
The Benefits and Deficits of Listening to Music While Studying

Julia D. Simoneau

Sacred Heart University

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Dr. Brian Stiltner and Dr. Suzanne Deschenes

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Introduction:

It is a Thursday afternoon, and you have a huge reading and paper due the next morning, but you are wanting a change of scenery from your apartment, so you decide to go to the small café on the corner. When you get there, however, it is way too loud, so you try to tune it out. You first try using ear plugs and that does not work. Next you try just blocking your ears with your hands, hoping you can tune the noise out, yet that doesn't work either, so you next try listening to music, but you contemplate what type of music is best.

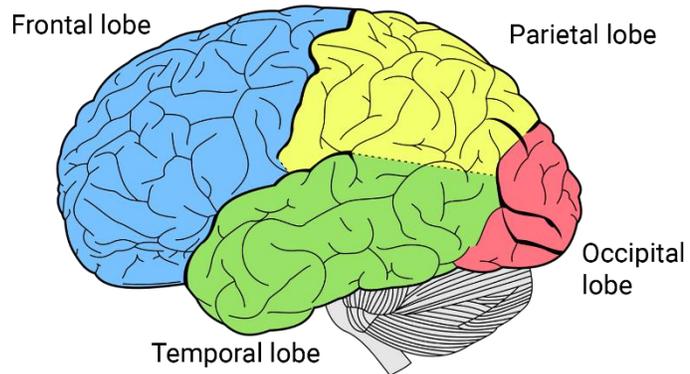
Within the past century, music has become a concept that many people have referred to for many different reasons. People connect to it when they are in their best mental state, when they are depressed, and when they are somewhere in the middle. Now with all these music platforms such as Apple Music, Spotify, Pandora, and others, many students today now have access to music at their fingertips and take full advantage of it constantly. For instance, like previously mentioned, they will use music to tune out the noise, but is that really the best way to study? This has been an ongoing debate for the last few decades. There are many that will say that music is terrible to use while studying, some will say that it is a great study tool, and some people are indifferent about it.

Music is usually detrimental when it comes to studying unless one chooses the right genre. In other words, some music such as pop, rap, or country, genres with lots of language or intense rhythms, could be more distracting than helpful while classical or instrumental music is more calming and can lessen stress levels. Furthermore, when studying anything involving comprehension or critical thought, music is detrimental, but music can be beneficial when studying mathematics. This does, however, depend on the person. This paper will dive into the

many different avenues associated with music and studying and the effects music has on different students' study habits.

Anatomy/Physiology of the Brain:

The brain is a very complicated organ in the human body. It controls how people think, where they store their memory, how they speak, how they operate, and more. The brain is made up of many different parts: the frontal lobe, the occipital lobe, the parietal lobe, the temporal lobe, insular lobe, and the limbic lobe. Each lobe controls a different portion of the body. In addition, it is widely known that the brain has two sides, the left side, and the right side. The left side of the brain is known to control the logic, speech, numbers, and language we think and speak daily, while the right side of the brain is known to control the creativity and intuition aspects of everyday life. There is a common phenomenon that is commonly spoken of, which is known as the left brain-right brain ideology. In other words, if someone tends to think more creatively and emotionally, it is likely that the right side of their brain, or right hemisphere, works harder than the left side of their brain, or left hemisphere, and that person is known to be more "right brained" (Michael C Corballis, 2014). On the other hand, if someone tends to think more logically or be more number oriented, the left side of their brain is probably more active than the right side of their brain, so they are considered more "left brained" (Michael C Corballis, 2014). This also correlates with the idea of left brain-right brain personality. If someone is more left-brained or more right-brained, music will impact them and their thinking in different ways.

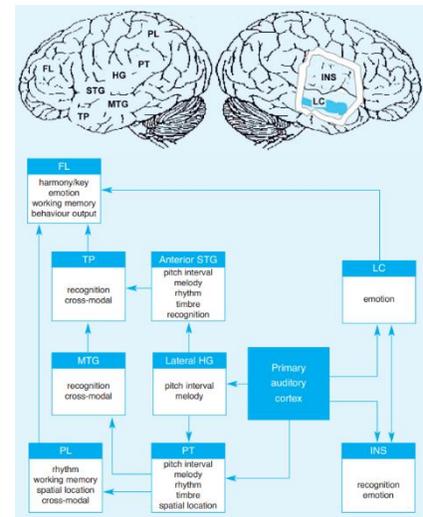


How the Brain Responds to Music:

Since there are many different areas of the brain, and many different elements of music, the brain reacts to different types of music in different ways. In many instances, when a song is played, different neurons throughout the brain are triggered, which starts the encoding process. At this time, the different elements of the song such as the frequency, the harmonics, or varying pitches, and the loudness of the song are encoded into the brain first. In other words, the elements of the song are converted or translated in a way in which the brain can process and analyze them. From there, the melodies are encoded and eventually, the different instruments used such as orchestral instruments like a violin, or a band instrument like a trumpet, or a more melodic instrument like a piano, are encoded and stored into our memory. From there, music is processed in the ascending auditory pathway from the cochlea to the primary auditory cortex, located in the Heschel Gyrus within the superior temporal lobe, where each individual sound is encoded, and each sentence and musical melody is analyzed (Jason Warren, 2008). Depending on what instruments are heard depends on how we respond and hence, what behavior is noted. For instance, a piano song might elicit a different behavior than an electric guitar. The surrounding areas of the temporal lobe and insula help to identify the nonverbal elements of the song including familiar music (Jason Warren, 2008). The lateral and parietal lobe are helpful in that they link the auditory information about the music to other previously found information such as what was seen or heard during the song. The rest of the processing and analysis is primarily done through the cerebral cortex. Thus, an enormous portion of the brain is used to analyze music and its elements when it is heard.

Like how different neurons and lobes are engaged when music is played, different sides of the brain are engaged in similar ways. Although it might seem that music only triggers the right

side of the brain, there are instances when the left brain is activated. In an article published by Jason Warren (2008) on how the brain responds to music, they show a visual (pictured to the right) of the brain and different areas that are receptive to music. In this visual, it shows that the left hemisphere tends to be more receptive of the musical aspects of a song such as the rhythm, timbre, melody, and pitch interval while the right hemisphere is more receptive to the emotions that result from the song (Jason Warren, 2008). This directly correlates to the idea above that emotions are more found in the right side of the brain while the rhythm or more numerical info is found in the left hemisphere of the brain. This makes sense given that rhythm is more mathematical and requires more logic due to counting while the right-side deals more with the emotions that come with the song. This also makes sense given that, as the article mentions, music is a form of language (Jason Warren, 2008). Language has grammar and vocabulary as does music. Additionally, the timbre or melodies that are analyzed are more found in the right hemisphere than in the left hemisphere, but in some cases, the melody analyzing can be done bilaterally in the superior temporal lobe. There is also research that suggests that areas of the temporal lobe are involved in the detection of nonverbal sounds including familiar music. Towards the end of the article, the author suggests that music is mostly detected in the right hemisphere of the brain, but according to the visual above, music is more detected in the left side, thus showing that music is very much present and detected in all areas of the brain.



Music's Influence While Studying:

As mentioned earlier, music is something that thousands of people use in their everyday lives. Whether that be while they are working, studying, relaxing, or doing something else, music is very universal and seen almost everywhere you go. Some people might think that music is simple, that it is something that can be used for any task, but it turns out that music is a lot more complicated than some might think. For instance, music involves rhythm, pitch, and language. As explained by Jason Warren (2008), Rhythm is the pattern of a song, so there are some songs that have a complex, upbeat rhythm, some songs with a very calm, slow rhythm, and some songs with a rhythm somewhere in the middle. The pitch is the frequency of the sound. For example, a song could, at one moment or another, have a very high pitch or present very high notes, and at another moment have a lower pitch or present very low notes. A pitch can also be in the form of chords which is when multiple pitches are played or sung at once. When the pitch and rhythm are combined, they form what is called a melody, or the main part of the song at any given moment. Depending on how the melody is constructed, it can affect different people in different ways. This will be explained more very soon.

Stress Reliever:

There are many reasons scientists have given insinuating that music is good to use while working or studying. One source mentions the idea that playing music while performing repetitive tasks can raise performance levels because it can relieve boredom and reduce tension (Gianna Cassidy and Raymond A.R. MacDonald, 2007). This could be helpful if one is studying a subject they are not as enthusiastic about and therefore, need motivation to continue studying that given material. Another source, written by Franziska Goltz and Makiko Sadakata (2021), makes the claim that classical music helped to improve many students' performances on multiple choice styled assessments. Additionally, Syarifah Noor Syakiyilla Sayed Daud and Rubita

Sudirman (2017) explain that listening to background music while performing tasks improves brain functions, creative thinking, helps one relax, relieves mental stress, and increases task efficiency. Additionally, studies show that if students listen to music that is not very rhythmic, they are more likely to be productive and focused (Serpil Umuzdas, 2015). When people listen to music that has a lot of varying rhythms, especially upbeat music like pop, country, or rap, the student is more prone to focus on the music and melody behind the song as opposed to the content they are studying. On the other hand, if the music is less rhythmic and more relaxing, it creates a “affective harmony and does not cause shift of interest” (Umuzdas 729, 2015). On a similar note, Franziska Goltz and Makiko Sadakata (2021), both brain and music specialists from the Netherlands, claim that memory can be enhanced by classical and calming instrumental background music. This can be very helpful when studying as it can help tune out noise if it causes low amounts of arousal such that it does not cause a huge shift in focus on the task at hand. There is also research suggesting that listening to background music can prevent distraction and thus enhance task performance (Anastasia Kotsopoulou & Susan Hallam, 2010). This is very important as many students tend to listen to music because they want to prevent distraction so they can be productive and do well on their work, which we will see further on.

The Mozart Effect:

There is another element that can be very helpful when studying. For example, an article written by Serpil Umuzdas (2015) about the academic achievements of those who listen to music and studying suggests that listening to Mozart can be beneficial while studying. Furthermore, in various studies, a new phenomenon known as the Mozart Effect was established. The Mozart Effect is the idea that if one listens to Mozart for ten minutes before taking a test, they increase their abstract and spatial reasoning (Syarifah and Sudirman, 2017). When someone listens to

Mozart music, the neurons are triggered more, causing them to fire in a stronger manner. Thus, when one learns a new concept or is studying it, the information is processed more quickly, thus decreasing the chances of the information being lost. Mozart music has also been known to influence one's mood which can also affect cognitive performance.

Meghan M. McConnell and David I. Shore (2011), psychologists at McMaster University in Ontario, Canada, conducted a separate study to detect the impacts of Mozart music on one's emotions and therefore, on one's arousal and attention and thus, on one's cognitive state. During this study, they split twenty-four undergraduate students from the university into four different groups of six and used four different forms of Mozart music differing in valence and arousal, fast-major, fast-minor, slow-major, and slow-minor, to detect changes in mood and attention. They also used two different testing mechanisms, the Affect Grid and the Profile of Mood States. The Affect Grid measures moods like pleasure – displeasure, and arousal – sleepiness. The Profile of Mood States uses thirty adjectives describing the subjects' states at a given moment using six subscales, three of which include the depression – dejection subscale, the vigor – activity subscale, and the fatigue – inertia subscale. The depression - dejection subscale uses adjectives describing negative effects, the vigor – activity subscale uses adjectives describing a positive arousal, and the fatigue – inertia subscale uses adjectives to describe low arousal. McConnell and Shore (2011) first administered the two tests to the subjects to test their arousal and mood, then had them sit in a dimly lit room for ten minutes while listening to the music. To ensure the subjects would stay alert, they told them there would be a series of questions to answer at the end. When they finished listening, the tests were administered again. From this test, McConnell and Shore (2011) found that the participants were in a better mood after listening to the major modes as opposed to the minor modes. Since many people tend to feel

happier and more energetic when listening to upbeat music, this result is justified. They also found that when participants listened to fast-tempo music, they had a higher arousal. This has also, in some cases, led to improvement on the performance of some simple tasks (Anastasia Kotsopoulou & Susan Hallam, 2010). On the other hand, when one listens to the slow-tempo music, arousal levels were decreased, which made sense based off previous research.

High Arousal Distraction:

Although many would make the claim that music is beneficial when studying, there are many sources suggesting that listening to music is not ideal while studying because it can be distracting. In one article, Anastasia Kotsopoulou and Susan Hallam (2010) asked several students their reasoning for listening to music when they study. When asked, of those who have said they listen to music while studying, they claim that they primarily listen to it when they are bored or happy and only did so when their mood prompted them to do so. Scientists have also said that teenagers typically listen to music for about three hours every day, and in most cases, this is done to satisfy their emotional needs. In many cases, however, that music is upbeat and vocal. Furthermore, scientists suggest that vocal music can be very distracting as it contains lyrics that can inhibit concentration, which contradicts students who suggest they listen to music to enhance concentration. It can be distracting because not only is music complex because of its elements, but there are also many forms of music, it has different complexities, different genres, some is more familiar than others, and like mentioned earlier, there are varying tempos. Therefore, in some cases, if a task is too complex, listening to certain kinds of music can hinder task performance (Anastasia Kotsopoulou and Susan Hallam, 2010). For instance, if a student is trying to re-arrange an advertising document for a marketing company, that might not require much critical thinking such that it is not that complex. As a result, the student might be okay to

listen to music of any kind since it might not hinder concentration. On the other hand, if a student were attempting to study for an English or History quiz, an activity requiring more concentration and complexity, listening to complex music such as pop, country, heavy metal, rap, or other music with complex rhythm and lyrics is not ideal. Therefore, as soon as those students got distracted, however, they turned their music off. This is also why many scientists advise against listening to music while memorizing. If the song they listen to has high arousal, they are more prone to focusing on the song than memorizing or working on schoolwork (Serpil Umuzdas, 2015) and thus, will not retain the information as well, making the technique less effective. As a result, although music might seem like a great option due to its accessibility, it might not be as beneficial as the student might perceive it to be. Either way, no matter what kind of music is listened to, consensus suggests that it is up to the person and their best learning style whether listening to music while studying is best for them.

Influence on Different Ages:

From what we have seen thus far, music impacts everyone in numerous ways. It affects various parts of the brain, impacts our memory, and how we think. While all of this is super important, we can now use this information to learn how it impacts several types of people.

First, we want to examine how music impacts different age groups as they study and learn. Anastasia Kotsopoulou and Susan Hallam (2010), a psychologist, and a music educator, conducted a study where they asked a variety of age groups how music impacts their study habits. They specifically asked three groups: one group of high school sophomores around twelve years old, one group of high school seniors between the ages of sixteen and eighteen, and a group of college sophomores around the age of twenty. Within this grouping, there was also representation from four different countries: America, the United Kingdom, Greece, and Japan.

They chose the United States because there is no specific music tradition, but we are well known for pop music. They chose the United Kingdom because their musical style is like that of the United States, but still has European heritage within it. Greece was chosen since they have many European traditions while still having their own style. Lastly, Japan has their own traditional music with western influences. In almost all cases, the Japanese people played their music the least. In most cases, however, almost everyone would play music in the background if they were thinking and then writing, and the least amount if they were memorizing texts or learning a foreign language. Also, college students typically say that music can have a relaxing effect, but it can also hinder concentration more than with younger students. This makes sense given that college studies are a lot more complex compared to grade school studies, so they need to concentrate more than they would need to for elementary school work. However, the age group differences typically do not interfere with reasoning for listening.

Influence on Introverts and Extroverts:

Introverts and extroverts are also said to be impacted by music in different ways. When thinking about people's personalities, one would typically think of someone as either an introvert or an extrovert. An introvert tends to be more reserved, gets entertainment from being alone, and if they go out, their energy drains quickly. On the other hand, an extrovert is more energetic, gets joy out of being around several others, and gains energy and happiness from socialization. There were many scientists who have conducted studies about how introverts and extroverts are differently impacted by background music.

In one source, Gianna Cassidy and Raymond MacDonald (2007) of Glasgow Caledonian University in the United Kingdom analyzed various studies conducted about how introverts and extroverts respond to background music while they learn and study. One of the studies suggests

that background music that has a greater arousal is worse for introverts than for extroverts, especially if it has lower intensity stimulation. This seems accurate since, in many cases, introverts prefer quieter environments, so even if the music was not the strongest, it would still affect the student greatly. Another study also says that introverts are less likely to study with the radio on than extroverts, but introverts tend to perform better than extroverts academically. This can also coincide with the fact that extroverts prefer studying in noisier areas than introverts, which could be a reason why they like louder music compared to introverts. This could also be due to introverts thriving more in quiet space where extroverts thrive in loud, energetic spaces. Also, since introverts prefer studying in quieter places, they sometimes might grasp certain information better than extroverts such that they score better academically when it comes to tests and exams. In terms of music preference, introverts tend to prefer pop, classical, and relaxing music while extroverts prefer rock, metal, or hip-hop music. This can coincide with the idea, as mentioned above, that introverts prefer quieter environments while extroverts prefer louder environments.

What Music is Best for What Subjects?

At this point, it is clearer how different age groups and personality types are impacted by music and studying, but it is also important to know the recommendations for whether to listen to music with certain subjects and if so, which kind of music. Like mentioned above, listening to music while studying any subject heavily depends on the type of person they are and what their best study habits are.

When it comes to studying math, different scientists and psychologists have varying ideas. Gianna Cassidy and Raymond MacDonald (2007) claim that listening to calming music as a child is good when studying math. This is because calming music, which in most cases has a

lower arousal, tends to lead to better performance when it comes to arithmetic and problem solving (Cassidy and MacDonald, 2007). On the other hand, there is also research suggesting that when undergrads study math in the presence of music, their performance decreases (Cassidy and MacDonald, 2007). This could also be due to the difficulty of math courses increasing as one goes further through undergrad, so there is more reading and language involved than math in younger grades. Many more students, however, listen to music more while studying more math-based courses (Serpil Umuzdas, 2015). Given that math has more arithmetic and requires less creative thinking and reading compared to subjects like English or history, it makes more sense to listen to music with math.

The opinions about reading, writing and memorization when listening to music can go either way. One study says that classical music has been found to improve reading efficiency and the speed of one's reading (Franziska Goltz and Makiko Sadakata, 2021). Since classical music is not as arousing as other music, this can help with reading speed and getting through a text quicker. Another study that was conducted, however, found that the performance of students on a reading comprehension test was worsened when the students had popular instrumental music playing in the back (Cassidy and MacDonald, 2007). Therefore, it makes sense that in many cases, most refrain from listening to music when reading if it gets too complex. If the music is calming, it can sometimes work to decrease noisy distractions, but if someone knows the music they are listening to, it can become more of a distraction since they might be tempted to think of the lyrics of the song instead of what they are trying to read. Thus, it is more detrimental to their comprehension skills. This also explains why students listen to music way less when memorizing since it can hinder concentration (Serpil Umuzdas, 2015). Thus, according to several researchers and studies, it is not recommended to listen to music of any kind while trying to memorize

something. Finally, many students say they do not listen to music when studying foreign language as it negatively impacted their concentration (Anastasia Kotsopoulou & Susan Hallam, 2010). Similar to English, or any native language, if one listens to music while trying to learn it or memorize it, their concentration could be negatively impacted such that they might not understand it as well or remember any of it.

White Noise:

From what has been seen thus far, listening to background music can be great to improve brain function, help one relax, relieve mental stress, or increase efficiency. Despite this, in many cases it can also be distracting, it can be concluded that studying with music is not always the best option. Some students have also tried studying in pure silence, but in many cases, this can make people feel sleepy, bored, or more stressed (Daud and Sudirman, 2017). Since that is the case, many have questioned if there is another way to block out noise. As it turns out, there is, and that concept is known as white noise.

White noise is the idea that various random audible frequencies are played together with no music or rhythm via stochastic resonance (Daud & Sudirman, 2017). This idea is said to be better because with the right amount of white noise present, sound can be eliminated, and one can still concentrate very well (Suzannah K. Helps, Susan Bamford, Edmund J. S. Sonuga-Barke, 2014). Plus, it can give the student just the right amount of noise such that they are motivated and focused and thus, increase their task performance. Various sources agree that if too much white noise is used, it might be distracting and overpowering, and too little white noise can be not powerful enough. Despite this, like previously mentioned, if just enough is used, it can be very beneficial. This is shown in a few studies.

One study conducted out of Universiti Kebangsaan Malaysia asked male students between the ages of 18 and 24 with no musical experience to listen to four words of the same length, then recite those words in the opposite order of which they were originally recited, while listening to moderate background noise, which would be fluctuated a few times. The main goal of this experiment was to detect whether white noise improved the performance of auditory working memory, one of the main components of how we study and learn. After the study, they found that if the background music was overpowering, the participants would not be able to hear the words presented. If the noise level was too low, it had no effect. With just the perfect amount of noise, however, cognitive task performance was significantly enhanced (Othman, 2019).

Another study also found that if children with Attention Deficit Hyperactivity Disorder (ADHD) listen to white noise, their task performance was greatly enhanced while that of non-ADHD children was disrupted (Helps, 2014). This is due to how the brain functions slightly differently in brains of students with ADHD versus without ADHD. Every person's brain is accustomed to a particular "noise" associated with how the neural system and neurotransmitters function. Dopamine plays a huge factor in this as it helps to control how much the neurons within the brain fire information, and it also helps to control attention and cognition. ADHD patients typically struggle with attention and cognitive performance, so they take medication to help relieve that lack of attention and improve cognitive performance. ADHD brains typically have less neural noise within, or less dopamine, so more white noise is required for there to be a positive effect. On the other hand, the typically brain has higher levels of neural noise within, or more dopamine within, so there is not as much white noise required to block out noise. Therefore, scientists say white noise is better when there is less neural activity and thus, better for those with ADHD than those without. Although this study has an excellent point, either way,

for many students, white noise could be beneficial for them and help them to study and learn better to improve their grades.

Conclusion:

After several studies, although students' study preferences entirely depend on the student, it is generally not recommended that one studies with music. Music is so widely used today since it is so easily accessible from our smartphones. While this is a great feature, many students believe that listening to music can be a good way to block out noise. As many studies showed us, however, in several cases the rhythm of music can be distracting for students, no matter their age or their personalities, because they most likely listen to their favorite songs while they study and, in many cases, those songs are upbeat with many lyrics. As a result, listening to music hurts us more when studying than it should. If one listens to classical music while doing certain subjects such as math, it might be helpful since it has a lower arousal such that it might not affect certain students as much. Generally, however, listening to music while someone studies is not recommended.

Although music is not recommended, white noise might be the correct solution to the problem at hand. Since it has that noise blocking effect without being overpowering, it might help students to concentrate without distracting them. Today, thousands of students have smartphones, and there are thousands of apps with white noise playing abilities. Plus, YouTube contains thousands of videos that play white noise for up to ten hours. So, the next time you are in a situation where you need to block out noise and concentrate on schoolwork, it might be better to put the music playing option aside and consider white noise. This way, you can still be concentrated, but not distracted.

Despite there being loads of helpful information about music and studying, there is still more that can be found. Music is not ideal for studying and many students use it more for the purposes of changing their mood if they are unmotivated. What is not as clear is how they are still able to concentrate on their work if they have music playing that contains complex lyrics? Is there a part of their brain that is built in a way such that listening to music with lyrics does not affect them as much? Or is there a part of them that can more easily block out those lyrics, and if so, what is it? That would be an interesting next step to determine how those that successfully listen to music and study succeed in school, or whether that is not the case, but they continue to listen to music anyway. Hopefully that mystery can be solved in a further study.

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