The Effects of Music and Context on Mood and Learning

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This work is mine unless otherwise cited.

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Abstract

Music is a ubiquitous aspect of college students' lives, often serving as a companion during activities such as walking to class, working out, and chief among all, studying (Stratton & Zalanowski, 2003). Previous research in the field of music and cognitive performance has shown that listening to background music while performing cognitive tasks can enhance task performance when compared to tasks performed without music (Cockerton et al., 1997). Additionally, music has been shown to heighten energy levels and induce positive mood arousal during cognitive tasks (Hirokawa, 2004). The current study aimed to investigate the impact of listening to subject-preferred background music on performance and mood during a memory recall task, as well as to explore whether potential positive mood arousal induced by music can further facilitate memory recall. Using a 2x2 experimental design, participants were randomly assigned to either listen to their preferred studying music during both an encoding and retrieval portion of a memory recall task, or not, with their mood assessed via a self-report scale after the encoding portion of the task. Recall performance was measured by the number of correctly recalled words from a studied list of 20 GRE vocabulary words. Results indicated that although listening to music increased positive mood and decreased negative mood states during the task, it did not have a significant effect on memory recall performance. Moreover, positive mood arousal induced by music was not found to be correlated with improved performance on the task. Limitations and implications are discussed. Future research on music, mood, and cognitive performance should be pursued to replicate findings and further clarify ambiguous results observed within the field of music and cognitions.

Keywords: music, cognitive performance, mood, arousal

The Effects of Music and Context on Mood and Learning

As of January 2023, 6.8 billion people, or 85% of people worldwide report having a smartphone (Gaubys, 2023). With the rise of streaming services such as Apple Music, Spotify, and Amazon Music, now more than ever people have access to their favorite music around the clock. As of June 2021, 88 million people are currently subscribed to Apple Music (Curry, 2022), and as of October 2021, 165 million people are subscribed to Spotify (Dean, 2021). These are just two out of dozens of music streaming services available to consumers, and yet, have amassed 253 million listeners globally.

With this, people spend an incredible amount of time listening to music. On average, people spend almost four hours everyday listening to music (Lonsdale & North, 2011). Reasons as to why people listen to music are more complex, however. In a study on why people listen to music, it was found that people listen to music in order to meet certain needs; those being enhanced mood, provide a background for other activities, to relieve stress, and to connect with others. In addition, the authors identified four main gratifications that can be satisfied with music; emotional, cognitive, social, and physiological (Lonsdale & North, 2011). It was found that listening to music is an important leisure activity and holds significant weight in people's day to day lives due to the benefits we gain from listening to it.

Furthermore, working out and exercising are very common activities in which people enjoy listening during. To examine this, a meta-analysis review revealed that when people listened to music while playing sports or exercising, there was a beneficial effect on the participants heart rate, oxygen consumption, perceived exertion, and overall performance (Terry et al., 2020). The participants that listened to music while exercising had a slower heart rate, consumed less oxygen, and felt that they had not worked as hard compared to the participants that did not listen to music while exercising. So then, not only is it enjoyable to listen to music while exercising, it actually facilitates better performance during the exercise itself.

Further studies on the frequency of music listening in college students specifically found that the majority of music listened to by college students was during other activities, chief among them being studying (Stratton & Zalanowski, 2003). Studying is a demanding and high effort mental task, requiring dedicated levels of concentration, perhaps for hours at a time, on the part of the student (Benassi et al., 2014). Mental effort refers to the amount of concentration available to an individual at a given time. This is a limited resource, meaning, there is a finite amount of concentration that can be used by an individual at a certain time to perform a given task. Knowing that the highest frequency of music listening in college students occurs while studying, it begs the question if music may help with this task - both, by way of improving mood and by providing possible contextual cues during encoding that may aid in recall. The main component of the studying process is consolidating new information and encoding it for storage in long-term memory, with the ability to retrieve this information at a later time. The current study aims to examine how learning is impacted by whether or not music is played in the background during the learning process. For those that enjoy working in public places, such as coffee shops, unless headphones are worn by the individual, the music played in the background, will most likely not be of chosen preference to the individual. There is no agency for the individual working to select what music is played in this scenario. With headphones, or other devices that allow for personal listening, there is agency on the part of the individual to select the music that is being played while working, or studying. So then, in the real world, what is the better environment to study in? In addition, the study seeks to test if recalling rehearsed information under similar vs. dissimilar conditions further affects performance.

Music and Cognitive Performance

Extant research has examined how music can impact cognitive performance in a wide variety of situations (Angel et al., 2010; Dolegui, 2013; Schellenberg, 2005). There is a level of ambiguity within the research of music and cognitive performance as multiple outcomes have been observed. There exists a familiar narrative that warns against listening to music while studying because it may be distracting. Indeed, the literature offers some evidence that this may be true. In one study, participants were randomly assigned to one of four conditions in a 2 (type of music: high arousal vs. low arousal) x 2 (context: same music during encoding and recall vs different music) during a face association recall task. It was found that regardless of the type of music played, high arousal (rock, electronica) vs low arousal (jazz, classical), the music was rated as a distraction by the participants (Reaves et al., 2015). Two control conditions accompanied these, those being silence during both portions of the task as well as “musical rain” during both portions. Findings from this study included no notable effects from the arousal (music) manipulations as well as the context manipulations on task performance. So while there was no direct impact on performance as a result of the music or context of encoding, the music was rated as a distraction. Similar to these results, a music and driving study had participants drive in either a simple or complex situation while either listening to music, or not, by way of using a driving simulator. It was found that the participants’ performance did not differ based on whether they were listening to music or not (Ünal et al., 2012). However, the mental effort exerted by the participants that listened to music while driving (as indicated through self-reports on the Rating Scale Mental Effort; Zijlstra, 1993) was increased when compared to the participants who did not listen to music while driving (Ünal et al., 2012). Given that the participants experienced an increase in mental effort while listening to music, regardless of the driving situation, the assumption that listening to music during a cognitively demanding task may have distracting effects is supported. Interestingly though, the drivers that listened to music while driving performed as well as the drivers that did not listen to music, with the exception of two specific driving situations; these being a hazardous event that required immediate braking of the driver to avoid hitting another car leaving a parking lot, and having to follow a lead car with an irregular driving pattern for extended periods of time. In both of these situations, the drivers that listened to music performed better than the drivers that did not. These two situations are very different in nature; one requires a quick and immediate reaction to a fast changing environment while the latter requires sustained attention over the course of a rather monotonous period of time with only small changes in the environment, yet, in both cases, music increased driving performance. So then, the increased mental stimulation of the music may have had a positive influence on the drivers in these situations due to the fact that a high level of concentration was required, and the music had just the right arousal to aid the drivers in these situations. Optimal levels of arousal for performance and how music may influence arousal will be discussed further later on.

Other studies within the literature have found that music will not only act as a distraction, but will also significantly impair performance on certain tasks. In one study, both introverts and extraverts (as determined by the Eysenck Personality Questionnaire, 1975), performed significantly worse on an immediate recall memory test when pop music was present (Furnham & Bradley, 1997). Interestingly, when pop music was played during the memorization portion of a different delayed recall memory test, this task having a delay of six minutes between studying and recall, the introvert group performed significantly worse than the extrovert group in the same condition, as well as the introvert group that studied in silence. Finally, introverts that completed a reading comprehension task while listening to music also performed worse than the extroverts in the same condition, as well as the introverts that did not listen to music. Although the sample size in this study was quite small (10 introverts and 10 extraverts), it suggests that listening to music may impair performance on different memory recall tasks. In addition, it suggests that personality may be a relevant moderator for studying how music affects cognitive performance. Characteristics of personalities are not being assessed in the current study, however, as well as people are able to choose their own music during the current study, so this may be less relevant. Similarly, music with familiar language lyrics can interfere with foreign vocabulary word acquisition, but only in the short term (De Groot & Smedinga, 2014). When the vocabulary test was delayed a week, the interfering effects of the familiar language lyrical music was no longer seen. This could suggest interference effects of hearing dissimilar language on recall performance, however, this will also not be studied in the current study so this will also be less relevant.

Despite all of this, a surplus of literature suggests that music actually facilitates cognitive performance similar to what Terry et al., (2020) observed. Participants who completed a cognitive task were able to answer more questions within the allotted time frame as well as answer these questions more accurately when they listened to music in the background (Cockerton et al., 1997). The music played during these tasks was computer generated in real time during the study, by a software named Koan Plus. This music is not precomposed, is ever changing, as well as being described as "harmonious." The AH4 general intelligence test was used to measure the effects of this music, and yielded clear results of facilitation effects as a result of the background music being present during the cognitive task. Furthermore, another study examined the role of background music on episodic encoding and verbal retrieval of a word list and found that music can have a positive influence on both encoding and retrieval (Ferreri et al., 2015). Episodic memory refers to the collection of recent or past personal experiences of an individual (Tulving, 2002). This is what is typically considered and thought of by laypeople as “memories.” Encoding then, is the actual process by which perceived information from the external environment is received and converted into a construct that can be then stored by the brain (Goldstein, 2015). In the music condition of this study, all participants listened to the instrumental jazz piece “Crab Walk,” by Everything But a Girl. It was observed that participants were able to chunk more words together when listening to music, suggesting associative strategies for encoding as a result of listening to the music. Furthermore, the prefrontal cortices of the participants were also monitored during the task using fNIRS. FNIRS, or functional near-infrared spectroscopy, is a method that allows researchers to monitor brain activity, as well as see which parts of the brain are firing during cognitive tasks (Ferreri et al., 2015). From this, researchers observed decreased activity of the prefrontal cortex during both the encoding and retrieval portions of the task when participants listened to music. The prefrontal cortex is the most prominent section of the brain responsible for episodic and working memory, as well as other language and information processing activities (Cabeza et al., 2002). Given that there was less activity in this region of the brain when participants listened to music, it suggests that the background music mediated the workload of the prefrontal cortex and made it easier for the individuals to remember more chunks of information while concurrently allowing the prefrontal cortex to work less.

Music and Mood

Music can have noticeable effects on the mood of the listener (Hunter & Schellenberg, 2010). Music is significant in the fact that it has the ability to elicit emotion in an individual as well as induce arousal, either positive or negative, simply from listening. The mood of a participant can affect the way information is processed, as well as the strategies that an individual uses to process new information (Forgas et al., 2013). More specifically, studies have shown that a given mood facilitates the processing of information that shares the same tone or valence of that given mood (Forgas et al., 2013). For example, participants were more readily able to recall positive narratives that they had read when the music they listened to was positive, and vice versa for sad narratives and sad music. This is what is known as the mood-congruence effect (Mayer et al., 1995). Mood-congruent memory effect is the process by which more information is stored and remembered if the material being studied is similar to the mood of the person studying it; i.e., happy people will remember more happy material than sad material, and vice versa (Mayer et al., 1995). Tesoriero & Rickard (2012) found a significant effect of this mood-congruence in both younger and older adults. Both age groups more accurately recited a narrative that was similar to their mood; positive moods showed better recall of positive narratives when compared to negative moods (Tesoriero & Rickard, 2012). In other words: there is good evidence that mood can have an impact on the way and the effectiveness of learning new information.

So then, it is important to take into account the mood of the participant when researching how information is encoded and stored. If a participant is listening to their favorite music, it is expected that they will be induced into a positive mood state. This is assumed on the basis that one's favorite music will be familiar to them, as well as being something they enjoy listening to. Zajonc (2001) first described this phenomenon in 1968, coining the term "mere-repeated exposure effect," which can be defined as the process of increased positive feelings and attitudes towards repeatedly seen and experienced stimuli (Zajonc, 2001). Consistent with the mere exposure effect, in one study participants listened to their preferred music during a working memory task (Hirokawa, 2004). While the preferred music did not significantly increase performance on the task, when compared to relaxing instructions and silence, it did have significant effects on the participants' arousal. Arousal was broken into four subcategories for this study, those being energy level, tiredness, tension, and calmness, and was assessed both before and after the experimental treatment by the Activation-Deactivation Adjective Check List (Thayer, 1978). Subject-preferred music increased energy levels of participants while relaxing instructions and silence increased tiredness levels of participants, as well as calmness levels. All three experimental conditions reduced the tension levels of the participants (Hirokawa, 2004). With increased energy levels and decreased tension levels observed in this study, it is supported that subject-preferred music will induce positive arousal in participants, putting them in better mood states that will in turn facilitate cognitive performance.

Optimal arousal levels for performance are best described by the Yerkes-Dodson law which states performance levels are highest at specific levels of arousal, with performance being lowest at levels of under or over arousal (Nickerson, 2021). On a graph, this would resemble a normal distribution bell curve, with optimal levels of arousal, and subsequent optimal levels of performance, residing in the middle, with lowest performance levels at the edges of the graph, corresponding to extremely low and high levels of arousal.

Furthermore, positive moods have been shown to increase cognitive flexibility, another avenue through which mood can influence an individual's ability to process and interpret new information. Cognitive flexibility is an important characteristic of cognitive performance and refers to the extent an individual can pursue complex tasks, multi-task, and find new, creative solutions to problems (Ionescu, 2012). Isen and her colleagues argued that positive mood increases perceptions of integration, facilitates associations among cognitions, and increases perceptions of interconnectedness among items (Isen, 1988; Isen & Daubman, 1984; Isen, Johnson, Mertz, & Robinson, 1985). Expanding on these initial findings, Murray and his team of researchers found that positive moods facilitate creativity, allows participants to identify a greater variety of similarities and differences among items, as well as create more narrow and specific categories of these items (Murray et al., 1990). When participants were in more positive moods, their cognitive flexibility was increased, leading to more creative problem solving and categorization of information.

Music as a Contextual Cue

According to the encoding specificity principle, memory is enhanced when the information being learned is consolidated alongside contextual information in the environment that is present during both encoding and retrieval (Tulving, 1983). One classic study conducted by Godden and Baddeley (1975) exemplifies this theory, where divers learned lists of words either underwater or on land. They were then asked to recall as many words as they can remember from the original list, either in the original environment or in the alternative. Lists that were learned underwater were best recalled underwater, and lists learned on land were best recalled on land (Godden & Baddeley, 1975). The authors emphasized that the movement from one environment to the other was likely not responsible for the difference in memory recall. This was a free-recall task, meaning that participants simply recalled as many words as they could remember without the help of word banks or clues given. 28 years later, Koens et al., (2003) replicated Godden and Baddeley's study to see if their results were generalizable to the medical field. The study was conducted using 63 clerks, with the bedside (clinical) and a classroom setting used as the two learning environments. Unfortunately, there were no significant findings of same-context advantage for the free recall of word lists in this study (Koens et al., 2003). These are two notable studies on context dependent memory, however, in the case with Koens et al., environmentally based contextual memory may not be generalizable to other circumstances.

Mood itself can also act as a contextual cue during the learning process in what is known as mood-state dependent retrieval (Kenealy, 1997). This is an interesting topic in psychology, due to the fact that research reporting null findings are far greater and outnumber the research that report positive findings of mood-dependent effects. Furthermore, much of the early research in this subject fell under stark controversy as a result of methodological issues that may have led to unreliable results. These methodological issues typically fell under three main categories, subject factors, emotional-state factors, and factors relating to the cognitive task (Ellis & Ashbrook, 1991). In addition to providing a review analysis of previous literature in the field, Kenealy (1997), conducted experiments in order to observe better results of mood-dependent retrieval with more reliable methodology. In experiment one, participants had better recall and less incorrect responses to the memory task when the information was encoded and retrieved in the same mood state, compared to when the mood state of the participant differed during encoding and retrieval. In this first experiment, participants were induced into either elated (E) or depressed (D) mood states using an adaptation of the Velten mood induction process (Velten, 1968). In the Velten mood induction process, participants are asked to read 12 cards with self-referent statements on them, those being statements such as, “I feel happy right now, I feel very content right now, I feel like smiling, it feels great to be alive,” for the elated mood state and statements like “I feel unhappy, I feel sad and blue, I feel pretty low, things seem futile and pointless,” for the depressed mood state. Moreover, the participants were asked to focus on their moods while reading the statements and to try their best to accurately feel and relate to the mood state they were being induced into. Subsequently, the two conditions in which the mood state was held consistent throughout the memory recall task (EE & DD), recall was highest among participants and the lowest levels of decrements were observed, when compared to the conditions in which mood state was not held constant (ED & DE). This experiment was replicated again in experiment two by the same authors with identical procedures, with the exception that the mood states were induced through music, as opposed to the Velten Process of induction. Yet again, strong support of mood-dependent retrieval was observed from the data. The participants that studied and recalled in the same mood state had far less decrements than those that studied and recalled in different mood states. The mood state induction via music proved to be more subtle and easier to administer than the adaptation of the Velten Process in the first experiment.

In other examples, olfactory stimuli has been shown to create contextual clues for learning. This induction of contextual learning was limited to certain situations, however, with better recall of objects from a stressful video only observed when a semantically related odor was present during encoding (participants watching the video) and during recall (participants recalling the target objects from the video) (Pützer & Wolf, 2021).

In addition, music has also been observed to induce context-dependent memory. In a multi-stage free recall experiment using background auditory stimuli as contextual clues, recall was better and forgetting was less among individuals when the information was presented alongside background sound as well as when the sound was reinstated during recall (Smith, 1985). In this case, the music created contextual cues which aided free recall 48 hours later. Interestingly, participants who studied in silence but recalled with background sound did not perform any worse, or better, than those that studied and recalled in silence. The background sounds used in the study were divided among three conditions; Mozart, Jazz, and white-noise, with the silence condition serving as the control. This demonstrates a lack of distraction effect of the background music, a narrative stated earlier that concerns many who think studying and testing with music can be distracting. Furthermore, this sheds light on contextual learning, and that when the context is changed, as in the example above, it may not have any detrimental effects on learning, but only for certain situations. In other words, more evidence that the Godden & Baddeley (1975) study may not be a robust effect.

The Present Study

The goal of the present study is to extend research on context-dependent memory and the effects of music on mood by testing if (a) self-chosen music can improve mood and therefore aid learning and if (b) music can serve as a contextual encoding cue for new information, and thus upon retrieval the same music may act as a retrieval cue for the studied information and therefore will aid learning.

To test these hypotheses, the present study will utilize a 2 x 2 experimental design in which participants will complete a recognition-recall task while either listening to their preferred studying music or not. The goal of having the participants listen to their preferred music during the task is to create positive mood arousal among the participants. This is based on the assumption that one's preferred choice of song is both familiar and enjoyable for the participant. For songs to become one's favorite, or to be categorized as a favorite, one will have listened to, or have been exposed to the music multiple times, as well as have experienced positive feelings on repeat occasions when the song was listened to. Thus, having the participants listen to their preferred studying music is expected to better facilitate more positive mood states and more feelings of ease while taking the recall task, which may increase performance. In addition, having the participants listen to their preferred choice of studying music during the experiment simulates a college student studying on their own before a test or exam. In order to test if the participant's preferred music influenced their mood, an adaptation of the Brief Mood Introspection Scale (Mayer & Gaschke, 1988), or BMIS, will be used following the encoding portion of the task. This scale asks participants to rate how accurately certain mood characteristics describe them, as well as their overall mood after having studied the words while listening to their favorite music, or not.

Unlike previous studies that utilized free recall tasks, the current study is using a recognition recall task, in which participants will be able to see the definitions of the words on paper and must write in the correct word that matches the given definition. Conversely, a free recall task would consist of participants freely writing in as many words and definitions as they can remember. This was done to simulate a vocabulary test or quiz that a student may see in one of their classes. A word bank was omitted from the recall task in order to challenge participants and to be able to have a clearer assessment of how well the participants were able to learn the new information.

Furthermore, the present study is employing an auditory context, using background music to create the context of studying and recall. Godden & Baddleley (1975) laid the groundwork for context-dependent memory, and Koens and her colleagues (2003) certainly expanded on it, however, direct comparisons from these studies to the present study may not be able to be made due to this fundamental difference; the contexts being manipulated are based in different sensory inputs. The first two manipulate environmental stimuli, while the present study is manipulating auditory stimuli.

I hypothesize that listening to music (during encoding) will improve positive mood states and decrease negative mood states. I further hypothesize that there will be a main effect of music during encoding as well as an interaction between music during encoding and music during retrieval on performance on the recall task. Specifically, I am hypothesizing that performance on the recall task will be higher when participants encoded to music vs no music, due to the hypothesized mood-boosting effects of music. Moreover, a combined mood and context effect would suggest that participants who encoded *and* retrieved to music will outperform all other groups due to the hypothesized contextual-encoding cue of music. If, however, context is more important than mood, participants in the two context-congruent conditions should outperform those in the incongruent conditions.

Method

Participants

33 undergraduate students from Allegheny College were recruited for this study. Demographic information of the participants, including race, gender, age, and ethnicity were collected in order to categorize and describe the data and results of the study. Students enrolled in introductory psychology courses were compensated with two SONA credits for their participation in the study. In addition, all participants were given the opportunity to enter a raffle for the chance to win a $20 gift card to Pampered Palate in Meadville, PA after their participation in the study. There was no exclusion criteria for the study and no one was excluded from participating. The study was posted and advertised on SONA's website for participants to see and sign up for, with open slots available everyday for four consecutive weeks. Psychology professors teaching introductory psychology courses also informed students about studies on SONA, including the current study, in order for the highest possible chance for people to sign up.

Materials

Manipulation of Music during Encoding. Participants were asked to indicate 7 songs of their study preference, as well as the accompanying artists, at the time they signed up for the study. This allowed the experimenter to create individual playlists to be used in the study for each participant before they arrived at the lab. Participants were randomly assigned to either listen to their favorite music (i.e., the 7 songs they submitted ahead of time) or not (i.e., they will study in silence) during the encoding portion of the experiment, which lasted 10 minutes exactly. As such, only three or four songs were actually played during the study for each participant assigned to listen to music during encoding. The music was controlled by the experimenter throughout the entirety of the study. A bluetooth speaker connected to the experimenter's phone was placed in the room with the participants. This was used to play music during the recall task from the experimenter's phone, which was located directly outside of the study room. This allowed the experimenter to control the participants' music from outside the room and only have the bluetooth speaker present in the room with the participants. The songs for each participant were added to a playlist; each participant had their own playlist consisting of their previously indicated 7 songs. For the participants assigned to listen to music while studying, the playlist of songs was shuffle played, meaning the songs were played in a random order. The experimenter did not select the order of any songs played during the study. When the encoding portion of the task began, a timer set for 10 minutes was started, as well as the music for those assigned to listen to music during encoding. No music was played for those assigned to the no music condition. Note; the volume of music was kept consistent throughout the experiment and each participant that was assigned to conditions listening to music during either portion of the task experienced the same volume of music from the speaker.

Cognitive Task. 20 words from the Graduate Record Examination word list were pulled from the graduateshotline.com website to be used in the study ("GRE Word List," n.d.). These 20 words were hand selected by the experimenter based on the perceived difficulty to an undergraduate student. More common and well known words were avoided and not selected for the reason that the most desirable words for the study were those that undergraduate college students may be unfamiliar with. This was done in order to allow more true studying and learning of new information to take place during the experiment, instead of a participant simply seeing a word that they already know the definition to, and as a result do not have to actually study the word and definition. The Graduate Record Exam is a rigorous examination for prospective graduate students, so the assumption is made that the more difficult words on the list, as judged by the experimenter, will be of at least some unfamiliarity to freshman undergraduate students. This still does not ensure that each participant is unfamiliar with every word in the list, however, this was done as an attempt at making participants study and memorize unfamiliar subject matter. Each word and definition were printed on either side of a standard 3x5 notecard for a total of 20 notecards. The note cards were laminated to prevent any damages that may occur during the study. Participants were given the 20 notecards and instructed to study the words and corresponding definitions with the goal of remembering each word's definition for 10 minutes during the encoding portion of the task. During the retrieval portion of the task, participants were asked to correctly handwrite in the word that matches the given definition for each definition listed. All 20 definitions of the words were printed on a sheet of paper and listed 1-20. Adjacent to each definition was a blank line representing the space in which participants were to write in the correct word. Performance was assessed based on the number of correctly recalled words. Each correctly recalled word received one point with the maximum number of points able to achieve on the task being 20. A word was scored as incorrect if more than two letters of the word were incorrect.

Mood Assessment. An adaptation of The Brief Mood Introspection Scale (Mayer & Gaschke, 1988), was used in order to gauge the mood of the participants after the 10 minute encoding portion of the task. This asks participants to rate how well certain qualities describe their current mood on a scale of 1-4 (definitely do not feel-definitely do feel) for 16 qualities, such as happy, stressed, calm, nervous, etc. It also asks participants to rate their overall mood on a scale of -10 to 10 (Very unpleasant-very pleasant). Each quality was categorized as either a "positive mood state" or a "negative mood state." Scores for responses to each of the eight positive and eight negative qualities (1-4 for each quality) were added to create total scores for positive mood states and negative mood states. This was then scaled across conditions to create positive and negative mood state scale scores. The overall mood was scored on the same scale of -10 to 10, and an overall mood scale score was created in order to analyze effects of music on overall mood.

Manipulation of Music during Retrieval. As in the encoding portion of the task, participants were randomly assigned to either listen to their preferred studying music, or not, during the subsequent retrieval portion of the task. This portion of the task was also 10 minutes long, just as the encoding portion. For those assigned to listen to music during retrieval, their preferred music was started at the same time as the timer, and stopped when the participant had finished the recall task, or when the 10 minute timer went off. If the participant was assigned to listen to music during both encoding and retrieval, then only the songs played during encoding were played during retrieval. This was done to ensure context would be considered "similar" and that the participant was hearing the same music during both portions of the task. In this scenario, the experimenter made note of what songs were played during encoding, deleted those songs that were not played from the participants playlist while the participant filled out the adaptation of the BMIS, and shuffle played the new and condensed playlist while the participant completed the recall task. Context could not be considered similar if the participants were to listen to different songs during both portions of the task. If the participant had not been assigned to listen to music during encoding but was assigned to listen to music during retrieval, then the original seven song playlist was shuffle played as normal. Finally, if the participant was not assigned to listen to music during retrieval, then simply no music was played. All music playing procedures were held constant from the encoding portion of the task.

Procedure

Participants were recruited to partake in a study on the effects of musical preference on verbal fluency. Upon arrival, participants received an informed consent sheet as well as a brief introduction letter and were properly briefed on the procedures, compensation, and any risks that may arise as a result of the study. Participants were randomly assigned to one of the four experimental conditions listed above; listen to music during encoding and retrieval (condition 1), listened to music during encoding but not retrieval (condition 2), did not listen to music during encoding but did during retrieval (condition 3), and did not listen to music during both encoding or retrieval (condition 4). Once the informed consent sheet was signed by the participant, the first part of the experiment began. The experimenter returned to the room and handed the participants the 20 notecards with the GRE words and definitions. The participants were verbally instructed that they will have 10 minutes to study each word and its definition, with the goal of remembering each word's definition. Once the experimenter left the room, a 10 minute timer was started. For participants assigned to listen to music during the study portion (conditions 1 and 2), their playlist of preferred songs was shuffle played at the same time the timer was started. For participants assigned to the no music condition during encoding (conditions 3 and 4), no music was played during the 10 minute study portion. After the 10 minutes were completed, the music was stopped (for those in conditions 1 and 2), and the experimenter re-entered the room to collect the notecards. The participants were then given the adapted Brief Mood Introspection Scale (Mayer & Gaschke, 1988) and verbally instructed to fill out the scale to the best of their ability in order to gauge their self-reported mood at the current moment. Instructions for filling out the scale were also outlined at the top of the paper. Participants were not given a time limit for this and were instructed to open the door to the study room to indicate to the experimenter when they had finished filling the scale out. No music was played during this time. When this was completed, the experimenter then collected the adapted BMIS and returned with the recall task. Participants were instructed, both verbally and in writing, that they have up to 10 minutes to write the correct word that corresponds to each definition listed on the paper, with a timer starting as soon as the experimenter leaves the room. The experimenter made sure to note that spelling will not be counted, as long as it is beyond any doubt that the participant was spelling the correct word. If participants finished before the 10 minute mark was reached, they were instructed to open the door of the study room to indicate to the experimenter that they have finished, just as before, and are ready to move on. Participants assigned to similar context conditions (conditions 1 and 4) experienced the same background auditory stimuli during retrieval as they did during the encoding portion. For example, if the participants listened to their preferred music in the encoding portion, then those songs were played again during the retrieval portion, and vice versa; if they did not listen to music during encoding then they also did not listen to it during retrieval. Participants assigned to dissimilar context conditions (conditions 2 and 3) experienced the alternative background stimuli to what was experienced in the first portion of the task. So, if they listened to their preferred study music during encoding, then they did not hear music during retrieval, and vice versa. Once the 10 minutes were reached, or the participants opened the door to the study room, the experimenter stopped the music (for participants assigned to listen to music during recall) and entered the room to collect the recall assignment. One final demographic survey was given to the participants to serve as the last portion of the study that involved participant responses. No music is played during this time for any participant and no time limit was given. Just as with the adapted BMIS portion of the study, participants opened the door to the study room when they had completed the demographic questionnaire. The demographic survey was not given to the participants until after they completed the cognitive task in order to avoid any stereotype threat that may arise. In some instances, men and women may react differently to gender stereotype activations in situations in which cognitive abilities are being assessed (Hirnstein et al., 2012). Therefore to avoid any potential risks of stereotype threat, the demographic survey was not given to the participants until the end of the study. Upon completion of the demographic survey, participants were given the debriefing form and properly debriefed of the study's true purpose and thanked for their participation. Each participant received 2 SONA credits as compensation for participating in the study, as well as being given the opportunity to be entered into a raffle for a chance to win a $20 gift card to Pampered Palate in Meadville, Pennsylvania. Participants entered this raffle by indicating to the experimenter their Allegheny College mailbox number and entering it into the signup sheet available to participants when they walked out of the study room. Finally, the participants were thanked once again for their participation and effort in completing the study.

Design

The current study is a 2 x 2 experimental, between-subjects design with music and context being manipulated in the study. Both independent variables had two levels: music was separated into preferred choice of study music vs. no music, while the context was separated into similar context vs. dissimilar context. In other words: music during encoding (yes vs no) and music during retrieval (yes vs no), served to create the four experimental conditions for participants to be randomly assigned to. Dependent variables for the study included the amount of correctly recalled words on the recall assignment, as well as the self-reported perceived mood states, and overall mood, of the participants.

Results

Effects of Music on Mood

Positive and negative mood state scale scores were calculated for each participant by adding the total value (1-4) of each response to the eight positive qualities and the eight negative qualities. Those totals were then scaled to create total positive and total negative mood state scale scores. In addition, an overall mood scale score was calculated for each participant. Three participants did not complete the positive and negative mood states survey in its entirety, so those mood scores were omitted from the positive and negative mood state scale scores. As such, the final sample size for the positive and negative mood states was 30.

To test if encoding to music boosted positive mood states and decreased negative mood states, an independent-samples t-test was run (note; retrieval to music: yes vs no was manipulated after mood was assessed, so no 2 x 2 ANOVA was run). Results from the independent-samples t-test indicate that, as predicted by the mood-facilitation effects of music, participants who listened to music during encoding reported increased positive mood states (M = 2.91, SD = 0.490), when compared to participants who did not listen to music during encoding

(M = 2.41, SD = 0.51), t(28) = 2.75, p = .01, d = 1.01. Moreover, as predicted, participants who listened to music during encoding had decreased negative mood states (M = 2.00, SD = 0.40), when compared to participants who did not listen to music during encoding (M = 2.51, SD = 0.39), t(28) = -3.52, p = .002, d = -1.28.

Conversely, the overall mood of the participants who listened to music during encoding (M = 5.53, SD = 3.13) were not statistically different than participants that did not listen to music during encoding (M = 4.06, SD = 3.97), t(31) = 1.18, p = .246, d = 0.41.

Effects of music on recall performance

In order to test whether listening to music during encoding (yes vs no), and recalling studied information in the same vs a different context (music during recall: yes vs no) increased the performance of the participants on the task, a 2 x 2 factorial ANOVA was run. Results from the two-way ANOVA revealed that there was no main effect of listening to music during encoding, F(1, 29) = 0.377, p = .544, η^2 = .013, nor a main effect of listening to music during retrieval on performance, F(1, 29) = 0.276, p = .603, η^2 = .009. Lastly, there was not a statistically significant interaction between the effects of listening to music and manipulation of context on participant's performance on the recall task, F(1, 29) = 0.276, p = .603, η^2 = .009. However, while this did not reach statistical significance, it is important to note that, consistent with predictions, participants who listened to music during both encoding and retrieval had a higher mean recall score (M = 6.11, SD = 4.96), than all other groups, respectively, (encoding to music but recall without music: M = 4.63, SD = 4.66; encoding without music but recall to music M = 4.50, SD = 2.88, encoding and recall without music, respectively M = 4.50, SD = 3.16). Please also see Figure 1.

Relationship between mood and performance

A Pearson's correlation coefficient was computed in order to assess the relationship among the participants mood states (positive vs. negative), participants overall mood, and the participants' performance on the recall task. As a result, it was found that there was no significant correlation between positive mood states and performance, $r(28) = -.029$, $p = .881$, between negative mood states and performance, $r(28) = -.060$, $p = .753$, or between overall mood and performance, $r(31) = .106$, $p = .556$. Please also see Table 1. In other words, none of the mood scales predicted performance on the recall task.

Discussion

The purpose of the current study was to test if music would facilitate mood as well as performance on a memory recall task. Previous research has indicated that music has the ability to act as a contextual encoding cue that can aid retrieval, as well as induce mood arousal, either positive or negative, depending on the valence of the music. To address whether listening to self-chosen music during both encoding and retrieval aids cognitive performance, the present study utilized a 2 (chosen music during encoding: yes vs no) x 2 (chosen music during recall: yes vs no) design. It was hypothesized that the participants who listened to music during the encoding portion of the task would have increased positive mood states and decreased negative mood states as a result of listening to their preferred music. Furthermore, it was hypothesized that they would have increased performance on the recall task as a result of the positive mood arousal, which is consistent with previous research. In addition, it was also hypothesized that the participants who listened to their music of choice during both the encoding and retrieval portions of the task would have increased performance on the task compared to all other groups, as a result of context-dependent memory effects with music acting as the contextual cue. Only the first hypothesis was supported by the results of this study, in that the participants who encoded to their preferred studying music had significantly increased positive mood states and significantly decreased negative mood states. However, the increased positive mood states did not translate to better performance on the recall task. Furthermore, results did not find evidence of context-dependent memory effects with music acting as a contextual encoding cue for the retrieval process, as performance among all four conditions on the memory recall task were not significantly different. However, recall performance for participants listening to music during both encoding and retrieval on average was almost two points higher than all other conditions, which may suggest the possibility that listening to music did facilitate performance on the recall task as a result of context-dependent memory. Given the small sample size of the present study, it is unclear if this difference is trustworthy and therefore warrants replication with a larger sample.

Mood

The significant results of participants having increased positive mood states and decreased negative mood states after listening to music they had identified as their favorite was not only expected, but makes sense logically. When we listen to our favorite music, we feel better. But why is this the case? Recent studies in neuroscience using brain imaging techniques have shown that when people listen to music described as highly emotional, the reward system in our brain is engaged and dopamine is released (Zatorre & Salimpoor, 2013). This dopamine is released in the striatum, an ancient part of the brain found in other vertebrates as well, that responds to naturally rewarding stimuli such as food and sex. So then, when we listen to music that can be described as emotional, or rather, music we find an emotional connection to, the part in our brain that responds to naturally rewarding stimuli is targeted and our brain releases chemicals that make us feel good. An important part of this though, is the specific music people would describe as emotional. Each person has a different music preference; different genres, musicians, instruments, and singing voices that they naturally respond positively too. This is why the preferred studying music for each participant was used; a song one may describe as emotional and have a rewarding reaction to most likely will not have the same effect on someone else. It is possible that participants may have selected music they do not have an emotional connection to, rather, and selected music they just enjoy studying too. Despite this, if the music is categorized as their preferred studying music, this means inevitably that they have listened to it while studying before on multiple occasions, as well as have had positive experiences while doing so. This will still affect the brain in similar ways as highly emotional music does, due to the fact that the person has made a personal connection of positive studying with the music, and will be aroused in a similar positive manner. Importantly, allowing participants to identify music they experienced as pleasant also enabled them to choose music that was presumably optimal in the intensity of evoked emotions. In other words: participants likely did not choose music that would have strong arousal or distraction effects which could impede their focus or performance.

It was also hypothesized that people in better and more positive mood states would perform better on the recall task by way of cognitive flexibility. Cognitive flexibility is defined as the human ability to adapt and change cognitive processing strategies to face and be successful in new and unfamiliar situations and environments (Canas et al., 2006). This was not supported by the results of the study, that is, there was no relationship between being in more positive mood states and performing better on the recall task. While research has suggested that better mood states increase the cognitive flexibility in an individual, (e.g., Rowe et al., 2007), the recall in short succession task in the present study may have been too short and too demanding to see the full effects of this phenomenon. Time given to participants to encode and recall the information was limited, especially considering the task was to memorize 20 new and unfamiliar

GRE words. Similarly, the task itself may have been too one-dimensional and had not allowed the participants to truly showcase their cognitive abilities and flexibility as a result of their increased positive moods. In the study above, Rowe and his colleagues (2007) observed that positive mood states actually loosened the grip of inhibitory control, and allowed the participants to have increased allocation of their attention in both external visual and internal conceptual space. This was accomplished using two tasks: a remote associates task in which participants are asked to generate a fourth word that is related to the three words given to them, as well as the Erikson flanker task, a task that asks participants to correctly respond to directional stimuli, either congruent, incongruent, or neutral, by pressing certain keys on a keyboard that correspond to a given direction. These relate directly to things such as a person's creativity and problem solving ability, as in the case of the remote associates task, where individuals must come up with a novel word that relates to the three they see in front of them. The simple word list recognition task used in the present study likely was not expansive enough to require the use of creative problem solving strategies for the participants, and as a result cognitive flexibility may not have played a pivotal part in the performance of the individuals on the task. In task, new and unfamiliar words were being presented to the participants, however, for most students this hardly qualifies as a new and unfamiliar situation and environment. Therefore, the beneficial impacts on cognitive flexibility caused by the more positive mood states most likely were not able to be observed due to the fact that the memory recall task was not an environment that required the use of new and adaptive cognitive processing and problem solving strategies.

Recall Scores

As mentioned previously, performance on the recall task was not significantly different across any of the four experimental conditions. Why may this be? Firstly, the recall task used in the present study turned out to be more difficult than intended. Although it was meant to be challenging, studying up to 20 unfamiliar, difficult words in 10 minutes may have been too ambitious. Successful encoding and storage of new information into long term memory takes time and elaborate rehearsal to make sure the information is consolidated completely. Studying the words for 10 minutes likely did not allow for this to happen, thus the task used may have been more akin to cramming before a test than actually studying information. Given this, it's not surprising that the average score on the task was 4.97 out of 20, and that the scores were not significantly different among the four experimental groups, regardless if they listened to their preferred music or not. Furthermore, the current study was only able to recruit 33 participants in total for the study, a sample size that is far too small to observe reliable, well-powered effects (if they exist) among groups. As such, effect sizes were also small for both main effects and interaction of the independent variables. Another explanation for the lack of significant results may be that the recall task used in this study was not sensitive enough to detect the effects of music on cognitive performance. Not "sensitive" enough in this case refers to the task being too broad in scoring to discriminate between subtle differences in performance as a result of listening to one's preferred choice of study music. Using such a rudimentary and mainstream method of testing long term memory acquisition may have not lent itself to polarizing and dramatic results.

Despite this fact, there was one result that proved intriguing. The average score of the participants who listened to their preferred studying music during both encoding and retrieval was two points higher on the recall task than each of the other three groups. This was the group that the current study was most interested in as this was the condition in which music would theoretically have the ability to function as a contextual encoding cue that could help participants retrieve more information during recall. Again, while the results were not significant, simply looking at the mean scores of the four groups shows this group scored on average, two points higher than each of the other three groups. So then, it is not unfair to say that in this study, the preferred studying music of the participants may have aided performance in the recall task, even in the slightest, through music acting as an auditory contextual encoding cue. This shows evidence in support of research that already exists on context-dependent memory and how music may act as a contextual encoding cue during a cognitive task (Jäncke, 2008). Another main component of this study was the role of the participants' preferred studying music and how it might have an increased beneficial effect to the individual because it was familiar and pleasant to them. The results observed of the mean scores of the four experimental groups could have been due to more factors than merely the context; valence and choice of music could be another explanation. In 2007, Janata and his colleagues conducted a study that found that participants listening to music that was personally significant and familiar to them led to increased activity in the brain regions associated with memory retrieval, compared to listening to music that was unfamiliar and otherwise meaningless to the individual (Janata et al., 2007). So while the results did not prove significant in this study, studying the role of preferred music seems promising and important and more research on how it may influence cognitive performance should be pursued.

Furthermore, the participants who only listened to music during the retrieval portion of the task did not perform significantly worse than those that listened to music only during encoding or did not listen to music at all during the task. One competing hypothesis of the study was that music may function as a distraction to the participants during the recall task, and instead of facilitating performance it may in fact interfere and hinder performance. More specifically, having participants study the vocabulary words in silence and then test them in the presence of music would logically suggest that the music may be distracting and interfere with the retrieval of the information. This was not supported by the study, and in fact, the mean scores of the participants in this group were almost identical to the participants who only listened to music during encoding and those who did not listen to music at all during the study. This is consistent with previous findings that when music is reinstated during retrieval, it does not have distracting effects, even when the information being retrieved was encoded under silence (Smith, 1985).

Limitations and Future Directions

The largest and most glaring limitation of the current study is the small sample size. Initially, when the study was first presented, the goal was to recruit 60 Allegheny College students to serve as the participants for the study. This would have resulted in 15 participants per condition, and while even this is still a small sample, the present study ended up with 8 participants per group, nearly half of the initial goal. As the study went on, even though sessions were being posted, students began to sign up for the study at a decreasing rate, eventually leading to zero signups by the fourth week of the study. This makes it very difficult to observe significant results given the small effect sizes.

In addition, it became apparent after the first few trials that the recall task used in this study was quite challenging, may not have been sensitive enough to detect any facilitation effects of music on cognitive performance, as well as far exceeding the average working memory acquisition capacity of the individuals. By using advanced GRE vocabulary words as the subject matter of the recall task, the goal was to compel the participants to learn and study new information that they were unfamiliar with, and be able to accurately retrieve this information, as opposed to words they would have already learned the definitions to previously. With this, the recall task given to the participants was very demanding, and may not have been representative of how cognitive performance can be facilitated by listening to one's preferred music. In a typical classroom setting, new information is introduced over the course of several weeks, with ample time given to consolidate the information before it is tested. Hardly ever is new information studied and tested under the conditions given in the present study, so the ecological validity may be lacking.

Further research on how one's preferred music can influence cognitive performance and cognitions in general should be pursued for a number of reasons. Listening to music is an incredibly popular activity among individuals of all ages, as well as with the presence of increased technological advancements, individuals can listen to their favorite music during almost any other activity they partake in. Literature on music and cognitions is vast (Angel et al., 2010; Dolegui, 2013; Schellenberg, 2005), however, outcomes on the influence of music are still highly ambiguous, and no clear precedent for the influence of one's preferred music has been solidified within the field of cognitive performance. If this study were to be replicated in the future, it is suggested that a less demanding and more representative measure of cognitive performance that resembles more traditional studying should be used to test the significance of listening to preferred music and how it may impact one's cognitive performance.

Despite the hypothesized results of the recall task not being supported by the data, there were promising patterns observed: though not significant, listening to music while encoding information, and then listening to the same music again while retrieving the information may aid the process of retrieval and allow for more information to be recalled. Furthermore, it has been observed beyond doubt that when we listen to our favorite music, we feel significantly more positive and significantly less negative, and these results should not be overlooked. Regardless if listening to our favorite music facilitates cognitive performance, listening to something intangible, has real, physical, tangible effects on our mood. The power of positive thinking and positive mood should not be understated, in any circumstance. Positive thinking has been shown to be linked to better physical and mental health, better achievement and success, as well as improved relationships (Scheier & Carter, 1993). Our reality is merely a reflection of our own internal thoughts and perceptions. We are what we put out into the world. Our world is what we believe it to be. However, it is not always easy to remain in a positive mindset in all scenarios, and for those instances, we have music.

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Zajonc, R. B. (2001). Mere Exposure: A Gateway to the Subliminal. Current Directions in Psychological Science, 10(6), 224-228. doi:10.1111/1467-8721.00154

Zatorre, R. J., & Salimpoor, V. N. (2013). *Why music makes our brain sing. New York Times*, *9*.

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Table 1.

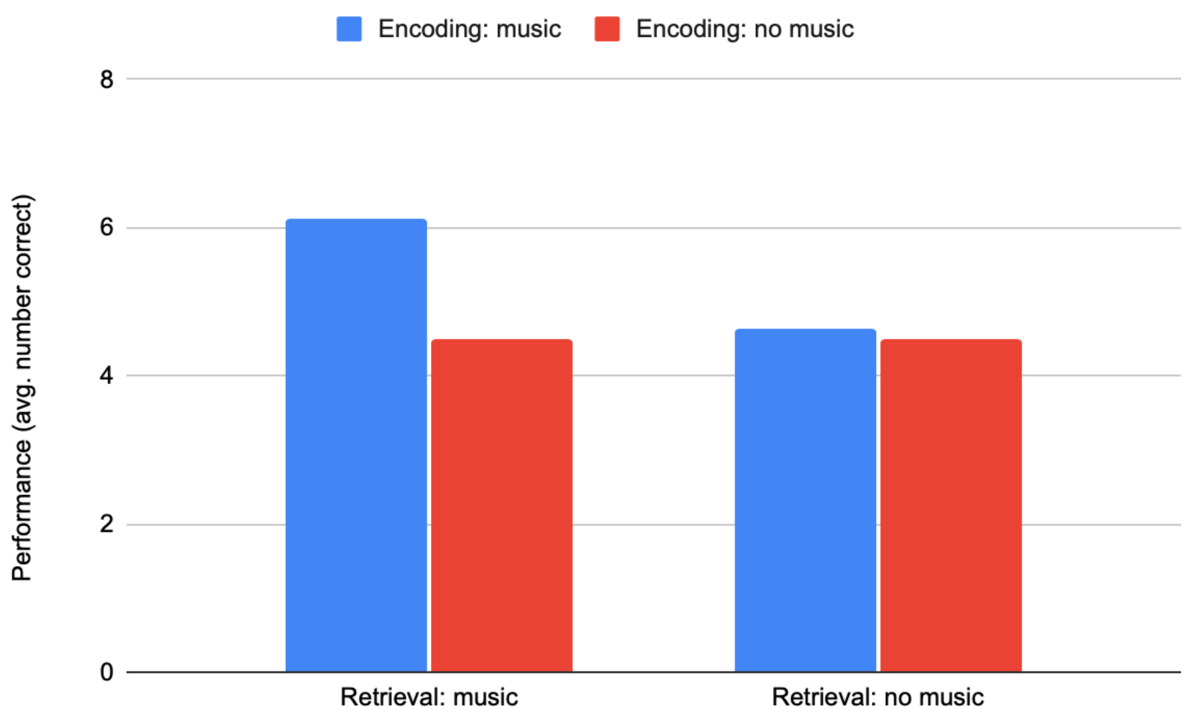
Means, standard deviations, and intercorrelates of all variables

Variable	*M*	*SD*	1	2	3	4
1. Positive Mood	2.7	.55	-	-	-	-
2. Overall Mood	4.8	3.6	.52*	-	-	-
3. Negative Mood	2.3	.47	-.72**	-.47*	-	-
4. Recall Score	5.0	3.6	-.03	.11	-.06	-

*Note. *<.05, **p<.01*

Figure 1.

Mean Recall Score vs. Experimental Condition



Appendices

Appendix A

Research Participation Consent Form

The Effects Musical Preference on Verbal Fluency
Allegheny College
Department of Psychology

Purpose of Research: The purpose of this study is to examine the effects of one's music preference on verbal fluency.

Procedure: I understand that I will be asked about my musical preferences when studying as well as potentially hearing these songs throughout the course of the study, answer questions based on words that I will study for 10 minutes, and answer questions to 2 questionnaires to the best of my ability. I understand that my participation will last approximately 30 minutes.

Risks to the Individual: I understand that there will be no more risk other than what is normally experienced in everyday life as listening to music and studying words are not out of the ordinary for a college student.

Compensation: I understand that I will receive 2 SONA credits. I may also receive extra credit at the discretion of my instructor, and I can choose to be entered into a raffle to win a $20 giftcard to Pampered Palate in Meadville, Pennsylvania.

Confidentiality: I understand that my name will never be associated with the data I provide and will be completely confidential. I understand that the researcher is interested in patterns in the data as a whole as opposed to individual scores. Any reports made based on the data will focus solely on these general patterns.
Furthermore, I understand that all data will be stored under lock and key in the Psychology Department at Allegheny College. I understand that my consent form will be stored in a locked cabinet separately from my data. When the data I provide today are no longer needed, they will be destroyed.

Voluntary Nature of Participation: I understand that I do NOT have to participate in this experiment. Furthermore, upon beginning the experiment, I may choose to withdraw my participation at any time without penalty. I understand that I may skip any individual questions that I do not wish to answer, and I may choose not to participate in any part of the study without being questioned.

Benefits of Participation. Research is designed to benefit society by gaining new knowledge. This research will give insight into how one’s preference of music can subsequently impact their verbal fluency.

Contact Information: If I have any questions about this research project, I can contact HUDSON ALREAD at alreadh@allegheny.edu or the research advisor, LYDIA ECKSTEIN at leckstein@allegheny.edu or at 814-332-5955. If I have questions or concerns about the treatment of research participants, I can contact the Chair of the Allegheny Institutional Review Board (IRB) at irb@allegheny.edu

I understand that my signature below indicates that I am at least 18 years of age at the time of my participation in this study, and that I have received a copy of this informed consent form. I have carefully read and understood the information on this form and all of my questions thus far have been answered. I hereby agree to participate in the study.

Participant's Signature ________________________ date ____________

Participant's Name (print) ____________________ date ____________

Researcher's Signature ______________________ date ___________

Appendix B: Adaptation of the Brief Mood Introspection Scale

Adapted from Mayer & Gaschke, 1988

INSTRUCTIONS: Circle the response on the scale below that indicates how well each adjective or phrase describes your present mood.

(definitely do not feel) (do not feel) (slightly feel) (definitely feel)

XX X V VV

Lively	**XX**	**X**	**V**	**VV**	**Drowsy**	**XX**	**X**	**V**	**VV**
Happy	**XX**	**X**	**V**	**VV**	**Grouchy**	**XX**	**X**	**V**	**VV**
Sad	**XX**	**X**	**V**	**VV**	**Relaxed**	**XX**	**X**	**V**	**VV**
Tired	**XX**	**X**	**V**	**VV**	**Nervous**	**XX**	**X**	**V**	**VV**
Caring	**XX**	**X**	**V**	**VV**	**Loving**	**XX**	**X**	**V**	**VV**
Content	**XX**	**X**	**V**	**VV**	**Fed Up**	**XX**	**X**	**V**	**VV**
Gloomy	**XX**	**X**	**V**	**VV**	**Calm**	**XX**	**X**	**V**	**VV**
Stressed	**XX**	**X**	**V**	**VV**	**Active**	**XX**	**X**	**V**	**VV**

Overall, my mood is:

Very

Unpleasant

Very

Pleasant

-10–9–8–7–6–5–4–3–2–101 2 3 4 5 6 7 8 9 10

Appendix C: Graduate Record Examination Word List

These are the 20 GRE words that were used during the study, listed in alphabetical order.

Abscond: To go away or flee suddenly (to avoid arrest)

Alacrity: Eager and cheerful; readiness

Austere: Severely strict or moral; plain and simple

Bellicose: inclined to fighting; demonstrating aggression

Consternation: feelings of anxiety or dismay, typically in an unexpected way

Diatribe: Bitter and forceful verbal attack

Ebullient: Overflowing with with enthusiasm; showing excitement

Enervate: Weaken; deprive of strength

Gerontocracy: A government ruled by old people

Guileless: Honest; Straightforward

Incorrigibility: Incapable of being cured, corrected, or changed

Inscrutable: Incapable of being discovered or understood

Loquacious: talkative; talking a great deal

Luculent: Easily understood; clear

Moribund: In a dying state; near death

Peregrination: A wandering journey; meandering

Pusillanimous: Lack of courage; cowardly; timid

Quiescence: State of being passive or motionless

Terse: Brief; to the point

Tocsin: a signal, especially of alarm; alarm signal

Appendix E: Recall Assignment

1. To weaken; deprive of strength ____________________
2. Bitter and forceful verbal attack ____________________
3. Incapable of being cured, corrected, or changed ____________________
4. A government ruled by old people ____________________
5. In a dying state; near death ____________________
6. Lack of courage; cowardly; timid ____________________
7. To go away or flee suddenly (to avoid arrest) ____________________
8. Incapable of being discovered or understood ____________________
9. talkative; talking a great deal ____________________
10. State of being passive or motionless ____________________
11. A signal, especially of alarm; alarm signal ____________________
12. A wandering journey; meandering ____________________
13. Honest; Straightforward ____________________
14. Easily understood; clear ____________________
15. Overflowing with with enthusiasm; showing excitement ____________________
16. Feelings of anxiety or dismay, typically in an unexpected way _______________
17. Severely strict or moral; plain and simple ____________________
18. Brief; to the point ____________________
19. Inclined to fighting; demonstrating aggression ____________________
20. Eager and cheerful; readiness ____________________

Appendix D: Demographic Questionnaire

1. Gender

    a. Female

    b. Male

    c. I identify as:__________(please specify)

    D. Prefer not to answer

2. Age:__________

3. Race

    a. American Indian or Alaska Native

    b. Asian

    c. Black or African American

    d. Native Hawiian or Other Pacific Islander

    e. White

    f. More than one race

    g. Unknown or not reported

    f. prefer not to answer

4. Ethnicity

    a. Hispanic or Latino

    b. Not Hispanic or Latino

    c. Unknown or not reported

    d. Prefer not to answer

Appendix E: Debriefing Form

Research Participation Debriefing Form
The Effects of Music and Context on Mood and Learning
Allegheny College
Department of Psychology

Purpose of Research: Music is a widely studied topic in psychology, however, there is a level of ambiguity that comes with the territory. Findings suggest that listening to background music increases performance on cognitive tasks (Cockerton et al., 1997) while other research suggests that background music will have no impact on performance and will only be seen as a distraction (Reaves et al., 2015). Even further research suggests that under certain circumstances, listening to music will impair performance on cognitive tasks (Furnham & Bradley, 1997). The goal of the present study was to build on existing research by testing if listening to one's preferred music affects one's mood as well as aids cognitive performance. Moreover, we also examined whether manipulating the context of studying impacted learning. In the study, participants were randomly assigned to one of four groups that all studied and tested on the 20 Graduate Record Examination (GRE) words using the notecards. The first group listened to their previously indicated preferred study music during both studying and recall, the second group listened to music only during studying, the third only during recall, and the fourth group did not listen to music during either the study or recall portion of the task. Our hypothesis was that listening to one's preferred music during both studying and recall would increase performance on the memory recall task, as well as induce a positive mood arousal. In order to minimize skewed results due to reactivity, deception was used in the study. We were not testing how musical preference impacted verbal fluency. This was used as a cover story to disguise the true purpose of the research in order to protect the integrity of the research.

Compensation: All participants of the study will receive 2 SONA credits as well as be entered in a raffle to win a $20 giftcard to Pampered Palate in Meadville Pennsylvania. A sign up sheet will be provided to enter the raffle by writing your mailbox number as form of entry. The winner will receive the gift card through the mail.

Confidentiality: The data you provided for this research project will be confidential and your name will never be associated with your results. Furthermore, when your data is no longer needed, it will be shredded.

To Learn More: For further information about this topic, please consult the following sources:

Angel, L. A., Polzella, D. J., & Elvers, G. C. (2010). Background Music and Cognitive Performance. *Perceptual and Motor Skills*, *110*(3_suppl), 1059–1064. https://doi.org/10.2466/pms.110.c.1059-1064

Cockerton, T., Moore, S., & Norman, D. (1997). Cognitive test performance and Background Music. *Perceptual and Motor Skills*, *85*(3_suppl), 1435–1438. https://doi.org/10.2466/pms.1997.85.3f.1435

Godden, D. R., & Baddeley, A. D. (1975). Context-dependent memory in two natural environments: On land and Underwater. *British Journal of Psychology*, *66*(3), 325–331. https://doi.org/10.1111/j.2044-8295.1975.tb01468.x

Dolegui, A. S. (2013). "The Impact of Listening to Music on Cognitive Performance." *Inquiries Journal/Student Pulse*, *5*(09). Retrieved from http://www.inquiriesjournal.com/a?id=1657

Contact Information: If you have any questions about this research project, please consult the information below:

Experimenter: Hudson Alread E-mail: alreadh@allegheny.edu

Faculty Advisor: Lydia Eckstein E-mail: leckstein@allegheny.edu

IRB Committee Chair E-mail: irb@allegheny.edu

Counseling Center (Winslow Health Center, Schultz Hall, Suite 128) - (814) 332-4368

If you would like a copy of the results of this research study, please fill out and tear off the bottom portion of this debriefing statement and return it to the researcher.

I would like to receive a summary of the results of this study.

Yes O No O

If yes, what is your Box #? _______________