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Music and Its Effect on Stress

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### Abstract

While stress is a common occurrence within society, some individuals face extreme stressors that can negatively impact their physical and psychological health. College students are a subset of society that face extreme stress on a daily basis. One of the most common forms of coping among college students is listening to music. The current research examines the effects of music listening on college student's stress levels. Participants (N= 27) were instructed to complete an impossible mental arithmetic task while under a time limit. Afterwards, participants were given a questionnaire to rate their anxiety levels. During a five-minute recovery period, participants either sat in silence or listened to a piece of music. Then, they were given the same questionnaire to rate their anxiety levels again. A 2x2 mixed ANOVA test concluded that music had no effect on the college student's stress levels. While these findings do not coincide with current literature, this study can be the starting point in examining how music or music therapy could be used among college students.

*Keywords:* college students, music, stress

### Music and Its Effect on Stress

According to the American Institute of Stress (2014), 77% of adults report regularly feeling stressed. Continuing, there is constant information on the radio or television news channel stating that students are reporting that they are feeling more stressed out than ever before. The American College Health Association (2015) found that about 30% of students reported that their stress levels affected their academic and personal lives; furthermore, more than 50% of students reported that they experienced an overwhelming or above average amount of stress within the last year. Daily stress can be caused and magnified by multiple personal and environmental factors. These could easily include mental health diagnoses, financial problems, or relationship problems. Though these issues can be quite debilitating at times, research has shown that there are effective coping mechanisms in order to handle our stress. Bland et al. (2010) conducted a study in which they compiled a list of 10 coping strategies that typical-functioning college students used to deal with stress. The study found that the number one coping strategy for participants was listening to music (Bland et al., 2010). Music is a convenient coping mechanism to come by due to the overwhelming majority of the population constantly being on their phones every day. So what would be the downsides of using music as a coping mechanism since it is so easily accessible? If listening to music can help relieve some stress, shouldn't this idea be researched more? This Senior Inquiry project delves into the already present research on stress, its effect on the body, and what type of role music can play in help relieving this stress. Additionally, there is a study and its results that will be extensively discussed.

Stress can be defined as external or internal stimuli that causes an impact on physiological and psychological aspects of our everyday life. External stimuli could be financial burdens or an upcoming Psychology midterm, and internal stimuli could be the constant drive for perfection or the need to do well on every assignment. There are two main types of stress: acute and chronic. Acute could be considered any short term stress that occurs on a semi-regular basis, but this stress is for such a small amount of time that causes no harm to an individual's physical and psychological well-being. Stress can act as natural motivator (APA, 2017). For example, one may feel stressed because there are an excess of items on your to-do list. By slowly checking things off of one's to-do list, it relieves your stress levels but also motivates you in a positive way to accomplish some of your tasks. Though there are times where stress can be viewed as a positive psychological factor, often times stress becomes chronic occurring quite regularly, and it is severe enough that it has an extremely negative impact on daily life (APA, 2017).

Physiologically, the main mechanism that controls our body's response to stress is the nervous system. There are two components to this system, somatic and automatic, and automatic is the system that directly relates to our body's stress response. This part of the nervous system is also divided into two parts: sympathetic and parasympathetic. The sympathetic nervous system (SNS) is the location of our body's response to stress, called 'fight or flight'. 'Fight or flight' is typically defined as our body's reaction to a stressful stimuli in which we either avoid the stimuli or we fight/face it (Mash & Wolfe, 2016). Once this stimuli appears, our SNS begins our body's stress response by signaling the hypothalamus-pituitary-adrenal (HPA) axis (APA, 2017). Within this axis, the hypothalamus signals the pituitary and adrenal glands to releases epinephrine and cortisol (stress hormones); additionally, depending of the severity of stress, adrenaline may also be released into the body (APA, 2017; Mash & Wolfe, 2016). Due to the

excretion of these hormones, the liver begins to produce a high level of glucose which will provide enough energy for the body to engage in its 'fight or flight' defense mechanism. After the release of stress hormones, 'fight or flight' manifests itself more visibly throughout the body through blood vessels beginning to direct blood to larger muscles, and the heart dilates so that blood pressure is heightened (APA, 2017). An individual undergoing 'fight or flight' may also experience feeling sick to the stomach, dry mouth, tiredness, or lack of concentration (Mash & Wolfe, 2016).

Though our body's defense mechanism is an extremely useful tool, prolonged exposure to stress can be extremely detrimental to our physical and mental health. If an individual is experiencing chronic stress, it can actually lead to early aging. In one study, researchers were interested in examining the effects of stress in middle aged caregiver's skin aging. In an experimental design, participants were split into two conditions: participants with ill children and those with healthy children. Though the group with ill children experienced more stress, overall, the researchers found that prolonged stress lead to specific indications of a decrease in skin's durability, which translates into an increase in the onset of our skin's aging (Epel, et al., 2004). Additionally, there are other negative impacts on the body that can be caused from prolonged stress exposure. When our bodies are stressed, our muscles become active and tense. If stress is not relieved, the muscles then undergo a constant state of being tense, which can lead to chronic pain conditions. Auvinen et al. (2017) were interested in examining the effects of psychological distress (stress) and the prevalence of long term musculoskeletal pain in adolescents. In this correlational study, participants were given questionnaires over the span of two years that asked them to rate their levels of anxiety, psychological distress, musculoskeletal pains, duration of these pains and levels of physical activity. The researchers found that there was a strong positive

correlation between psychological distress and pain, especially chronic pain (Auvinen et al., 2017). It seems clear that stress can magnify biological issues that many individuals face every day; however, chronic stress can also lead to much more serious negative biological and psychological effects.

Though the external effects of prolonged exposure to stress are extremely detrimental to one's health, the internal effects of prolonged stress on our bodies is even greater. Looking at a larger aspect of our internal mechanisms, our immune system is the primary defender against disease. If our immune system is not working properly, there is greater risk of becoming sick. Thus it is noteworthy to establish the effects that chronic stress has on our immune system. For example, chronic stress can lead to a higher risk of developing a cold, and in medical students, it was found that chronic stress can higher this population's risk for developing mononucleosis (McEwen, 2003). In addition, chronic stress can cause immense harm to our cardiovascular system. When discussing the cardiovascular system in regards to stress, it was already established that this system's response to a stress stimuli is increased heart rate and blood flow to the rest of the body. If the body is unable to return to 'baseline' then heart rate could continue to stay elevated, which puts these individuals at a higher risk for developing a related heart disorder (Shubert, Lambertz, Nelesen, Bardwell, Choi, & Dimsdale, 2009). Finally, research has shown that chronic stress also negatively affects both male and female reproductive systems. Testosterone levels is a general indicator of sperm count and fertility rates in men. Unfortunately, studies have found that stress greatly reduces the amount of testosterone that men produce (McGrady, 1984). The reproductive system of females is slightly more complicated than their male counterparts. Female's reproductive systems are controlled by the HPO (hypothalamus-pituitary-ovarian) axis. This axis controls a chain reaction that mediates the

release of proper hormones (i.e. progesterone) into a female's ovaries. Additionally, there is a hormone contained within the tissue of the ovaries, uterus, and placenta, the Corticotropin-releasing hormone (CRH). This hormone plays a key role in helping regulate a woman's reproductive system as well. When the HPA-axis is activated in the 'fight or flight' response, the HPO-axis's flow of hormones to a women's ovaries is halted. If a woman suffers from chronic stress, it is likely that her reproductive hormones will suffer thus causing fertility issues. Moreover, due to the extra release of CRH due to chronic stress, women can suffer from early ovarian failure, premature labor, and preeclampsia (Kalantaridou, Makrigannkis, Zoumakis, & Chrousos, 2004). It is quite obvious that chronic stress can cause severe impairment within an individual's body. Unfortunately, this type of stress can cause even more damage within an individual's physical well-being in regards to memory and movement.

Though debilitating neurodegenerative diseases are fairly rare, they are still noteworthy, especially due to the fact that chronic stress can serve as a risk factor for these diseases. Alzheimer's disease is typically seen in elderly individuals, and is one of the leading factors in developing dementia. Chronic stress causes severe impairment upon the HPA-axis, which in turn can cause early aging. This early aging can then have an adverse effect on glucocorticoid receptors (GCR) which is a part of the neural anatomy of the brain that is closely related to Alzheimer's disease and other associated diseases. Thus if there is a dysregulation of the HPA-axis and the glucocorticoid receptors, it can lead an individual to have an increased risk of developing Alzheimer's disease (Machado et al., 2014). An additional neurodegenerative disease that affects about 1% of the population is Parkinson's disease. In many individuals, this disease can be portrayed as "slow movements, tremor, stiffness and postural instability" (Sugama, Sekiyama, Kodama, Takamatsu, Takenouchi, Hasimoto, Bruno, & Kakinuma, 2016, p.

39). The effects of chronic stress on an individual's HPA-axis and GCRs can also increase their risk for developing Parkinson's disease. There are similar brain functions involved in both Alzheimer's disease and Parkinson's disease; however, there is also a role in dysregulation of cortisol and dopamine levels, both hormones that are associated with 'fight or flight', that can cause an increase in risk for developing Parkinson's disease as individuals age (Hemmerle, Herman, & Seroogy, 2012). All in all, it is clear that chronic stress has an extremely negative effect on our bodies; however, chronic stress can also negatively impact our psychological well-being as well.

Understanding and researching the negative effects that stress has on individuals psychologically is important. Marin et al. (2011) discuss the extent in which chronic stress can negatively impact our psychological health. There are indications that due to the high and constant levels of stress that is accompanied by many jobs that this can lead to high burnout rates and risk for developing depression. This connection derives from the notion that due to the body's constant heightened state of 'fight or flight' it can lead adults to be fatigued and lose some keen cognitive abilities. If an individual experiences a traumatic event and feels chronic levels of stress after the event, this could be a risk factor for developing PTSD (Marin et al, 2011). While these diagnoses are treatable, they can still have lifelong impacts. In regards to depression, though recovery is possible, individuals diagnosed with this disorder tend to have at least 1-2 relapses over their lifespan. Furthermore, typically PTSD is a disorder that constantly affects individuals because something as little as a door slamming could set off the recurring traumatic memory (Mash & Wolfe, 2016). It is clear that stress can adversely impact an individual's mental and physical well-being, no matter the age.

While researching the negative effects of chronic stress on older adults is highly integral, examining how this type of stress affects other populations is also noteworthy. Alzheimer's and Parkinson's diseases are two typical degenerative diseases that affect older adults; as well as, the studies that examine the cardiovascular, skin, and reproductive systems also use an older population for their studies. Thus, up to this point in the paper, no other population has really been discussed. Being a college student could be considered an extremely stressful portion of one's life. The American College Health Association recently completed a mass data collection through a survey completed by 20,840 college students that examined "students' habits, behaviors, and perceptions on the most prevalent health topics" (ACHA, 2015, pg. 2). According to these researchers, 30% of college students reported that within the past 12 months they had experienced academic impairment due to stress. Students also reported experiencing academic impairment due to drug use, eating disorder/problems, anxiety, depression, etc. Stress is easily a risk factor in many of these issues, especially mental health disorders, or chronic stress can be a major symptom of many of these issues as well. Continuing, the report found that 90.8% of respondents stated that overall they felt an average level of stress or more within the past 12 months, and of these 90.8%, 53.5% felt an above average or an enormous amount of stress (ACHA, 2015). Other studies have researched a similar concept and have found supporting statistics in regards to college students feeling chronic stress (Shatkin, Diamond, Zhao, DiMeglio, Chodazek, & Bruzzese, 2016). Other researchers have examined the effects of chronic stress and college students' mental and physical health.

Because of the media, it is becoming more and more apparent of the growing prevalence of mental health disorders in college students today. In examining the ACHA's (2015) survey again, 14.5% of students reported being diagnosed with a mental health disorder. This number

does not account for the percentage of college student undiagnosed with a psychological disorder, which could be caused by their high stress levels. In one study, researchers examined college student's mental health through self-administered questionnaires. The study was able to conclude that 47.1% of respondent experienced moderate or severe symptoms of anxiety, and 27.1% experienced moderate or severe symptoms of depression (Bayram & Bilgel, 2008). Though this study did not examine the correlation between chronic stress and depression and anxiety, chronic stress is a risk factor for developing both of these mental health disorder so one can infer that chronic stress played a role in these college students developing their depression and anxiety symptoms. Other research reports that because of students chronic stress they experience negative behavioral and lifestyle changes, sleep problems, and have an increased risk for developing physical ailments (Shatkin et al., 2016). With all of the data presented and collected, the outcome for college students may seem quite bleak, especially given the risk for developing lifelong illness, so we are left with the question of, what can be done? Rightfully, many clinicians have examined resilience factors and coping mechanism aimed at reducing the negative effects of chronic stress.

Many students would most likely agree that in order to stay sane they must take some type of mental break throughout their homework or study period. Whether this break is meditation, listening to music, exercising, or internet scrolling, these are all things that are helpful in combating the negative impact of stress on one's physical and psychological well-being. Clinicians examined college student's cognitive coping strategies and levels of stress. It was found that accommodation, or accepting the stressor for what it is, and approach, facing the stressor one step at a time, were to two most common forms of cognitive coping mechanisms (Brougham, Zail, Mendoza, & Miller, 2009). Using this type of information is useful in

understanding how college students can self-regulate their chronic stress through their cognitive abilities. In regards to external avenues, other common coping strategies include discussing with close friends, exercising, and leisure activities (Pierceall & Keim, 2007). Though these specific categories under 'leisure activities' were not specifically denoted, it could be assumed that activities like reading or actively listening to music could fall under this category.

Music has been around since the ancient Greeks and has always been well-revered within society. It has not been until recently that individuals have begun to research and practice with music as a therapeutic treatment. It is noteworthy to state now that the study discussed later in this paper is not an attempt or research for the validity and use of music therapy; however, the evidence for the use of music as stress relief is heavily influenced and aided by the use of music therapy research. With the current literature, there is deep and substantial support the use of music as a way to relieve stress (Darnley-Smith & Patey, 2003). As stated prior in the Bland et al. (2012) study, the top rated coping mechanism for college student's stress was listening to music. Further support is seen within research conducted by Goethem & Sloboda (2011) in which the researchers examined affects, or moods, that are affected by active listening to music. Between two studies the researchers conducted, they concluded that the highest rated use of music was for relaxation, and participants also reported the music positively affected how excited, calm, and less tense they felt (Goethem & Sloboda, 2011). From this evidence, one can gather that music has some type of positive effect on a person's cognitive abilities which would allow them to feel less stress. Those experiencing chronic stress have also reported experiencing lower levels of cortisol, blood pressure, heart rate, and pain when exposed to music (Fratianne, Prensner, Huston, Super, Yowler, & Standley, 2001; Leardi, Pietroletti, Angeloni, Necozone, Ranalletta, & Gusto, 2007; Smolen, Topp, & Singer, 2002). It is clear that music has a profound

effect on a person's mental and physical well-being while under stress, and understanding how and why music affects our bodies the way it does is extremely noteworthy as well.

At times, music can be an extremely subjective and mysterious area to study. For example take a typical pop tune on the radio today, and ask someone how they feel about the song. To you it might be a great musical composition, but to someone else it may be awful. So when it comes to distinguishing what music is 'good' and 'bad', it can be extremely sticky for any individual to do so. Additionally, it is not until recently where society has had the technological ability to understand how music affects certain parts of our bodies, especially the brain. Though there is little research targets exactly how music impacts the brain, the body of research that is published do have promising results. Weinberger (2004) examined what areas of the brain are affected when music is playing and found that there was increased activity within the temporal cortex, which is the auditory area of the brain. Furthermore, the researcher noted that previous clinicians have found that musician's brains are different from non-musicians' brains. Musician's brains have a more active left-hemisphere, increased motor coordination and larger areas of the brain altogether (Weinberger, 2004). Why exactly this occurs within musician's brains compared to non-musician's brains is still yet to be understood. Stanford conducted a study in which they found that music activates regions of the brain that deal "with paying attention, making predictions and updating (an) event in memory" (Baker, 2007). This research indicates that music has some type of positive effect on the brain. There is something to be said about the melodic and rhythmic content of music; however, there is little researching pinning down how exactly these musical ideas affect the brain. Continuing, one of the main ways the music affects individuals is through their mood, and since mood is a psychological process focused in the brain, this is a another clear way the music. For some individuals, music can act

as trigger for positive memories or act some way to improve someone's mood; however, again, what mechanisms in the brain mood sets off is yet to be fully understood. Finally, in their book, Darnley-Smith and Patey (2003) make the argument that, from the time that we are born, music is something that is innately human. So when individuals have such a profound experiences due to music and its use as therapy that it is due to the fact that music taps something innate within humans. For example, when infants begin to babble, it could be said that it is sing-song like, and parents can mimic the sounds back to the infants; thus, even from our youngest utterances, humans can make music by altering pitch (Darnley-Smith & Patey, 2003). Taking all of this research and formulating it together, one can infer that music impacts us on some type of innate level and affects our brain and body in a clear way; however, the mechanism found within music responsible for our body's response to it still needs to be researched further. Regardless of this point, music has been shown to greatly reduce symptomology of chronic related stress disorders discussed earlier in this paper.

One of the disorders previously discussed was Alzheimer's disease which primarily affects a person's memory. A symptom that can commonly accompany Alzheimer's disease is agitation. This symptom is typically "defined as the inappropriate verbal, vocal, or motor activity that is not explained by needs or confusion of the individual..." (Gerdner, 2000, p. 51). Music therapy has been used to significantly decrease this symptom; as well as, there were positive emotional responses elicited from the therapy (Gerdner, 2000). Music therapy can also be a useful tool in treating depression. Hanser and Thompson (1994) demonstrated the effectiveness of music therapy with individuals diagnosed with depression compared to a waitlist control. Overall, they concluded that participants reported a reduction in symptoms due to the music therapy and continued to implement techniques taught in therapy at home throughout the next

nine months (Hanser & Thompson 1994). Regardless if the disorder's symptoms manifest physically or psychologically, music therapy has been shown to reduce symptoms over the course of treatment. Music, without its use in therapy, has also been shown to reduce the negative effects of chronic stress in many college students.

While there are plenty of effective tools for chronic stress management, music is one of the most accessible and most used tool for stress management in college students (Bland et al., 2010). A study was conducted on college aged females that examined the effects of music on naturally occurring stress. The participants were given music to listen to at various points of the day during the middle of their university's semester, and before and after they were asked to rate their stress levels on a 5-point Likert Scale. The researchers found that overall, when music was used for 'relaxing', it was the best reducer of stress (Linnemann et al., 2015). This study demonstrates the common belief that music is used as a relaxing mechanism, and it also suggests the effectiveness of music used as chronic stress relief without its use in a therapy setting. Researchers have also examined the effects of music on induced stress in college students and found that music had a significant effect on reducing the induced stress effects on the participants (Jiang, Rickson, & Jiang, 2016). Using the basis of Linnemann et al. (2015) and Jiang, Rickson, & Jiang (2016)'s studies, the purpose of this study is to examine the effects of music on induced stress with the hypothesis being that music will have a significant impact on reducing the effects of stress.

## **Methods**

### *Participants*

Participants (N=28) were found through the Psychology department's SONA website. This website is home to the list of current psychological studies occurring at Augustana College.

As an incentive, class credit for Intro Psychology was given to students that completed the study. The participant's ages ranged between 18 and 22 years old, and there were double the amount of females compared to males (female N=19; male N=9). There was no exclusion criteria for the study, and a written consent form was given out to the participants prior to the study being conducted.

### *The State-Trait Anxiety Inventory*

The State-Trait Anxiety Inventory was discovered by Spielberger et al in 1983. Most of the research conducted with this inventory is used to distinguish among types of anxiety and depressive indicators and tendencies (American Psychological Association, 2011). In order to look at purely somatic and cognitive responses to stress and anxiety, a modified version of State-Trait Inventory for Cognitive and Somatic Anxiety was used (Gros, Simms, Antony, & McCabe, 2010). Additionally, the modified version of the inventory was meant to combat the limitations of the original STAI. In the inventory, there are 17 questions that measure a participant's anxiety and stress in 'the way they are feeling now'. The cognitive items were meant to measure a person's internal response to stress (i.e. thinking work was good); whereas, somatic items were meant to measure a person's external response to stress (i.e. tense muscles). The inventory is based on a 10-point Likert type scale. The higher the score, the more anxious the individuals are. The current inventory has a high internal consistency for the somatic measure ( $\alpha = 0.871$ ) and the cognitive measure ( $\alpha = 0.859$ ).

### *Rationale for Music Choice*

The term 'relaxing' music is tossed around quite a bit within the vernacular on a regular basis; thus, it was important to find a piece of music that was short enough for the researcher to use in a study but was empirically support to be 'relaxing'. In the case of this study, 'relaxing' or

'stress relieving' music was deemed as low in arousal and high in valence. Arousal means to elicit a strong response, and emotions associated with low arousal are feeling calm and satisfied. Valence means to invoke enjoyment, and emotions associated with high valence are pleased and delighted (Jiang, Rickson, & Jiang, 2016; Grekow, 2016). The little research that has been done on what is considered 'relaxing' music supports the notion that this music is low in arousal and high in valence (Linnemann et al., 2015). Thus, a study by Grekow (2016) examined the arousal and valence levels of piece by the Beatles and Beethoven. Through multiple statistical tests, the researcher was able to determine that *Pathetique* mvmt. 2 by Beethoven had the lowest scores in arousal and high score in valence; thus, the use of the piece as the music in the music condition (Grekow, 2016).

### *Procedure*

Participants were randomly assigned to participate in an experimental condition with music as a coping mechanism for stress or a control condition. After informed consent was given, the researcher gave the participants a mental arithmetic test. This type of test has been used to induce modest amounts of stress in previous research (Jiang, Rickson, & Jiang, 2016; Yuko, Tetsumi, Mihoko, Kyoshi, & Kazuyoshi, 2005). Stress was induced in at least three ways. First, there were items on the test that were nearly or completely impossible (spec. item 6). Next, neither a calculator or scratch paper were allowed which places greater demand on working memory. Also, the participants were instructed that they will have 5 minutes to complete as many items on the test as possible, but that most participants are able to finish the test in 3 minutes. Finally, the researcher turned a computer around to show participants a stopwatch when 2 minutes 30 seconds were left in the time allotted. After the 5 minutes have passed, the researcher ended the arithmetic test and handed out the modified version of the State-Trait

Anxiety Inventory. After completion, the researcher collected the scale and instructed the participants that they will be back after grading the test. The participants in the music condition were given *Pathétique* mvmt 2 by Ludwig van Beethoven (approx. 5:35) to listen to while the researcher was grading the test compared to the control group that waited in the lab. After the tests are graded, the researcher administered the STAI again (to measure reduction in stress). Once the posttest questionnaire was completed and collected, the participants in all conditions were debriefed.

### Results

The main hypothesis of this experiment was that the music condition would result in a greater reduction in stress levels over a 5 minute increment compared to the control. Out of the 28 participants, one was omitted from data calculation due to technological difficulties, i.e. the computer lost internet connection so the music could not be played. If the data from this participant was kept, it would eliminate the validity of the study due to a lack of randomized condition assignment. For the remaining participants ( $N=27$ ), items on their questionnaires were categorized into pre/post somatic and cognitive scales, and each scale's mean was calculated. In order to examine if there was a statistical significance of the interaction between the effect of music and time, a 2(Time) x 2(Music) mixed ANOVA with time being a repeated measures variable and somatic stress as the dependent variable was ran. The mixed ANOVA demonstrated that there was a significant main effect of time on somatic stress  $F(1, 25)=17.595, p<.001, h_p^2=.413$ ; however, there was no statistical significance of a main effect of music on somatic stress  $F(1,25)=.717, p=.405, h_p^2=.028$ . Additionally, there was not a significant interaction between music and somatic stress levels  $F(1, 25)= 1.178, p=.288, \eta_p^2=.045$ .

Table 1

*Means and standard deviations of stress responses prior and post 5 minutes with or without music present*

Stress	Control		Music	
	M	SD	M	SD
	Somatic			
Pre	5.161	2.048	4.946	1.723
Post	4.241	2.087	3.385	1.208
	Cognitive			
Pre	5.611	2.000	4.392	2.322
Post	4.392	2.323	3.966	1.356

The same 2(Time) x 2(Music) mixed ANOVA statistical test was conducted again, but cognitive stress was used as the dependent variable. Like the first test, there was a significant main effect of time on cognitive stress  $F(1, 25)=29.915, p<.001, h_p^2=.545$ . However, there was no significance of a main effect of music on cognitive stress  $F(1, 25)=.405, p=.53, h_p^2=.016$ , and no interaction was found between music and time's effect on cognitive stress  $F(1, 25)<.001$ ,

$p=.99$ ,  $h_p^2 < .001$ . In looking primarily at the means of both groups, between pre and post scores, they are quite similar which could be considered an early indicator of no statistical significant.

With the current results, the main hypothesis is not able to be supported.

### **Discussion**

The primary purpose of this paper and study was to investigate the role of music's effect on stress. Stress has been shown to have tremendous negative effects on our physical and psychological well-being, and numerous music therapy articles have demonstrated the positive effects of music on individuals who continuously cope with chronic stress (Gerdner, 2000; Leardi et al., 2007). Also, other research has examined positive effects of music on college student's stress level (Jiang, Rickson, & Jiang, 2016; Linnemann et al., 2015). With the evidence presented, it led to the hypothesis that music will have an effect on reducing stress symptoms compared to a control. As stated previously, the questionnaire used in the study examined somatic and cognitive indications of stress. Though two separate data tests were ran, neither the somatic nor the cognitive subscales of the questionnaire came back significant in regards to being affected by music. In total, this unfortunately means that the null hypothesis cannot be rejected, or music had no significant effect on the participant's reduction in their stress levels post-stress inducing task.

The next question is to address is why the hypothesis was not supported because the literature appears to support the notion. On a statistical level, a Type II error could have occurred within the study. In layman's terms, a Type II error can occur due to human error, item-measure error, or lack of power (Leary, 2012). While there was most likely some degree of human error, as much care as possible was taken by the researcher to make sure all conditions and participants received the same care and instructions throughout data collection. Furthermore, both the music

selection and the State-Trait Anxiety Inventory use were supported by literature. The most logical conclusion as to why a Type II error may have occurred would be in regards to the amount of power found within the study. Power is defined as the likelihood that the null hypothesis will be correctly rejected if it is truly false. This statistical data allows researchers to examine the total effect that an independent variable will have within their study. One of the largest components of power is the study's sample size. The larger the sample size, the more the sample is representative of the population, and the more power the study will have (Leary, 2012). The present study only had 27 participants that were used for data collection. It would be quite understandable that there was no significance found with such a small sample size. Researchers who examined the effects of music on college student's stress levels had 280 participants, which is astronomically larger than the current study's sample (Jiang, Rickson, & Jiang, 2016). Sample size cannot be the only factor that influenced the data due to the large number of other articles that found that music had a significant effect on reducing stress whose sample sizes were also small (Fratianne et al., 2001; Linnemann et al., 2015; Smolen, Topp, & Singer, 2002).

A consequential step in determining why the hypothesis wasn't supported in this study is to examine the study's design. One of the key aspects of this study is the induction of short term chronic stress upon participants. While this worked quite successfully in Jiang, Rickson, & Jiang (2016)'s study, most of the consequential research has examined the effects of music on stress in naturally occurring situations. For example, Leardi et al. (2007) used participants who were undergoing a day-surgical procedure as their sample; as well as, Fratianne et al. (2001) examined burn victims as their subjects. While both studies examine stressors that are not necessarily common, although day surgery could be considered common to a point, they do examine naturally occurring chronic stress due to the invasiveness and disruption of these medical

procedures. In applying this idea to the examined population of this study, Linnemann et al. (2015) examined the effects music on stress when college students were less stressed (beginning semester) compared to when college students were more stressed (end semester). Thus since stress was induced upon participants, the stressor could have been one of two things. Either the stressor was not chronic enough. This meaning that the arithmetic exam was not difficult enough so that the participants felt a high level of stress. Or, the stressor was not presented to the participants for a long enough period of time. This meaning that the duration of the arithmetic exam needed to be longer. In order to gauge the reliability and validity of the mental arithmetic task, statistical tests on these principles would need to be ran across multiple samples in order to see if the task was chronic inducing enough. Also, individualized studies need to be ran on different periods of time in order to see what amount of time given to participants is the most stress inducing. In all, one of the main reasons why the hypothesis was not supported could be the lack of chronic stimuli and its duration of time. Following this idea of duration of stimulus, another issue that could have contributed to the hypothesis not being supported is the duration of music presented.

In the music condition, the music was played for 5 minutes and 35 seconds because that's how long the recording was. In hindsight 5 minutes does not seem like a significant amount of time. Thus, the music may not have been present for a long enough period of time in order for it to have any effect on the participant's stress levels. Typical music therapy sessions can last from 45 minutes to an hour; however, they can also last as few as 20 minutes (Darnley-Smith & Patey, 2003). Furthermore, the studies that used music either as a therapy or coping mechanism for stress tended to have participants listen or partake in therapy for 30 minutes to an hour (Fratianne et al., 2001; Linnemann et al., 2015). So in order to have any type of stress relieving effects for

the sample size, the study most likely would have benefited from having a longer duration in which participants listened to music. Two final components are key in understanding why the hypothesis could have not been supported: active listening and degree of 'likeness' of the music selection.

There is clear rationale that in order to benefit from a therapy or a program one must actively participate. For example, family-based therapy is an effective avenue for the treatment of many mental disorders. In order for the client to get the most out of the therapy, both they and the family need to actively participate in the therapy (Mash & Wolfe, 2016). This concept also applies heavily in academics. Many professors begin their semester by telling the students that if they apply and actively engage in class, they will get more out of it compared to not applying themselves. In many cases, this idea is true. In the current study, participants were not required to be active in their engagement of the music. While they noticed the music, they were not given any guidelines in how to listen or engage with the music. So, by passively listening, the participants may not have been able to take in the effects of the music given. Continuing, it is also important to note the degree of preference that a participant has to the music they listened to. In this study, music preference, or the degree a person enjoys a piece, was not taken into consideration; however, research has demonstrated that the more a participant enjoys the music, the better stress reliever it is (Jiang, Rickson, & Jiang, 2016; Leardi et al., 2007). With the current sample, the music condition may have consisted of individuals who do not enjoy Classical/Romantic compositions or these participants may find a different genre of music more stress-reducing than the 2<sup>nd</sup> movement of *Pathétique*. In future research, it will be beneficial the researcher if multiple genres and pieces are examined along with the participants' preference of

the music listened to. The final step in understanding the purpose of this study as a whole is where to go from the current point.

In most researchers' eyes, it would make sense that there is a hope that their research can serve some type of purpose within their field or the world. In reality, it could appear that this study is a great foundation to build upon for other research. To reiterate again, it would be extremely beneficial to examine a stimuli that is more stress inducing to see if there is an effect of music on induced chronic stress. Also, it would be interesting to investigate how small an amount of time of active listening to music is needed in order to feel relieved of stress. In order to examine this idea, a researcher could give out iPod to students and instructed them to listen to music with specific increments of time, and then rate themselves on how tense or stressed they feel before and after the experience. Overall, there needs to be more research done on music therapy and music's use as a coping mechanism for chronic stress, especially in college students. While there is published research, the body of research is fairly small. Music therapy is a growing field, and in order for it further recognized, more effective and efficacious research on music therapy needs to be conducted. Also, students who are in college could be considered the next Einstein's or Susan B. Anthony's. This population of individuals need to be learning as much as they can in order to help better society, and since stress is one of the main inhibitors of this population, music is an easily accessible and reliable tool for coping mechanisms. The more research that is conducted in order to understand and support this notion, the more awareness and acceptance can be brought forth.

### References

- American College Health Association. (2015). *National College Health Assessment II: Spring 2015 Reference Group Executive Summary*. Hanover, MD: American College Health Association.
- American Psychological Association. The State-Trait Anxiety Inventory (STAI). Retrieved from <http://www.apa.org/pi/about/publications/caregivers/practice-settings/assessment/tools/trait-state.aspx>.
- . (2017). Stress: The different kinds of stress. *American Psychological Association*. Retrieved from <http://www.apa.org/helpcenter/stress-kinds.aspx>.
- American Institute of Stress. (2014). 2014 Stress Statistics. In *What is Stress?*. Retrieved from <https://www.stress.org/daily-life/>
- Auvinen, J., Eskola, P.J., Ohtonen, H.R., Paananen, M., Jokelainen, J., ... Karppinen, J. (2017). Long-term adolescent multi-site musculoskeletal pain is associated with psychological distress and anxiety. *Journal of Psychosomatic Research* 93: 28-32.
- Baker, M. (2007). Music moved brain to pay attention, Stanford study find. In *Stanford Medicine*. Retrieved from <https://med.stanford.edu/news/all-news/2007/07/music-moves-brain-to-pay-attention-stanford-study-finds.html>
- Bayram, N. & Bilgel, N. (2008). The prevalence and socio-demographic correlations of depression, anxiety, and stress among a group of university student. *Social Psychiatry and Psychiatric Epidemiology* 43(8): 667-672.
- Bland, H.W., Melton, B.F., Welle, P., & Bigham, L. (2012). Stress tolerance: New challenges for millennial college students. *College Student Journal* 46(2): 362-375.

- Brougham, R.R., Zail, C.M., Mendoza, C.M., & Miller, J.R. (2009). Stress, Sex Differences, and Coping Strategies Among College Students. *Current Psychology* 28: 85-97.
- Darnley-Smith R. & Patey, H.M. (2003). *Music Therapy*. London, England: SAGE Publications.
- Epel, E.S., Blackburn, E.H., Lin, J., Dhabhar, F.S., Adler, N.E., ... Cawthon, R.M. (2004). Accelerated telomere shortening in response to life stress. *Proceedings of the National Academy of Sciences* 101(49): 17312-17315.
- Fratianne, R.B., Prensner, J.D., Hutson, M.J., Super, D.M., Yowler, C.J., & Standley, J.M. (2001). The Effect of Music-Based Imagery and Musical Alternate Engagement on the Burn Debridement Process. *Journal of Burn Care Rehabilitation* 22: 46-53.
- Gerdner, L.A. (2000). Effects of Individualized Versus Classical “Relaxation” Music on the Frequency of Agitation in Elderly Persons with Alzheimer’s Disease and Related Disorders. *International Psychogeriatric* 12(1): 49-65.
- Grekow, J. (2016). Music Emotion Maps in Arousal-Valence Space. In Saeed, K., & Homenda, W. *Computer Information Systems and Industrial Management*: 697-706.
- Gros, D.F., Antony, M.M., Simms, L.J., & McCabe, R.E. (2007). Psychometric Properties of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA): Comparison to the State-Trait Anxiety Inventory (STAI). *Psychological Assessment* 19(4): 369-381.
- Hanser, S.B. & Thompson, L.W. (1994). Effects of a Music Therapy Strategy on Depressed Older Adults. *Journal of Gerontology: Psychological Sciences* 49(6): 265-269.
- Hemmerle, A.M., Herman, J.P., & Seroogy, K.B. (2012). Stress, Depression and Parkinson’s Disease. *Experimental Neurology* 233(1): 79-86.
- Jiang, J., Rickson, D., & Jiang, C. (2016). The mechanism of music for reducing psychological stress: Music preference as a mediator. *The Arts in Psychotherapy* 48: 62-68.

- Kalantaridou, S.N., Makrigiannakis, A., Zoumakis, E., & Chrousos, G.P. (2004). Stress and the female reproductive system. *Journal of Reproductive Immunology* 62: 61-68.
- Learidi, S., Pietroletti, R., Angeloni, G., Necozone, S., Ranalletta, G., & Del Gusto, B. (2007). Randomized clinical trial examining the effect of music therapy in stress response to day surgery. *British Journal of Surgery* 94(8): 943-947.
- Leary, M. (2012). *Introduction to Behavioral Research Methods 6<sup>th</sup> ed.* New Jersey: Pearson Education Inc.
- Linnemann, A., Ditzen, B., Strahler, J., Doerr, J.M., & Nater, U.M. (2015). Music listening as a means of stress reduction in daily life. *Psychoneuroendocrinology* 60: 82-90.
- Machado, A., Herrera, A.J., de Pablos, R.M., Espinosa-Oliva, A.M., Sarimento, M., Ayala, A., . . . Cano, J. (2014). Chronic stress as a risk factor for Alzheimer's disease. *Reviews in the Neurosciences* 25(6): 785-804.
- Marin, M.F., Lord, C., Andrews, J., Juster, R.P., Sindi, S., Arseneault-Lapierre, G., . . . & Lupien, S.J. (2011). Chronic stress, cognitive functioning and mental health. *Neurobiology of Learning and Memory* 96(11): 583-595.
- Mash, E.J. & Wolfe, D.A. (2016). *Abnormal Child Psychology 6<sup>th</sup> ed.* Boston, MA: Cengage Learning.
- McEwen, B.S. (2003). Stress and Neuroendocrine Function: Individual Differences and Mechanisms Leading to Disease. *Psychoneuroendocrinology: The scientific basis of clinical practice*: 513-546.
- McGrady, A.V. (1984). Effects of Psychological Stress on Male Reproduction: A Review. *Archives of Andrology* 13: 1-7.
- Pierceall, E.A. & Keim, M.C. (2007). Stress and coping strategies among community college students. *Community College Journal of Research* 31: 703-712.

- Shatkin, J.P., Diamond, U., Zhao, Y., DiMeglio, J., Chodaczek, M., & Bruzzese, J.M. (2016). Effects of Risk and Resilience Course on Stress, Coping Skills, and Cognitive Strategies in College Students. *Teaching of Psychology* 43(3): 204-210.
- Shubert, C., Lambertz, M., Nelesen, R.A., Bardwell, W., Choi, J-B., & Dimsdale, J.E. (2009). Effects of stress on heart rate complexity- A comparison between short-term and chronic stress. *Biological Psychology* 80: 325-332.
- Smolen, D., Topp, R., & Singer, L. (2002). The Effect of Self-Selected Music During Colonoscopy on Anxiety, Heart Rate, and Blood Pressure. *Applied Nursing Research* 15(3): 126-136.
- Sugama, S., Sekiyama, K., Kodama, T., Takamatsu, Y., Takenouchi, T., Hasimoto, M., Bruno, C., & Kakinuma, Y. (2016). Chronic restraint stress triggers dopaminergic and noradrenergic neurodegeneration: Possible role of chronic stress in the onset of Parkinson's disease. *Brain, Behavior, and Immunity* 51: 39-46.
- Van Goethem, A. & Sloboda, J. (2011). The functions of music for affect regulation. *Musicae Scientiae* 15(2): 208-228.
- Weinberger, N.M. (2004). Music and the Brain. *Scientific American* 291(5): 88-95.
- Yuka, N., Tetsumi, S., Mihoko, K., Kiyoshi, K., & Kazuyoshi, H. (2005). The Relationship Between Salivary Biomarkers and State-Trait Anxiety Inventory Score Under Mental Arithmetic Stress: A Pilot Study. *Anesthesia & Analgesia* 101(6): 1873-1876.