method selected was a mixed method including a pre-experiment survey, an experiment, and a post-experiment survey. Before students were able to participate in the study, IRB approval was needed since the study included people. Students also submitted an assent form, one to three days prior to the date of experimentation in order to participate. 123 students from varying degrees of AP English, regular level English, and AP Research classes were asked to participate within the study. These students were in grades 10-12, primarily 11th grade. Determination of which classes fell into which testing group was entirely random.

The pre-experiment survey, created by me and administered online, included questions primarily considered to be secondary data; however, there were some questions that gathered essential data to determine how comprehension of high school students is affected by popular music. The survey was broken up into two different sections. The first section was made up of nine questions, focusing on secondary data such as a student's grade level and their grade in both past and current English classes. These questions would help to develop the demographic of subject within the study. For more information on the first portion of the survey, refer to Appendix A. One question asked in the second portion of the survey that played a valuable role in the experimental portion of the survey. In Figure 1 below, students were asked to choose between five songs as to which one of them they would prefer based off of the "Year End Hot 100 Songs" chart created by Billboard Magazine (Billboard, 2018). These five songs would come into play depending on what group a student is placed into for the experiment portion.

Out of the Following Songs Listed, Which Song Would You Prefer to Listen To? *

- "God's Plan"- Drake
- "Perfect"- Ed Sheeran
- "Meant to Be"- Bebe Rexha ft. Florida Georgia Line
- "Havana"- Camila Cabello
- "Rockstar"- Post Malone ft. Ty Dolla \$ign

Figure 1 shows the final question of the pre-assessment survey in which students were to choose between the five songs listed off of the “Billboard Year-End Hot 100 Songs” chart and determine which one they personally preferred (Chrosniak, 2018).

The experiment formulated for this research question involved six groups of students. Two of these six groups were seniors in a regular level English course, one group consisted of sophomores in a regular level English course, the next two groups were juniors in AP Language and Composition, and the final group was a fellow AP Research course. Any students who knew of how the study was to be conducted or the purpose of it were immediately declared ineligible for participation. Classes chosen were primarily English since a comprehension test would best be able to be conducted within an English classroom. These six classes of students were classified in group A, B, and C. All three letter groups were to read, and answer provided questions from an ACT prose fiction from the 2011-2012 academic year. Unlike the survey, the test was administered on paper. The excerpt chosen was since many students may have taken an ACT test or a practice ACT test prior to this study; if a recent ACT test was chosen, students may have already seen the excerpt before the research study concurred.

Group A students were to take the test in silence, in order to create a control group. Group B students were to take the test while listening to a piece by Mozart entitled, “Sonata for Two Pianos in D Major, K. 448”, the most common piece for Mozart studies. During the classical groups’ experiment, the selected music was played out loud from a school issued computer via the test proctor. This piece has been used for decades in Mozart Effect studies, such as in a published study by a master’s student at Gardner-Webb University in which the focus was to determine how music affects the comprehension of a fourth grader (Huckabee, 2016). Group C students were to take the song they had chosen from the last question of the survey (Figure 1) and listen to it on repeat through headphones while completing the ACT test. Students were to keep their device screen up, whether it be a personal device, or a school issued computer, to prevent students from changing the song and altering the study’s intended effects. While not all students may enjoy the five songs, they were able to choose among, these songs are determined to be some of the most well-liked in the United States as of recent; therefore, they were classified as popular. Students were given up to thirty minutes to complete the task and were graded for accuracy

After finishing the excerpt, students were then given a short post-assessment survey in which they were to rate the overall experience. The purpose of this survey was to present students with the opportunity to express how they felt the testing environment they were in impacted their performance on the comprehension task. Over the course of four questions, students were to depict which auditory environment they experience and rate several things, such as their opinion on the song (or silence) they listened to as well as compare it to their normal testing. Refer to Appendix B for the survey. This survey was administered online in the same format as the pre-assessment survey.

Results

Over the course of six weeks, seventy-nine students participated within the research study. Twenty-three students were placed into the silent research group, twenty-four were placed into the classical music research group, and thirty-two were placed into the popular music research group. For the silent group, nine students came from a college prep level English course and fourteen came from an Advanced Placement English course. In the classical music group, fifteen students came from a college prep English course while the remaining nine came from an AP Research class (all students in this group were unbiased as none of them had any information on the study beforehand). The remaining students were placed in the popular music group, an assortment of thirteen college prep English and nineteen Advanced Placement English students. These students varied from sophomore to senior (10-12) across the board. The ACT test administered had a total of ten questions that were paired with a reading excerpt from the year 2011-2012 (ACT). Participants were to begin the task once the auditory source began to play, and the silent group could begin to task immediately upon receiving it. After completing the task, participants were graded for accuracy with their scores placed into the table below for how many they had correct out of ten.

Analysis

The original hypothesis for this study was that popular music would cause students to perform with lower rates of accuracy on the comprehension task in comparison to when taking the test in silence as well as while listening to classical music. In order to determine if this was true, all three groups of participant scores (*Figure 2*) were placed into an ANOVA calculator to determine if there was any statistical significance across the three categories of data with a .05 significance level. The p-value of the data in *Figure 2* below was only .59271, proving to be statistically insignificant.

	Silent	Classical	Popular	Total
N	23	24	32	79
$\sum X$	140	128	192	460
Mean	6.087	5.3333	6	5.823
$\sum X^2$	1004	882	1404	3290
Std.Dev.	2.627	2.9439	2.8511	2.8

Figure 2 above shows the ANOVA table for comparing each of the three testing groups to one another. Many of the areas represented in the chart appear to be similar, such as the mean and the standard deviation for each group. In the silent, classical, and popular testing categories, most students averaged five or six questions correct, and most data falls near 2.8 standard deviations of the mean for each said group. The summation rates were also very similar for each group, despite the slight jump in participant rate for the popular music testing group in comparison to the classical and the silent. Due to the similarities in analysis results for each of the three categories, there is not much surprise in the data resulting as statistically insignificant.

In terms of secondary data, multiple T-Tests were performed to determine if there was any correlation between how students in college prep style courses performed in different auditory backgrounds in comparison to Advanced Placement courses in the same background. The silent college prep class participants were compared to the silent Advanced Placement students, and the same for classical and popular music students, all three using a .05 significance scale. None of the data in these tables proved to be statistically significant. The T-Test table results are shown in more detail in Appendices C, D, and F.

Conclusion

It cannot be determined whether high school students comprehend more information while in a silent room or while listening to various types of music based on the data collected in this study. The results of the study showed to be inconclusive, meaning that none of the three background types have proven to be of help or harm to students at work. There is also no proof as to whether college prep students perform better or worse on a comprehension task while listening to silent, classical, or popular music when compared to Advanced Placement students. All p-values in the study were below .6 upon data analysis in either an ANOVA or a T-Test, therefore leading to all data being statistically insignificant. The T-Tables performed on AP students versus regular level students when listening to classical music during the task had a slightly different result; however, this information is further shown in Appendices C-E.

All data collected has strong validity throughout the course of the study. Any information taken in regard to participant sampling, such as student grade level, music preference, and grades in English courses taken by the participants, has been kept confidential. No one participant has been identified, nor were scores on the assessments associated with individuals or taken for a grade. All surveys and tests were given in a similar environment to a normal classroom setting, apart from the possible background music depending on the group participants were placed into. Students were informed of the purpose behind the research, in terms of why it was being performed, but were left unaware of the researcher's hypothesis of students possibly performing worse while listening to popular music in comparison to a silent background or classical music. All participants were given the same presentation of information across various days upon presentation of assent forms and as the research study occurred, therefore all students had the same amount of information when participating. Participants were also given a refresher on how the study would function once assent forms were collected the day of. Students could drop out of the study at any point.

Studies conducted before mine have either promoted the idea that classical music can influence a student's comprehension abilities and test taking skills in a positive way, leading to a higher rate of information being absorbed and soothing potential test taking anxieties. On top of this, other studies have shown that popular music can negatively impact a student's performance or that there is not enough information to truly determine how popular music impacts a student. The data collected within this study proved to be statistically insignificant, showing that it could not be determined if students perform better when working on a comprehension task in silence, while listening to classical music, or while listening to popular music, regardless of their academic background. It cannot be determined exactly why the data has shown none of the hypothesized predictions. This could be due to different rates of exposure to the ACT depending on age and if a student has taken it; however, it cannot be determined for sure what caused the data to be inconclusive.

Since the data does not support one auditory background over another, it cannot be determined how music can be used in schools to best benefit students. This study adds to the field of unknown in terms of how exactly music can be used outside of a music class to best benefit students. As stated prior in the introduction, many researchers have not delve into how popular music impacts student performance, and there is a lot of unknown information in terms of how music impacts high school students or how music has different impacts on students in varying school subjects. Based upon the data collected in this study, a teacher could

not argue against a student listening to music while working, nor could they argue for a student to be listening to music in class. The results of this study do not provide insight as to how different auditory backgrounds and types of music can impact a student in varying school subjects either.

The types of music used throughout the study may have impacted participant performance. Participants placed in classical music group only could listen to one song while popular music students had a choice of five, and even five songs are a strong limitation as participants may not have enjoyed any of the songs provided as an option in the pre-assessment survey. By placing such a tight limit on music options for non-silent students, participants may have tried to tune out the music or have been negatively impacted by the lack of freedom in music choice. Potential study limitations include the music choices students were given, the low student participation rate, the combining of AP and regular/college prep level students for the ANOVA test, and the amount of exposure student to the ACT prior to the experiment. All these factors may have been a cause for a statistically insignificant outcome in all data analyses conducted for this study.

Further research needs to be conducted to determine how music can impact a high school student's comprehension ability. Studies conducted further down the road could include more genres of music as well as more freedom in song choice in order to aid in determining how popular music as well as music student's prefer that may fall outside of the general "popular music" category could impact a student's comprehension skills. Participant samples should include a more equal grouping of students across multiple grades (9-12th) as well as a more balanced amount of students in college prep or regular level courses in comparison to Advanced Placement, as well as look into how students perform while listening to different forms of music across different grade levels. Either way, much more research needs to be conducted before it can be determined how a student performs in school under different auditory backgrounds and how music can be further implemented into schools.

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Appendix A

The following images show the questions from the pre-assessment survey mentioned in the method apart from the final question.

What Gender Do You Identify With? *

- Female
- Male
- Non-Binary/Third Gender
- Prefer not to say

What Grade Are You In? *

- Freshman (9th)
- Sophomore (10th)
- Junior (11th)
- Senior (12th)

⋮

What is Your Preferred Genre of Music? *

- Pop (Popular)
- Rap
- Rock
- Country
- Electronic
- Classical
- R&B
- Gospel
- Other...

What English Class Did You Take Last Year? *

Short answer text

What was Your Final Grade in English Last Year? *

- A (90%-100%)
- B (80%-89%)
- C (70%-79%)
- D (60%-69%)
- F (<59%)

Have You Taken the ACT Before? *

- Yes
- No
- Practice Tests Only

...

How Likely are You to Listen to Music While Working on an Assignment During Class?

- Extremely Likely
- Likely
- Moderately Likely
- Slightly Likely
- Not at all Likely

What English Class Are You Currently Taking? *

Short answer text

What was Your English Grade for First Semester this School Year?

- A (90%-100%)
- B (80%-89%)
- C (70%-79%)
- D (60%-69%)
- F (<59%)

Appendix B

The following images show the questions from the post assessment survey as mentioned in the method.

Please answer the following questions honestly.

* Required

Which Audio Type was Played During your Test? *

- Silence
- "Sonata for Two Pianos in D Major, K. 448"
- Pop Song (One of Five Chosen from Survey)

Briefly Explain How This Testing Scenario Compared to Your Normal English Class Test Setting? *

Your answer

How Likely is it that You Would Take an English Test with the Same Audio/Music Type as You Did During this Assessment? *

- Extremely Likely
- Likely
- Moderately Likely
- Somewhat Likely
- Unlikely

What is Your Opinion on the Song You Listened To During the Assessment? *

- Extremely Enjoyed the Song
- Enjoyed the Song
- Indifferent/Neutral
- Disliked Song
- Extremely Disliked the Song
- No Music was Played (Silent)

Appendix C

The following table shows the results of the T-Table analysis performed to see if there was a difference in how a silent testing background impacted Advanced Placement students versus regular level English students. The data was not statistically significant, showing that silent backgrounds have no impact on the comprehension capabilities of students in AP English as opposed to regular level English students.

Result Details				
Source	SS	df	MS	
Between-treatments	8.3596	2	4.1798	$F = 0.52667$
Within-treatments	603.1594	76	7.9363	
Total	611.519	78		

Appendix D

The following figure shows the calculations of a T-Table analysis conducted to determine if students in Advanced Placement Research performed differently on a comprehension task than regular level English students when listening to classical music. This proved to be statistically significant; however, this analysis was performed between an AP Research course and a group of sophomores (10th graders) whom were less compliant with the task at hand and also have had much less experience with such a test up to this point. Therefore, although the T-Table showed statistical significance, this conclusion is invalid.

Difference Scores Calculations

Treatment 1

$$N_1: 9$$

$$df_1 = N - 1 = 9 - 1 = 8$$

$$M_1: 7.44$$

$$SS_1: 86.22$$

$$s^2_1 = SS_1 / (N - 1) = 86.22 / (9 - 1) = 10.78$$

Treatment 2

$$N_2: 15$$

$$df_2 = N - 1 = 15 - 1 = 14$$

$$M_2: 4.07$$

$$SS_2: 48.93$$

$$s^2_2 = SS_2 / (N - 1) = 48.93 / (15 - 1) = 3.5$$

T-value Calculation

$$s^2_p = ((df_1 / (df_1 + df_2)) * s^2_1) + ((df_2 / (df_1 + df_2)) * s^2_2) = ((8 / 22) * 10.78) + ((14 / 22) * 3.5) = 6.14$$

$$s^2_{M_1} = s^2_p / N_1 = 6.14 / 9 = 0.68$$

$$s^2_{M_2} = s^2_p / N_2 = 6.14 / 15 = 0.41$$

$$t = (M_1 - M_2) / \sqrt{(s^2_{M_1} + s^2_{M_2})} = 3.38 / \sqrt{1.09} = 3.23$$

Appendix E

The following figure shows the calculations from a T-Table analysis between AP English students versus regular level English students in terms of their performance on a comprehension task. The results were statistically insignificant, showing that popular music does not impact students differently based on their English course and education.

Difference Scores Calculations*Treatment 1*

$$N_1: 14$$

$$df_1 = N - 1 = 14 - 1 = 13$$

$$M_1: 6.71$$

$$SS_1: 66.86$$

$$s^2_1 = SS_1 / (N - 1) = 66.86 / (14 - 1) = 5.14$$

Treatment 2

$$N_2: 19$$

$$df_2 = N - 1 = 19 - 1 = 18$$

$$M_2: 7.42$$

$$SS_2: 62.63$$

$$s^2_2 = SS_2 / (N - 1) = 62.63 / (19 - 1) = 3.48$$

T-value Calculation

$$s^2_p = ((df_1 / (df_1 + df_2)) * s^2_1) + ((df_2 / (df_1 + df_2)) * s^2_2) = ((13/31) * 5.14) + ((18/31) * 3.48) = 4.18$$

$$s^2_{M_1} = s^2_p / N_1 = 4.18 / 14 = 0.3$$

$$s^2_{M_2} = s^2_p / N_2 = 4.18 / 19 = 0.22$$

$$t = (M_1 - M_2) / \sqrt{(s^2_{M_1} + s^2_{M_2})} = -0.71 / \sqrt{0.52} = -0.98$$