THE EFFECTS OF HIGH SCHOOL INSTRUMENTAL MUSIC PERFORMANCE ANXIETY ON THE ACCELERATED RECOVERY OF SOCIAL ANXIETY

by

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Liberty University

School of Music

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Music Education

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APPROVED BY:

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Abstract

This quantitative correlational study aims to examine the challenges secondary students encounter in sustaining positive mental health and how the benefits of music performance anxiety in secondary school students can aid in the accelerated recovery of social anxiety. There is a present gap in the research exploring the benefits of situational anxiety on clinically diagnosed anxiety disorders and noting that this situational anxiety is a standard expectation and volunteered for when participating in performing arts environments. The objective is to understand the therapeutic benefits of micro-dosing the brain with music performance anxiety in a controlled environment and its potential uses in aiding students' mental resilience development. This quantitative study uses a correlational approach guided by the theoretical framework of Edward Thorndike's learning theory of connectionism. This research aims to gain a comparative understanding of individuals that have consistent music performance anxiety within a controlled environment and how that can assist the brain in its ability to process the symptoms of an anxiety disorder efficiently. The study focuses on the research obtained from data collected in a survey administered to secondary school-aged students. The questions in the survey center on music performance anxiety and how that affects the students. Findings revealed by the research lead to rejecting the null hypothesis as there is evidence for instrumental music experience's predictive nature and improvement in musical performance anxiety on general anxiety disorder.

Keywords: music performance anxiety, anxiety disorder, instrumental music's effect on general anxiety, mental health in music, benefits of performing arts on social anxiety disorder

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Social Anxiety disorder (SAD)

Music-Based Interventions (MBIs)

Motor Neuron Disease (MND)

Rhythmic Auditory Stimulation (RAS)

Autism Spectrum Disorder (ASD)

World Health Organization (WHO)

Eating Disorders (EDs)

Anorexia Nervosa (AN)

Bulimia Nervosa (BN)

Binge Eating Disorder (BED)

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Chapter 1: Introduction

A crucial aspect of educators' mental state in music education is their perspective on positive mental health. There are many potential purveyors of this perspective, but the question remains about the potential to predict its increase due to participation in performing arts. Music performance anxiety is a situational and isolated occurrence; however, some individuals experience more intense symptoms than others. Studies indicate that a third of individuals suffering from performance anxiety also exhibit disorders categorized as generalized anxiety, referred to now as social anxiety. Individuals with both tend to manifest significant impairments in a performance setting.[1]

Overall mental health and, specifically, positive mental health are not similar: they are two constructs that contribute to one's overall mental well-being. Positive outcomes are directly associated with an individual's positive mental state, even for students with a documented mental health disorder. Utilizing the theoretical framework of Edward Thorndike, connectionism may facilitate the identification of the correlation between music performance anxiety and its effect on social anxiety improvement. Connectionism bases its learning framework on the idea that assimilation is associated with an unobservable internal state. This behavioral phenomenon supports the notion that any stimuli with a positive reward, in the same order, being sufficiently received frequently will cause the brain to adapt to see that stimulus as positive. This research is designed to ascertain a comparative understanding of individuals that manifest consistent music performance anxiety within a controlled environment and how that can affect the brain's ability to process the symptoms of an anxiety disorder efficiently.

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[1] Dianna T. Kenny, in *The Psychology of Music Performance Anxiety* (Oxford University Press, 2011).

Background

Instrumental music is an artistic activity that processes individuals' means of expression concerning their social value. Mental health has experienced a significant stigma for many years. Reducing that stigma through participation in performing arts is essential to continuing a positive conversation about the importance of mental health within the musical arts.[2] Mental health professionals have noted that educational interventions are more effective than social interaction associated with reducing mental health stigmas. Many studies have been employed to understand whether these trait anxieties are measurable and related to their participation in performing arts.[3]

Music performance anxiety may present itself for several reason, still, many studies have noted significant correlations between individuals with frequent music performance anxiety and those having social phobias, trait anxieties, and an exaggerated need for perfectionism.[4] These emotional coping styles can be good indicators that predict a higher incidence of music performance anxiety in an individual performer.[5] For musicians to present a compelling performance, they must correlate their body and mind in a conducive manner. A certain level of pre-performance excitement is desired for spontaneity to foster the performance-ready feeling. Music performance anxiety occurs when the arousal state escalates, and cognitive-behavioral interference interrupts the quality of the performance.[6]

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[2] Shivani Mathur Gaiha et al., "Effectiveness of Arts Interventions to Reduce Mental-Health-Related Stigma among Youth: A Systematic Review and Meta-Analysis," *BMC Psychiatry* 21, no. 1 (2021), https://doi.org/10.1186/s12888-021-03350-8.

[3] Ibid.

[4] Ibid.

[5] Ajhriahna Henshaw and Sarah Collyer, "Under Pressure: Reports of Performance Anxiety Across Multiple Singing Genres," *Journal of Singing* 8, no. 5 (May 2022): 583-90.

[6] Wendy J. Cox, and Justin Kenardy, "Performance Anxiety, Social Phobia, and Setting Effects in Instrumental Music Students," *Journal of Anxiety Disorders* 7, no. 1 (1993): 49-60.

Individuals must possess various cognitive, psychological, and musical skills to be a successful musician. The literature about facilitating opt music performance tends to focus on the trend of the pathological aspects of performance: reducing symptoms of debilitating music performance anxiety. According to positive psychology, optimal functioning cannot be achieved solely through avoiding pathology but through cultivating methods to facilitate a positive state of mind.[7]

Positive psychologist Martin Seligman suggests that optimal functioning cannot be achieved solely by avoiding pathology but by actively cultivating skills that facilitate optimal functioning.[8] Many believe that the best performance can be achieved when a person is fully immersed in and completely concentrated on an enjoyable experience. The concept of "flow" describes this state when a person is completely absorbed and focused on an enjoyable and rewarding activity.[9]

The connectionism hypothesis suggests that neurons are wired together to enable them to operate based on a few neurophysiologically plausible principles, allowing them to perform complex logical calculations. In the beginning, they noted that neurons are all-or-none in their activity. Electrochemical impulses are either sent from neurons to other neurons via long

[7] Susanna Cohen, and Ehud Bodner, "Music Performance Skills: A Two-Pronged Approach – Facilitating Optimal Music Performance and Reducing Music Performance Anxiety," *Psychology of Music* 47, no. 4 (July 2019): 521–38. https://doi.org/10.1177/0305735618765349.

[8] M. Seligman, "Positive Health," *Applied Psychology* 57 (2008): 3–18.

[9] Ibid., 3–18.

projections or not sent at all. Correlational mathematical formalisms can be used to describe these principles and calculate the unfolding behaviors of networks governed by them.[10]

The correlational aspect of this research will be based on the theoretical framework of Edward Thorndike and his learning theory of connectionism. Based on behavioral psychology, these learning constructs are associated with the result between stimuli and responses. The frequency of a habit can strengthen these associations. One core aspect of connectionism is the belief that the transfer of learning depends upon the presence of elements identical to the original learning situation. The transferred information is never general but always specific to the original learning element.[11]

"Implicit learning" occurs when unconscious sets of trained stimuli are induced while creating an unconscious intentionality hypothesis, applying the standardized interpretation of connectionism and consciousness. Researchers have extensively researched the connection of implicit learning with instrumental music.[12] The most significant finding between implicit learning and connectionism is that implicit learning is unconscious, as the synopsis is created by stimulus influenced by set durations and intensities. The subject is typically aware of the stimulus itself. However, the relationship between the stimulus and the outcome or reward elicits implicit learning.[13] As subjects are exposed to trained stimuli, they unconsciously internalize

[10] "Connectionism," Internet Encyclopedia of Philosophy, Google, Accessed February 27, 2023, https://iep.utm.edu/connectionism-cognition/#SH9a.

[11] Edward Lee Thorndike, *Educational Psychology: The Psychology of Learning* (Andesite Press, 2015).

[12] Donelson E. Dulany, "Consciousness, Connectionism, and Intentionality," *Behavioral and Brain Sciences* 22, no. 1 (1999): 154–155, https://doi.org/10.1017/s0140525x99281794.

[13] Ibid.

knowledge explicit to the relationship the stimuli created; thus, influencing connected decision-making even if the reasoning remains unconscious.[14]

Thorndike's theory of connectionism is primarily based on three laws: the law of effect, the law of readiness, and the law of exercise.[15] Based on this theoretical framework, similar learning situations can be connected to a learning outcome if the action sequence is the same. If music performance anxiety is experienced consistently, these chained-together practices should employ the law of exercise, where connections are strengthened by their frequency. The law of effect should transfer to an individual's general anxiety.[16]

Positive mental health is a combination of three different areas. The first, emotional, pertains to positive and negative influences within one's environment that affect his or her daily mental process. The second is social well-being and is a state of self-actualization of an individual's perspective of social integration with the people in his or her environment. Finally, psychological well-being is an inner monologue and belief in self-acceptance. This area is where an individual deals with one's personal development. [17]

Stage fright is a normal reaction to nervousness that often enhances an achievement. It is not until the symptoms have intensified to the point that they interfere with the performance

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[14] Donelson E. Dulany, "Consciousness, Connectionism, and Intentionality," *Behavioral and Brain Sciences* 22, no. 1 (1999): 154–55, https://doi.org/10.1017/s0140525x99281794.

[15] Edward Lee Thorndike, *Educational Psychology: The Psychology of Learning* (Andesite Press, 2015).

[16] Ibid.

[17] Eryn Piper Block et al., "A Symphony within Frequent Participation in Performing Arts Predicts Higher Positive Mental Health in Young Adults," *Social Science & Amp; Medicine* 292 (2022): 114615, https://doi.org/10.1016/j.socscimed.2021.114615.

quality and diminish the instrumentalist's accomplishments that the pathological symptoms are categorized as music performance anxiety.[18]

The Project Make Arts exhibit, initiated by Karen Gallant, focuses the narrative on musicians with mental health diagnoses and how they perceive the positive influence of performing arts on their mental well-being.[19] Gallant attempts to identify a connection between participation in the performing arts and accelerated recovery of that individual's mental health. Although the musicians in the exhibit maintained diverse artistic backgrounds, their art medium allowed them to engage in an activity that meaningfully connected them to an audience through a tangible process. Although a significant majority of the musicians stated that their performing art helped them deal with their positive mental health, there is no evidence that the activity created mental recovery minus the opportunities the activity facilitates. These opportunities include but are not limited to a flexible structure, social connections, and a developed personal narrative.[20]

This study area is significant among secondary school-age students transitioning into young adulthood because this age range represents an enhanced developmental period crucial for stability. Minimal studies acknowledge the role of the arts in treating clinical mental illness. However, little attention has been focused on the possibility that instrumental performance may influence the promotion of positive mental health in young adults. This study addresses the gap

[18] Eryn Piper Block et al., "A Symphony within Frequent Participation in Performing Arts Predicts Higher Positive Mental Health in Young Adults," *Social Science & Amp; Medicine* 292 (2022): 114615, https://doi.org/10.1016/j.socscimed.2021.114615.

[19] Karen Gallant et al., "Removing the Thorns': The Role of the Arts in Recovery for People with Mental Health Challenges," *Arts & Amp; Health* 11, no. 1 (2017): 1-14, https://doi.org/10.1080/17533015.2017.1413397.

[20] Ibid., 1-14.

in the research examining a potential direct relationship between positive mental health and frequent participation in performing arts.[21]

Statement of the Problem

Anxiety conditions are expected in performing arts environments, and music performance anxiety (MPA) is no exception, as it creates a wide range of anxiety conditions. Even though the situation is voluntary and can be managed by a person's free will, it can still be quite debilitating long term. Affective symptoms, which include anxiety and fear regarding one's performance as well, are characterized by anxiety and apprehension regarding one's performance and can be considered to belong to three categories: cognitive, somatic, and behavioral symptoms.[22] When people suffer from cognitive dysfunction, they are activated to respond to symptoms like panic attacks. It is common for people suffering from anxiety to experience several symptoms, including poor concentration, memory lapses, and negative self-talk.[23] Cognitive symptoms, like a racing heart, dry mouth, and physical shaking, usually precede somatic symptoms, such as anxiety, insomnia, and depression. It is essential to realize that these symptoms can result in

[21] Eryn Piper Block et al., "A Symphony within: Frequent Participation in Performing Arts Predicts Higher Positive Mental Health in Young Adults," *Social Science & Amp; Medicine* 292 (2022): 114615, https://doi.org/10.1016/j.socscimed.2021.114615.

[22] Susanna Cohen and Ehud Bodner, "Music Performance Skills: A Two-Pronged Approach – Facilitating Optimal Music Performance and Reducing Music Performance Anxiety," *Psychology of Music* 47, no. 4 (2018): 521-538, https://doi.org/10.1177/0305735618765349.

[23] Andrada Lavinia Faur, Sebastian Vaida, and Adrian Opre, "Kenny Music Performance Anxiety Inventory: Exploratory Factor Analysis of the Romanian Version," *Psychology of Music* 49, no. 4 (2020): 777-788, https://doi.org/10.1177/0305735619896412.

behavioral disorders. Due to the overwhelming effects of these stressors on the mind and body, behavior is inclined toward avoidance and escape.[24]

A professor of neuroscience at the University of New York, Joseph LeDoux, conducted clinical research to understand the causes of music performance anxiety to make a more informed treatment decision.[25] A neuroendocrine reaction is triggered when the neuroendocrine system senses that an external threat has been detected, releasing more significant symptoms than a normal sympathetic response. The Vagas nerve, which is responsible for triggering the defensive response in an individual, can be triggered directly by a negative performance of an instrumental event, causing up to fifty somatic reactions.[26] Because the nervous system cannot distinguish between potentially life-threatening circumstances and those which are not, it treats everything the same and reacts accordingly.

The Connectionist theory of assimilation is like many behavioral approaches in its belief that unobservable internal states accompany assimilation. Using this paradigm, it has been proven that if the brain receives stimuli with positive rewards frequently, it can learn how to perceive them as positive, leading to a change in perception.[27] If musicians utilize the flow mechanism to motivate themselves to perform optimally, they will be rewarded for achieving good performance, regardless of whether they experience negative performance anxiety.

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[24] Andrada Lavinia Faur, Sebastian Vaida, and Adrian Opre, "Kenny Music Performance Anxiety Inventory: Exploratory Factor Analysis of the Romanian Version," *Psychology of Music* 49, no. 4 (June 2020): 777-788, https://doi.org/10.1177/0305735619896412.

[25] Patrick Gannon, "Don't Call It Stage Fright! New Ideas about Treating Music Performance Anxiety." *International Musician*, 12 (2015).

[26] Dianna Kenny, *Study Confirms Scourge of Performance Anxiety* (Strad 122, 2011).

[27] Edward Lee Thorndike, *Educational Psychology: The Psychology of Learning* (Andesite Press, 2015).

Assimilation of the whole process is positive if the positive rewards associated with acquiring a good performance outweigh the negative inputs. It is also likely that this process is connected to a person's ability to manage social anxiety because the brain perceives all anxiety similarly.[28]

Statement of the Purpose

There may be an association between the anxiety associated with music performance and the ability to quickly recover from social anxiety that may benefit secondary school students in their efforts to maintain positive mental health. Considering this, it could predict how anxiety during instrumental performances in high school may lead to accelerated recovery from social anxiety. Stress and anxiety affect both the benefits of creativity and the resilience of the psychological system. On stage, performers are constantly exposed to the possibility of performance anxiety. When it is worked through, the ability to process it improves to the point that individuals can do so more efficiently. Tony Gilliam describes concept of the internal connection between creativity and mental health as "*a factor in establishing a healthy mind*." The musician Edward Elgar is cited as an example of someone who overcame mental illness by using his creativity to create stress that was a means of coping with his condition.[29]

Thorndike's connectionism is applied to the study of music performance anxiety when incorporated into the framework of his theory. Analyzing music performance anxiety may help determine if it improves social anxiety. The law of effect states that to motivate someone, the stimulus must be followed by a reward for the stimulus to have an impact.[30] The pursuit of flow

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[28] Edward Lee Thorndike, *Educational Psychology: The Psychology of Learning* (Andesite Press, 2015).

[29] Tony Gillam, *Creativity, Wellbeing and Mental Health Practice* (Cham, Switzerland: Palgrave Macmillan, 2018).

[30] Edward Lee Thorndike, *Educational Psychology: The Psychology of Learning* (Andesite Press, 2015).

in optimal performance may be related to performance anxiety, even though it is considered a negative emotion. If the reward of a good performance is deemed a positive emotion, however, then a performer has achieved a higher level of positive mental health. Based on the law of exercise, the degree of improvement in positive outcomes is primarily determined by the frequency with which the positive results are triggered.[31] It is only a matter of assimilation to the new information the brain faces as soon as it is presented with the same sequence of events.

Significance of the Study

Anxiety caused by music performance is a situational manifestation in which people worry about making mistakes and being unable to manage their actions during a performance in front of others. Another phrase for this is performance anxiety, which can be described as fear or nervousness during a performance.[32] Even though performers are prone to performance anxiety, little research has been done on how prevalent it is among them. An international survey of 400 musicians conducted by the International Conference of Symphony and Opera Musicians reported that 24 percent of the respondents said they had experienced MPA on stage, and 16 percent reported severe MPA on stage.[33] In smaller-scale studies, it has been found that performing musicians are prone to feeling performance anxiety across various situations.[34] A musician is likely to experience some level of performance anxiety at times. Still, excessive performance anxiety levels can make it difficult for them to perform at their full potential and keep their professional goals on track.

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[31] Edward Lee Thorndike, *Educational Psychology: The Psychology of Learning* (Andesite Press, 2015).

[32] Wendy J. Cox, and Justin Kenardy, "Performance Anxiety, Social Phobia, and Setting Effects in Instrumental Music Students," *Journal of Anxiety Disorders* 7, no. 1 (1993): 49-60.

[33] Ibid., 52.

[34] Ibid., 52.

Performance settings can influence performance anxiety since it influences how anxiety is perceived. Regarding training level, ability, and trait anxiety, the level of anxiety can differ from one subject to another. Musicians who have completed more years of musical training may perform better, receive higher performance scores, and report lower anxiety levels than those who have completed fewer years of training. Students' anxiety about performing music decreased as they were exposed more and more to the public arena. A musician with high general anxiety levels during a performance situation is significantly more likely to experience music performance anxiety. This is compared to a musician with medium or low levels of anxiety during that performance situation.[35]

It is believed that these symptoms of music performance anxiety, when experienced consistently and over an extended period, will help train the brain to cope more effectively and efficiently with generalized social anxiety. The level of performance anxiety can positively or negatively impact a performance based on the degree to which anxiety is present.[36] There is no doubt that musicians can apply moderate levels of MPA to enhance their performances; this, when appropriately managed, can lead to an overall improvement in the overall quality of their performances. As it should be noticed, when MPA reaches a high level, it becomes a disability that has adverse effects on the performance of an instrumentalist to the point of becoming detrimental.[37] Developing coping skills is imperative for musicians to combat the potentially debilitating effects of anxiety. As negative coping skills have been associated with social anxiety

[35] Shivani Mathur Gaiha et al., "Effectiveness of Arts Interventions to Reduce Mental-Health-Related Stigma Among Youth: A Systematic Review and Meta-Analysis," *BMC Psychiatry* 21, no. 1 (2021), https://doi.org/10.1186/s12888-021-03350-8.

[36] Eryn Piper Block et al., "A Symphony within: Frequent Participation in Performing Arts Predicts Higher Positive Mental Health in Young Adults," *Social Science & Amp; Medicine* 292 (2022): 114, https://doi.org/10.1016/j.socscimed.2021.114615.

[37] Ibid., 114.

and avoidance, developing coping mechanisms for MPA can directly correlate with the development of general mental health.

Research Question and Hypothesis

RQ: How accurately can expected changes in general anxiety disorder be predicted from a linear combination of instrumental music experience and improvement in musical performance anxiety?

H_0: Expected changes in general anxiety disorder cannot be predicted from a linear combination of instrumental music experience and improvement in musical performance anxiety.

Definition of Terms

1. *Music Performance Anxiety (MPA)* – is a complex phenomenon caused by the interaction of many factors, including genetics, environmental stimuli, and the individual's experience, emotions, cognitions, and behaviors at an elevated level that performance is affected negatively (Kenny, 2011).

2. *Social Anxiety disorder (SAD)* – also known as social phobia, is an anxiety disorder characterized by sentiments of fear and anxiety in social situations, causing considerable distress and impaired ability to function in at least some aspects of daily life (British Psychological Society, 2013).

3. *Stage Fright* – A state of nervousness about performing some action in front of a group of people, on or off of a stage; nerves; a lack of self-assurance before an audience (Kenny, 2011).

4. *Flow* – The concept of "flow" describes this state when a person is completely absorbed and focused on an enjoyable and rewarding activity (Seligman, 2008).

5. *Implicit Learning* – Learning that occurs when unconscious sets of trained stimuli are induced while creating an unconscious intentionality hypothesis between stimuli and reward (Delany, 1999).
6. *Connectionism* – Connectionism theory is based on the principle of active learning and is the result of the work of the American psychologist Edward Thorndike. According to these Laws, learning is achieved when an individual is able to form associations between a particular stimulus and a response (Thorndike, 2015)
7. *Law of Effect* – Responses to a situation which are followed by a rewarding state of affairs will be strengthened and become habitual responses to that situation (Thorndike, 2015).
8. *Law of Readiness* – a series of responses can be chained together to satisfy some goal which will result in annoyance if blocked (Thorndike, 2015).
9. *Law of Exercise* – connections become strengthened with practice and weakened when practice is discontinued (Thorndike, 2015).

Summary

There are many potential catalysts for artists' perception of positive mental health, and most experts agree that perspective is a crucial factor in their overall mental health.[38] Individuals will react to these catalysts in their own way. This study aims to test the hypothesis that participation in the performing arts can predict the probability of its increase.

Peter Lang, a psychologist specializing in music performance anxiety, has developed a contemporary three-factor model of anxiety related to music performance.[39] Generally speaking, anxiety is an emotional state caused by three different factors in the human brain. These factors are cognitive, behavioral, and psychological. In the event of a mental or cognitive representation of danger being created in the brain, the most common behavior side effect is for the brain to develop a flight-or-fight response for escape, which then engages the somatic nervous system, which causes physical symptoms such as shaking or dry mouth as a result.[40]

It is essential to distinguish between mental health and positive mental health. Both constructs influence one's overall mental well-being. The positive mental state of an individual is directly related to the positive outcomes they achieve, even when they have a documented mental health disorder. Positive mental health contributes substantially to overall mental health; this factor alone calls for greater understanding.[41] In this example, let's consider the concept of flow, a psychological state where people become absorbed in an activity because they perceive

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[38] Lacey Hutchison Marye, "A Survey of Music Performance Anxiety: Definitions, Causes, and Treatments," (University of South Carolina Dissertations & Theses Global, 2011), ProQuest (AAT 3454396).

[39] Ibid.

[40] Ibid.

[41] Dianna T. Kenny, *The Psychology of Music Performance Anxiety* (Oxford University Press, 2011).

psychological benefits.[42] Facilitating flow is primarily focused on optimizing performance in this case. There is an antithetical relationship between flow and anxiety in general. Music performance anxiety can be alleviated in part by cultivating a technique that fosters a tool that facilitates this process. This tool, referred to as flow, may determine whether immersion in extremely intense activities can positively influence mental health.

[42] Susanna Cohen and Ehud Bodner, "Flow and Music Performance Anxiety: The Influence of Contextual and Background Variables," *Musicae Scientiae* 25, no. 1 (2019): 25-44, https://doi.org/10.1177/1029864919838600.

Chapter 2: Literature Review

Music-Based Interventions

The research field of neuroscience and music-based interventions (MBIs) has always been challenging, considering the ambiguous components of music within the framework of human society. Music-based interventions help initiate the brain as it activates nerve cells to influence and better understand potential therapeutic gains within neuroplasticity.[43] MBIs are not just music therapy treatments but also categorized within educational values such as listening or performing music, music-based movement, or music training in an academic environment. Technology with motion-capturing shows brain structural activities and allows the observation of brain stimulation about rhythm perception that enables neural analysis of the effect of music-based interventions. These analyses show neural stimulation in the brain's affective/reward, motor, and cognitive function areas.[44]

Music educators have experienced the power of music and how it effectively influences human movement, emotion, and behavior. Neuroscientists also know that music connects to the ability to engage multiple neurological systems within the brain.[45] It is crucial to explore the neurological benefits of musical engagement to the brain, as there is rigorous evidence to show its positive impact. By delving into this area, a better understanding can be gained of how music enhances cognitive function and improves overall well-being. The brain's neural structure may seem straightforward, still, as the auditory mechanisms within the central nervous system process musical sounds, therapeutic benefits require that the brain's neural pathways and other

[43] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

[44] Ibid.

[45] Ibid.

physiological symptoms, somewhat indirectly or directly, be connected to the neural structure in the auditory system that perceives the musical elements.[46]

Three elements define music-based interventions. These elements include rhythm, melody, and harmony in conjunction with a delivery mode. These three elements encompass various tempos, dynamics, and volumes, creating an enormous array of delivery patterns. The delivery method also includes many different options. The simplest form of delivery is an individual's active listening or performing, but it often requires some degree of physical activity, such as playing an instrument, singing, or dancing.[47] However, therapeutic MBIs usually involve a social interaction component. These delivery modes are in group settings that require interaction between listeners and performers. These interactions could include audience listening in a concert hall, playing in a musical group, or receiving music therapy as a patient.[48]

Identifying the connection between auditory, cognitive, and sensory pathways must be explored to understand the therapeutic effects of music-based interventions. Sound is perceived first within auditory neurological pathways; neurologists know that the auditory system can engage both cognitive motor skills and affect reward pathways. These neurological interactions can also activate the sensory pathways that initiate pain reception. All these physiological

[46] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

[47] Psyche Loui, "Neuroscientific Insights for Improved Outcomes in Music-Based Interventions," *Music & Amp; Science* 3 (2020): 205920432096506, https://doi.org/10.1177/2059204320965065.

[48] Ibid.

systems are connected and activated by sound. Theoretically, if individuals can control the sound, they can control the reaction.[49]

The Reward Mechanism

Human culture has a complex and innate ability to produce pleasure from music and reward the response with emotional value. These intense and sometimes euphoric responses to music are frequently accompanied by an autonomic or psychophysiological component. These responses contribute to the erratic increase or decrease of cerebral blood flow in brain regions that generally include reward and motivation. The medial prefrontal cortex, midbrain, and orbital frontal cortex activate euphoria-like feelings, such as the stimuli one would receive from food or physical attraction. [50]

Neuroimaging studies have identified activation in the striatum and associated neurological areas with the experience of musical pleasure. Related to these activations, individuals will have autonomic system engagement. Individuals may experience an elevated heart rate, sweating, or fast respiration; however, these responses are not perceived as a fight or flight reaction because they are not associated with a release of norepinephrine. These autonomic side effects show a striatal response to a dopaminergic release.[51] These symptoms directly connect to a neurological response related to the reward prediction mechanism. This allows the

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[49] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

[50] Anne J. Blood and Robert J. Zatorre, "Intensely Pleasurable Responses to Music Correlate with Activity in Brain Regions Implicated in Reward and Emotion," *Proceedings of the National Academy of Sciences* 98, no. 20 (2001): 11818–23, https://doi.org/10.1073/pnas.191355898.

[51] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

process of musical engagement and its pleasurable reception to connect to a neurological activation that transfers to an autonomic response that encodes a predictable synopsis in the brain's reward system.[52]

This notion suggests that rhythmic sound patterns processed within the auditory system can assign value as a reward to increase the motivation to continue the stimulus of the musical intervention. These scientific findings provide an understanding of the mechanistic neural basis that music-induced pleasure creates. Musical intervention affects individuals neurologically and can manipulate autonomic responses such as mood induction or emotional regulation; this evidence may lead to transformative musical exposure for therapeutic benefit. Music is a creative process that influences the mind's neurological function.[53]

Multiple studies have explored human subjects and the relationship between musical involvement and cognitive functions. Along with the identified autonomic responses, longitudinal studies note a significant development of advanced executive function in individuals with multiple years of musical training. Specific executive functions such as verbal intelligence, working memory, abstraction, and psychomotor speed are developed and show little degradation over time if an individual stays involved in music-based interventions.[54]

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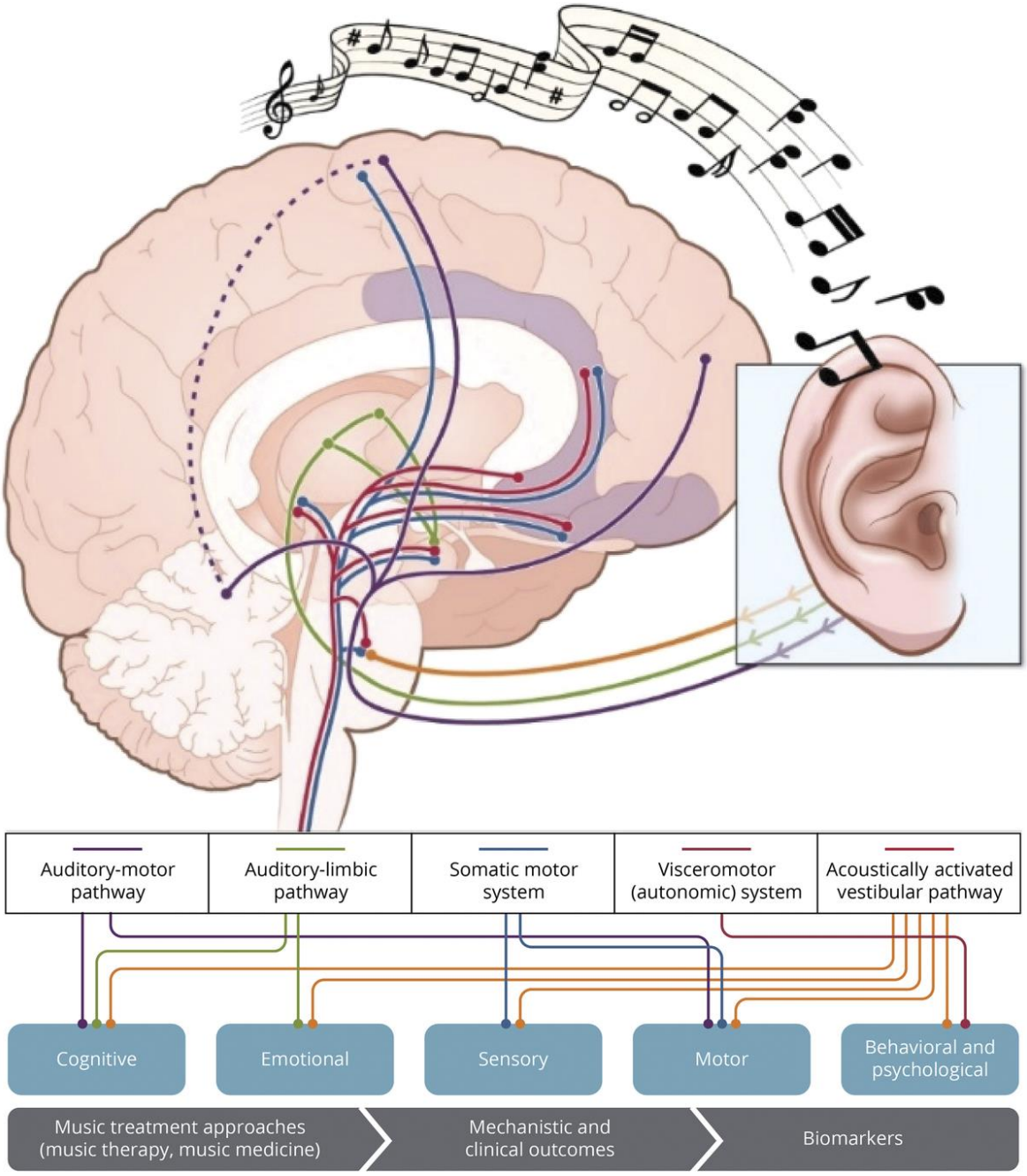
[52] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

[53] Psyche Loui, "Neuroscientific Insights for Improved Outcomes in Music-Based Interventions," *Music & Amp; Science* 3 (2020): 205920432096506, https://doi.org/10.1177/2059204320965065.

[54] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.



[55]

Figure 1. Pathways Underlying Neural and Physiologic Responses to Music
Note. Pathways Underlying Neural and Physiologic Responses to Music Adapted with permission from Koelsch S. Brain correlates of music-evoked emotions.

[55] Emmeline Edwards et al., "NIH Music-Based Intervention Toolkit," *Neurology* 100, no. 18 (2023): 868–78, https://doi.org/10.1212/wnl.0000000000206797.

Dopaminergic Abstract Reward

The brain's processing and derivation of pleasure from music requires further research, and exploring this topic can provide valuable insights into how humans process abstract rewards. Previous research in Helsinki with neuroimaging techniques has shown that the dopaminergic system is crucial in generating pleasure through music; however, establishing a definitive connection between the dopamine function and the enjoyment of music has been a challenge. [56]

The Copeland study presents new evidence that supports the causal role of dopamine in the experience of musical pleasure. Furthermore, it suggests that dopamine might have distinct or complementary functions in affective processing, specifically within abstract cognitive activities. This finding opens a new avenue for understanding how the brain perceives and responds to music, underscoring the complex mechanisms underlying this enjoyable and satisfying experience.[57]

This study utilizes a novel approach by assigning music-induced pleasure as the dependent variable and manipulating dopamine levels to administer a dopamine precursor. The researchers recruited participants with low baseline dopamine levels and measured their subjective pleasure experiences while listening to various music genres. The result of the study revealed that participants who received the dopamine precursor experienced a significant increase in their pleasure rating compared to those who received a placebo. This indicates that dopamine directly contributes to the experience of musical pleasure.[58]

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[56] Laura Ferreri et al., "Dopamine Modulates the Reward Experiences Elicited by Music," *Proceedings of the National Academy of Sciences* 116, no. 9 (2019): 3793–98, https://doi.org/10.1073/pnas.1811878116.

[57] D. A. Copland et al., "Dopaminergic Neuromodulation of Semantic Processing: A 4-T Fmri Study with Levodopa," *Cerebral Cortex* 19, no. 11 (2009): 2651–58, https://doi.org/10.1093/cercor/bhp017.

[58] Laura Ferreri et al., "Dopamine Modulates the Reward Experiences Elicited by Music," *Proceedings of the National Academy of Sciences* 116, no. 9 (2019): 3793–98, https://doi.org/10.1073/pnas.1811878116.

The study also found that the effect of dopamine on pleasure was specific to music, as there was no significant increase in pleasure ratings for other types of stimuli, such as visual art or food. This suggests that dopamine contributes to processing pleasurable music-related experiences.[59] These findings involve essential implications for understanding the neural mechanisms underlying reward processing.

They support that the diamagnetic system, traditionally associated with reward and reinforcement, involves more abstract and cognitive processes, such as music perception and enjoyment. Overall, this research provides compelling evidence for the position of dopamine in our experience of musical pleasure. It highlights the complexity of the brain's reward system and emphasizes the need for further research to fully understand how the brain processes and derives pleasure from music.[60]

Dopamine's role in reward processing is not limited to generating pleasurable experiences but also includes signaling the difference between expected and actual rewards. Other neurotransmitters, such as opioids and endocannabinoids, may be more directly involved in the enjoyable aspects of reward.[61] Numerous studies have examined the functions of alternative neurotransmitters associated with pleasure and reward. Receptors such as opioids are crucial for perceiving pleasurable sensations and rewarding experiences. Conversely, endocannabinoids influence how rewarding experiences are encoded and remembered in the brain. These

[59] Elvira Brattico et al., "It is Sad but I Like It: The Neural Dissociation between Musical Emotions and Liking in Experts and Laypersons," *Frontiers in Human Neuroscience* 9 (2016), https://doi.org/10.3389/fnhum.2015.00676.

[60] Laura Ferreri et al., "Dopamine Modulates the Reward Experiences Elicited by Music," *Proceedings of the National Academy of Sciences* 116, no. 9 (2019): 3793–98, https://doi.org/10.1073/pnas.1811878116.

[61] Ibid., 93.

fascinating findings elaborate on how neurotransmitters interact and contribute to the subjective experience of pleasure and reward.[62]

Despite the ongoing debate, it is evident that dopamine is a consequential contributor to the cognitive processes underlying musical pleasure. Music is a complex and rewarding stimulus that engages various cognitive functions, such as expectation formation, association formation, and learning and memory processes. Dopamine shapes expectations about the unfolding of musical events, forms associations between music and reward, and facilitates the learning and memory of musical experiences. [63]

Understanding the intricate involvement of dopamine in musical pleasure can provide valuable insights into how music influences emotions and cognition. It may also affect therapeutic cognitive and emotional well-being interventions like music therapy. By harnessing the power of music to modulate dopamine release and its associated cognitive processes, researchers and therapists can develop more effective treatments for mental and emotional dysregulation conditions.[64]

Rhythmic Auditory Stimulation

Research conducted over the past few decades in essential music and clinical neuroscience has begun to reveal the great potential of music as a rehabilitation tool. Music intervention has made significant strides in recent years, thanks to advancements in

[62] D. A. Copland et al., “Dopaminergic Neuromodulation of Semantic Processing: A 4-T Fmri Study with Levodopa,” *Cerebral Cortex* 19, no. 11 (2009): 2651–58, https://doi.org/10.1093/cercor/bhp017.

[63] Xuejing Lu, Fei Yi, and Li Hu, “Music-Induced Analgesia: An Adjunct to Pain Management,” *Psychology of Music* 49, no. 5 (2020): 1165–78, https://doi.org/10.1177/0305735620928585.

[64] Elvira Brattico et al., "It is Sad but I Like It: The Neural Dissociation between Musical Emotions and Liking in Experts and Laypersons," *Frontiers in Human Neuroscience* 9 (2016), https://doi.org/10.3389/fnhum.2015.00676.

understanding its influence on the brain. By engaging parallel brain networks that support sensory and motor processes, reward, arousal, and emotion regulation, researchers now have a solid neuroscientific foundation for developing theory-driven music interventions.[65] This is particularly relevant in the sports rehabilitation profession. Music's rhythmic nature has also profoundly affected movement patterns among patients with movement-related disorders. It serves as a continuous temporal reference that helps regulate the timing and rhythm of their movements. Numerous clinical and experimental studies have explored rhythm and music-based interventions to enhance motor function in the context of central nervous system injury and degeneration.[66]

The objective of the research is to evaluate the current state of knowledge regarding the effectiveness of music and rhythm in modulating spatiotemporal movement patterns and restoring motor function. These findings provide valuable insights for developing targeted interventions that can make a real difference in rehabilitation programs.[67] Integrating music into therapeutic strategies provides great promise for optimizing outcomes in sports rehabilitation and other areas related to motor function. Leveraging an understanding of neuroscience can harness the power of music as a therapeutic tool for promoting recovery and enhancing well-being.

Functional recovery achievement processes through neuroplasticity linked to rhythm and music-based interventions. The training and learning involved in music have been shown to elicit significant structural and functional changes, especially in the brain's motor regions. One

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[65] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

[66] Thenille Braun Janzen et al., "Rhythm and Music-Based Interventions in Motor Rehabilitation: Current Evidence and Future Perspectives," *Frontiers in Human Neuroscience* 15 (2022), https://doi.org/10.3389/fnhum.2021.789467.

[67] Ibid.

possible explanation is that acquiring motor skills, gradual assimilation of sensory input, multimodal stimulation, and extensive practice in these interventions promote activity-dependent neuroplastic changes in participants.[68] Consequently, brief interventions may lead to similar positive results. Participants who move freely in ecological settings offer a new opportunity to observe brain function with portable neuroimaging technologies that are not motion-sensitive. Previously, comparisons of brain activity pre- and post-music interventions showed brain plasticity, but this method needs to be updated.[69]

The regeneration of neurons in the adult brain does not impact the recovery of the brain after injury. Instead, the compensation for the damage relies on the spared neurons' ability to develop new synapses and remodel the affected networks. In the past, accomplishments progressed through targeted exercises to address specific weaknesses. Still, a new strategy involves stimulating brain activity through sensory input, such as music.[70] Motor neuron disease (MND) encompasses a fatal group of neurological disorders that cause the degeneration of motor neurons and impair voluntary muscle activity for breathing, walking, and bulbar functioning. Additional research found that individuals with poor psychological status experience faster disease progression and shorter survival. Promising interventions implement music to treat the symptoms of various neurological disorders, including degenerative types.[71]

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[68] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

[69] Thenille Braun Janzen et al., "Rhythm and Music-Based Interventions in Motor Rehabilitation: Current Evidence and Future Perspectives," *Frontiers in Human Neuroscience* 15 (2022), https://doi.org/10.3389/fnhum.2021.789467.

[70] A. G. Flagge. B. Pierce, K. L. Garand, and S. H. Ra, "Active Music Interventions and Music Therapy in Motor Neuron Disease: A Systematic Review." *The Australian Journal of Music Therapy* 32, no. 2 (2021): 26-38.

[71] Ibid., 26-38.

Rhythmic auditory stimulation (RAS) involves accessing a metronome or music to stimulate auditory timing, resulting in auditory-motor pathway connections within the human brain. These pathways, originating from the pontine nucleus in the cerebellum, lead to a motor response when activated by music or sounds. RAS attempts to create a rhythmic movement by stimulating the sensory and motor systems. Extensive research shows that RAS is efficacious in improving gait and dynamic balance in populations of acute, subacute, and stroke patients.[72]

RAS operates within the brain through the audio-motor pathways in the brainstem and cerebellum. The brain's supplementary auditory and motor regions, connected by the basal ganglia, influence these pathways. RAS can elicit autonomic responses and promote neurogenesis within the brain by providing external stimulation. Promoting proper cadence and gait sequencing is crucial in assisting patients with motor planning or correction issues by providing cues for when and at what speed to move. Additionally, the sounds emitted during RAS can trigger a significant response, further activating and stimulating the brain.[73]

This response can significantly benefit individuals with Parkinson's, stroke, or other movement disorders. RAS interventions can improve motor function, balance, and gait in Parkinson's patients.[74] The rhythmic cues provided during RAS can help to bypass the impaired basal ganglia neural pathways, allowing for more coordinated and fluid movements. In stroke

[72] Kathryn Pfeiffer et al., "Does Rhythmic Auditory Stimulation Compared to No Rhythmic Auditory Stimulation Improve Patient's Static and Dynamic Standing Balance Post Stroke?," *Physical Therapy Reviews* 24, no. 5 (2019): 216–22, https://doi.org/10.1080/10833196.2019.1666220.

[73] Ibid., 220.

[74] Thenille Braun Janzen et al., "Rhythm and Music-Based Interventions in Motor Rehabilitation: Current Evidence and Future Perspectives," *Frontiers in Human Neuroscience* 15 (2022), https://doi.org/10.3389/fnhum.2021.789467.

patients, RAS has also enhanced motor recovery. It can help to re-establish neural connections that may have been damaged by stroke, leading to improved motor function and mobility.[75]

Additionally, RAS has explored potential therapeutic interventions for individuals with autism spectrum disorder (ASD). Research suggests that the rhythmic cues provided during RAS can help to promote synchronization between different brain regions, leading to improved social communication and sensory integration in individuals with ASD.[76] Overall, rhythmic auditory stimulation shows promising results as a non-invasive and safe intervention for improving motor function and facilitating neuroplasticity in various neurological conditions. Further research is still needed to fully understand the underlying mechanisms and optimize their effectiveness.[77]

[75] Kathryn Pfeiffer et al., "Does Rhythmic Auditory Stimulation Compared to No Rhythmic Auditory Stimulation Improve Patient's Static and Dynamic Standing Balance Post Stroke?," *Physical Therapy Reviews* 24, no. 5 (2019): 216–22, https://doi.org/10.1080/10833196.2019.1666220.

[76] Thenille Braun Janzen et al., "Rhythm and Music-Based Interventions in Motor Rehabilitation: Current Evidence and Future Perspectives," *Frontiers in Human Neuroscience* 15 (2022), https://doi.org/10.3389/fnhum.2021.789467.

[77] Kathryn Pfeiffer et al., "Does Rhythmic Auditory Stimulation Compared to No Rhythmic Auditory Stimulation Improve Patient's Static and Dynamic Standing Balance Post Stroke?," *Physical Therapy Reviews* 24, no. 5 (2019): 216–22, https://doi.org/10.1080/10833196.2019.1666220.

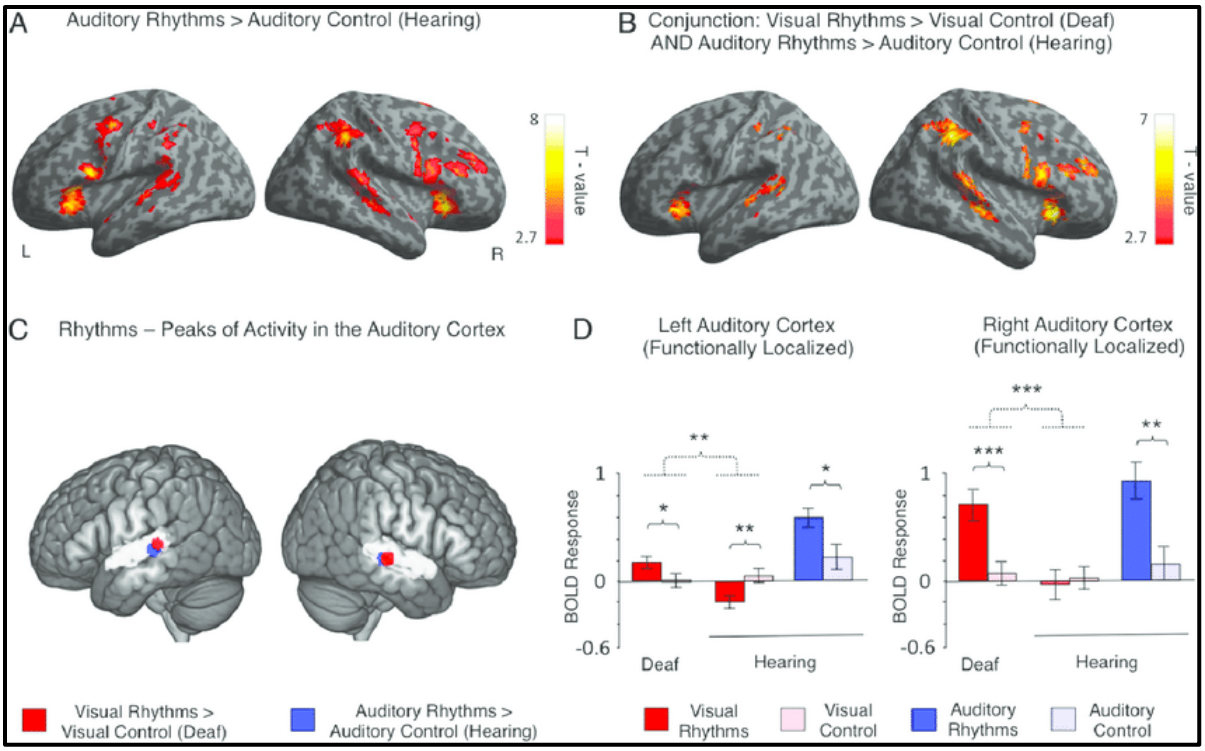

Figure 2. The Auditory Cortex Processes Rhythm [78]

Note. A) Activations induced by auditory rhythms relative to regular auditory stimulation in hearing subjects. (B) Brain regions were activated by visual rhythms relative to regular visual stimulation in deaf subjects and auditory rhythms relative to regular auditory stimulation in hearing subjects (conjunction analysis). (C) Peaks of activation for visual and auditory rhythms in the auditory cortex. Peaks for visual rhythms relative to regular visual stimulation in deaf subjects are illustrated in red. Peaks for auditory rhythms relative to regular auditory stimulation in hearing subjects are depicted in blue. The high-level auditory cortex is illustrated in gray, based on an anatomical atlas. The peaks are visualized as 6-mm spheres. Note the consistency of localization of peaks, even though deaf and hearing subjects performed the task in different sensory modalities. (D) The results of an ROI analysis in which activations in the auditory cortex induced by visual rhythms and auditory rhythms were used as independent localizers for each other. ROIs for comparisons between visual tasks were defined based on activation in the auditory cortex induced by auditory rhythms relative to regular auditory stimulation in hearing subjects. ROIs for comparison between auditory tasks were defined based on visual rhythms vs. regular visual stimulation contrast in deaf subjects.

[78] Łukasz Bola et al., "Task-Specific Reorganization of the Auditory Cortex in Deaf Humans," *Proceedings of the National Academy of Sciences* 114, no. 4 (2017), https://doi.org/10.1073/pnas.1609000114.

Mental Health

Depression is a significant cause of disability, according to the World Health Organization (WHO), and suicide ranks as the second leading cause of death among adolescents and young adults aged 15-29.[79] The prevalence of mental health conditions and suicidality in this age group has been rapidly increasing, especially during the COVID-19 pandemic, with its effects on social isolation, distancing, and family stress.[80] The transition from adolescence to adulthood is a critical period when mental health disorders can emerge and reach their peak intensity; itt is also worth noting that around half of all mental disorders manifest by age fourteen, and approximately three-fourths develop by age twenty-four.[81]

Adverse experiences such as complex trauma and prolonged stress can heighten the risk of various adverse outcomes throughout an individual's life, including poor academic achievements, mental health disorders, suicidality, and substance use. These effects disproportionately affect socially and economically marginalized adolescents and young adults.[82] One contributing factor to disengagement is the increased autonomy accompanying this developmental transition. Young people have more independence in managing their mental health decisions. Consequently, even evidence-based interventions for improving mental health may be minimally effective if adolescents and young adults choose not to access these services

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[79] "World Health Organization," Depression: Key Facts, World Health Organization (2021), https://www.who.int/news-room/fact-sheets/detail/depression.

[80] Aaron H. Rodwin et al., "A Systematic Review of Music-Based Interventions to Improve Treatment Engagement and Mental Health Outcomes for Adolescents and Young Adults," *Child and Adolescent Social Work Journal* 40, no. 4 (2022): 537–66, https://doi.org/10.1007/s10560-022-00893.

[81] "World Health Organization," Depression: Key Facts, World Health Organization (2021), https://www.who.int/news-room/fact-sheets/detail/depression.

[82] Aaron H. Rodwin et al., "A Systematic Review of Music-Based Interventions to Improve Treatment Engagement and Mental Health Outcomes for Adolescents and Young Adults," *Child and Adolescent Social Work Journal* 40, no. 4 (2022): 537–66, https://doi.org/10.1007/s10560-022-00893.

willingly. Music and expressive arts strategies have significantly impacted engagement, prevention, and treatment of health and mental health conditions.[83]

The World Health Organization has compiled a comprehensive body of evidence. One of the primary findings is that music and expressive arts strategies stimulate aesthetic engagement, ignite imagination, and activate the senses. This can lead to improved cognitive attention and enhanced emotional experiences. The power of music, particularly, to evoke emotions and create a deep connection with individuals has been well-documented.[84] Furthermore, research suggests that interventions incorporating music and rhythm have the potential to foster integration, regulate emotions, and promote attunement.[85] This can be particularly beneficial in alleviating stress, anxiety, and depression. Music and expressive arts strategies can reach individuals on an enhanced level, bypassing the limitations of language when it comes to integrating disorganized emotions and sensations.[86] In the context of traumatic stress, dynamic and multisensory approaches are crucial. Words alone may not be sufficient to address trauma's influence on the brain and body. Music and expressive arts can provide a holistic and integrative approach to healing, allowing individuals to process their experiences and find emotional release.[87]

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[83] Aaron H. Rodwin et al., "A Systematic Review of Music-Based Interventions to Improve Treatment Engagement and Mental Health Outcomes for Adolescents and Young Adults," *Child and Adolescent Social Work Journal* 40, no. 4 (2022): 537–66, https://doi.org/10.1007/s10560-022-00893.

[84] "World Health Organization," Depression: Key Facts, World Health Organization (2021), https://www.who.int/news-room/fact-sheets/detail/depression.

[85] Ibid.

[86] Aaron H. Rodwin et al., "A Systematic Review of Music-Based Interventions to Improve Treatment Engagement and Mental Health Outcomes for Adolescents and Young Adults," *Child and Adolescent Social Work Journal* 40, no. 4 (2022): 537–66, https://doi.org/10.1007/s10560-022-00893.

[87] Ibid., 537–66.

Implementing music interventions in juvenile mental health is a precious tool, especially for patients who struggle with verbal expression of their emotions. Through music as a nonverbal method of communication, therapists can establish meaningful connections with these patients and assist them in navigating their psychopathologies. Music therapy has been well-documented as an effective treatment for children and adolescents grappling with diverse psychiatric disorders, leading to its widespread implementation across numerous countries.[88] Music is especially significant for adolescents as it is integral to their social identity. It elicits a feeling of connectedness to their peer group and facilitates emotional expression. This is why incorporating music into therapeutic processes can be highly engaging and effective for young patients, allowing them to explore their emotions without resistance.[89]

Receptive music interventions involve the adolescent passively engaging with music by listening to pre-recorded music or participating in guided music-listening activities. These interventions promote relaxation, reduce stress, and improve emotional regulation. Research has shown that receptive music interventions can improve adolescents' active engagement in musical activities such as improvisation, songwriting, or playing musical instruments.[90] These interventions aim to facilitate self-expression, enhance creativity, and promote personal growth and development. Music can be an intervention to encourage activity and engagement.[91]

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[88] Carina Freitas et al., "Music Therapy for Adolescents with Psychiatric Disorders: An Overview," *Clinical Child Psychology and Psychiatry* 27, no. 3 (2022): 895–910, https://doi.org/10.1177/13591045221079161.

[89] Aaron H. Rodwin et al., "A Systematic Review of Music-Based Interventions to Improve Treatment Engagement and Mental Health Outcomes for Adolescents and Young Adults," *Child and Adolescent Social Work Journal* 40, no. 4 (2022): 537–66, .

[90] Ibid., 540.

[91] Carina Freitas et al., "Music Therapy for Adolescents with Psychiatric Disorders: An Overview," *Clinical Child Psychology and Psychiatry* 27, no. 3 (2022): 895–910, https://doi.org/10.1177/13591045221079161.

The focus on mental health care shifted from curing to promoting recovery. Within the concept of recovery, the objective is the pursuit of a meaningful and purposeful recovery. At the center of the recovery concept is the understanding that individuals with mental health conditions determine meaning, purpose, and value in their lives.

The foundation of the recovery movement lies in the belief that people with mental health conditions have the potential to recover and lead productive and fulfilling lives according to their criteria. However, there has yet to be a consensus on how to define recovery as an optimal process, and various authors have expressed that it does not comprise a specific set of techniques.[92] To gain insight into recovery and develop a conceptual framework associated with Andresen's study,examined published accounts from individuals with schizophrenia and other severe mental health conditions who had experienced recovery. Andresen's framework classified and operationally defined a stage model for recovery.[93] Andresen's model of recovery is as follows:

1. *Moratorium* - In this stage, the person experiences denial, confusion, hopelessness, identity confusion, and self-protective withdrawal.
2. *Awareness* - In this stage, the person recognizes hope for a better life and acknowledges that recovery is achievable. This recognition can be an internal event or externally influenced by a clinician, significant other, peer, or role model. It involves a cognizance of a possible identity other than that of a sick person (i.e., a self capable of recovery, which is not defined by the mental health condition).
3. *Preparation* - In this stage, the person resolves to start working toward recovery. This stage involves taking inventory of the self and one's values, strengths, and weaknesses. It also involves connecting with peers, learning about mental health conditions, potential services and resources available, recovery skills, and involvement in psychoeducational programming and therapy.

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[92] Michael J. Silverman, "Comparing Educational Music Therapy Interventions via Stages of Recovery with Adults in an Acute Care Mental Health Setting: A Cluster-Randomized Pilot Effectiveness Study," *Community Mental Health Journal* 55, no. 4 (2019): 624–30, https://doi.org/10.1007/s10597-019-00380-1.

[93] Retta Andresen, Peter Caputi, and Lindsay Oades, "Stages of Recovery Instrument: Development of a Measure of Recovery from Serious Mental Illness," *Australian & Amp; New Zealand Journal of Psychiatry* 40, no. 11–12 (2006): 972–80, https://doi.org/10.1080/j.1440-1614.2006.01921.

4. *Rebuilding* - In this stage, the person works to forge a positive identity that involves setting and working towards personally valued goals. This stage may also include reassessing old goals and values and taking responsibility for managing the mental health condition, taking control of one's life, taking risks, suffering setbacks, and trying again if goals are not initially achieved.
5. *Growth* - In this stage, although the person may not be completely free of symptoms, the person knows how to manage the mental health condition to remain successfully. The person is resilient in the face of setbacks, has faith in their ability to overcome adversities, and maintains a positive attitude. The person can live a meaningful life, looks forward to the future, and has a positive sense of self. The person may even conceptualize that the experience of having a mental health condition has made them a better person. This is considered the final stage of recovery, the terminal objective, or outcome of the recovery process.[94]

There is a need for further research to determine the potential influence of music interventions on mental health recovery. Given the significance of mental health recovery, exploring whether specific music interventions can facilitate recovery in individuals with mental health conditions is essential. Future research should investigate and compare various music interventions, considering their varying levels of structure. Additionally, interpretive paradigms and mixed methods investigations can provide insights into participants' experiences during educational music interventions, leading to a more comprehensive understanding of the treatments and potential mechanisms of change.[95]

Mental health recovery is a multi-faceted process that involves various stages and interventions. This significant process cannot overemphasize gained skills that empower individuals with mental health conditions to regain control over their lives and discover peace

[94] Retta Andresen, Peter Caputi, and Lindsay Oades, "Stages of Recovery Instrument: Development of a Measure of Recovery from Serious Mental Illness," *Australian & Amp; New Zealand Journal of Psychiatry* 40, no. 11–12 (2006): 972–80, https://doi.org/10.1080/j.1440-1614.2006.01921.

[95] Michael J. Silverman, "Comparing Educational Music Therapy Interventions via Stages of Recovery with Adults in an Acute Care Mental Health Setting: A Cluster-Randomized Pilot Effectiveness Study," *Community Mental Health Journal* 55, no. 4 (2019): 624–30, https://doi.org/10.1007/s10597-019-00380-1.

and fulfillment. However, there is still much to explore regarding the role of music interventions in facilitating this recovery.[96]

Research is imperative to fully comprehend the potential effects of music interventions on mental health recovery. Considering their varying degrees of structure, investigating and comparing different music interventions is vital. By so doing, it is possible to ascertain which interventions most effectively promote recovery among individuals with mental health conditions.[97] Moreover, interpretive paradigms and mixed methods investigations can offer valuable insights into participants' experiences during educational music interventions. This approach enables an understanding of the treatments and potential mechanisms for change comprehensively.[98]

Individuals can better tailor interventions to meet the unique needs and enhance recovery of patients by delving into their perspectives. The path to recovery from a mental health condition is a comprehensive and intricate process beyond simply addressing and alleviating symptoms. It encompasses much more: the ultimate objective is to attain elevated well-being, strength, and positivity. Each step brings about transformation, equipping individuals with invaluable tools and strategies to manage their mental health effectively. With these skills, they can cope with their condition and lead rewarding and purposeful lives.[99]

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[96] Aaron H. Rodwin et al., "A Systematic Review of Music-Based Interventions to Improve Treatment Engagement and Mental Health Outcomes for Adolescents and Young Adults," *Child and Adolescent Social Work Journal* 40, no. 4 (2022): 537–66, https://doi.org/10.1007/s10560-022-00893.

[97] Ibid., 542.

[98] Ibid., 546.

[99] Michael J. Silverman, "Comparing Educational Music Therapy Interventions via Stages of Recovery with Adults in an Acute Care Mental Health Setting: A Cluster-Randomized Pilot Effectiveness Study," *Community Mental Health Journal* 55, no. 4 (2019): 624–30, https://doi.org/10.1007/s10597-019-00380-1.

Individuals experiencing mental health conditions can reclaim control over their lives with this newfound understanding and perspective. They acknowledge that while ongoing challenges and setbacks may occur, they possess the resilience and capabilities to overcome them. This empowerment enables patients to chart a unique path toward holistic well-being, a journey encompassing physical, emotional, and spiritual harmony.[100] During this stage of recovery, individuals become advocates for themselves and others experiencing similar struggles. They can share their experiences, offer support, and inspire hope in those undergoing analogous journeys. Their transformative odyssey becomes a source of motivation for themselves and the broader mental health community.[101]

Traumatic Events

The prevalence of exposure to traumatic events during childhood and adolescence is high, surpassing 50 percent in Switzerland and the US. These traumatic experiences elicit significant short-term effects on children. Still, their consequences can extend into the long term due to the social, emotional, and psychological changes during this crucial development period.[102] This examination explores the efficacy of creative arts-based interventions in mitigating psychological distress from trauma exposure.

One perspective through which potentially traumatic events during childhood and adolescence develop is through diagnostic criteria for trauma-related disorders. In the case of

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[100] Retta Andresen, Peter Caputi, and Lindsay Oades, "Stages of Recovery Instrument: Development of a Measure of Recovery from Serious Mental Illness," *Australian & Amp; New Zealand Journal of Psychiatry* 40, no. 11 (2006): 972–80, https://doi.org/10.1080/j.1440-1614.2006.01921.

[101] Ibid., 973.

[102] Linda Morison, Laura Simonds, and Sarah-Jane F. Stewart, "Effectiveness of Creative Arts-Based Interventions for Treating Children and Adolescents Exposed to Traumatic Events: A Systematic Review of the Quantitative Evidence and Meta-Analysis," *Arts & Amp; Health* 14, no. 3 (2021): 237–62, https://doi.org/10.1080/17533015.2021.2009529.

adolescents and children aged six and older, the Diagnostic and Statistical Manual of Mental Disorders characterizes a traumatic event as exposure or threat of actual death, serious injury, or sexual violence. The individual can directly experience an event they witnessed in person or learned about as it affected a close family member or friend.[103]

Death exposure occurs via violence or accident. However, it is improbable for many children and adolescents to fulfill the requirement of experiencing repetitive or intense exposure to distressing specifics of traumatic events. This requirement explicitly pertains to exposures encountered in a professional setting, such as an emergency service responders may experience, rather than exposures occurring online or through media sources.[104]

Since 2013, there has been much discussion pertaining to the definition of potentially traumatic events provided by older guidelines. Hyland reveals that childhood neglect, emotional abuse, and bullying were just as significantly associated with post-traumatic stress disorder (PTSD).[105] As a result, some argue for an updated guideline that considers a broader range of experiences when defining a traumatic event. This approach aligns with how traumatic events are conceptualized in the International Classification of Diseases for Mortality and Morbidity Statistics.[106]

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[103] Linda Morison, Laura Simonds, and Sarah-Jane F. Stewart, "Effectiveness of Creative Arts-Based Interventions for Treating Children and Adolescents Exposed to Traumatic Events: A Systematic Review of the Quantitative Evidence and Meta-Analysis," *Arts & Amp; Health* 14, no. 3 (2021): 237–62, https://doi.org/10.1080/17533015.2021.2009529.

[104] Ibid., 238.

[105] Philip Hyland et al., "Does Requiring Trauma Exposure Affect Rates of ICD-11 PTSD and Complex PTSD? Implications for DSM–5," *Psychological Trauma: Theory, Research, Practice, and Policy* 13, no. 2 (2021): 133–41, https://doi.org/10.1037/tra0000908.

[106] Ibid., 133.

The definition of children's traumatic events is further complicated due to factors such as their stage of development and attachment relationships. Even events that may seem insignificant to adults become traumatic experiences for children. Psychological interventions that utilize creative arts, such as art, music, and dance/movement, are called innovative arts-based interventions.[107] The effectiveness of these interventions in treating trauma-exposed children and adolescents is still in its early stages of understanding.

Experiencing trauma has been widely considered to affect an individual's psychological and physiological aspects significantly. The memories of these traumatic events may not be readily accessible through explicit memory but, instead, stored implicitly or in sensory memory, making it challenging to articulate the experience verbally. When verbal expression is complex, various art, music, or movement forms can serve as alternative means of communication and expression.[108]

[107] Linda Morison, Laura Simonds, and Sarah-Jane F. Stewart, "Effectiveness of Creative Arts-Based Interventions for Treating Children and Adolescents Exposed to Traumatic Events: A Systematic Review of the Quantitative Evidence and Meta-Analysis," *Arts & Amp; Health* 14, no. 3 (2021): 237–62, https://doi.org/10.1080/17533015.2021.2009529.

[108] Nadine van Westrhenen and Elzette Fritz, "Creative Arts Therapy as Treatment for Child Trauma: An Overview," *The Arts in Psychotherapy* 41, no. 5 (2014): 527–34, https://doi.org/10.1016/j.aip.2014.10.004.

[109]

Figure 3. Trauma List
Note. Defined Child Trauma Types

Music interventions offer a secure and non-verbal means for individuals to process and articulate their emotions. Individuals can explore their inner thoughts, sentiments, and encounters via diverse music techniques. This is especially beneficial for those struggling to find appropriate words or feel overwhelmed or silenced by their traumatic experiences. Music possesses substantial healing and communication capabilities: it can access emotions and memories, frequently eliciting profound reactions. Through active listening and creative expression,

[109] Linda Morison, Laura Simonds, and Sarah-Jane F. Stewart, "Effectiveness of Creative Arts-Based Interventions for Treating Children and Adolescents Exposed to Traumatic Events: A Systematic Review of the Quantitative Evidence and Meta-Analysis," *Arts & Amp; Health* 14, no. 3 (2021): 237–62, https://doi.org/10.1080/17533015.2021.2009529.

individuals gain access to and communicate their inner realm, facilitating a more comprehensive comprehension and resolution of their trauma.[110]

Movement-based therapies, such as dance or yoga, offer another non-verbal communication and healing avenue. These practices encourage individuals to connect with their bodies, release tension, and explore different physical sensations and movements. By moving mindfully and intentionally, individuals can remove and process trauma stored in the body, promoting healing and empowerment.[111]

These alternative forms of communication should not be something other than a replacement for traditional therapy or verbal expression. Complementing different therapeutic approaches can provide a comprehensive and holistic healing experience. Trained professionals, such as art therapists, music therapists, or movement therapists, can guide individuals through these processes and help them navigate their trauma in a safe and supportive manner.[112]

At the core of art therapy are the theories Winnicot (1971) established, which emphasize the role of imagination as a connector between the imagination and the real world. In individuals with a healthy psychological state, this relationship between fantasy and reality is in constant flux, allowing for development and exploration.[113] However, after experiencing trauma, this connection often becomes stagnant and unyielding. The play space is a transitional zone that

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[110] Nadine van Westrhenen and Elzette Fritz, "Creative Arts Therapy as Treatment for Child Trauma: An Overview," *The Arts in Psychotherapy* 41, no. 5 (2014): 527–34, https://doi.org/10.1016/j.aip.2014.10.004.

[111] Ibid., 527–34.

[112] Linda Morison, Laura Simonds, and Sarah-Jane F. Stewart, "Effectiveness of Creative Arts-Based Interventions for Treating Children and Adolescents Exposed to Traumatic Events: A Systematic Review of the Quantitative Evidence and Meta-Analysis," *Arts & Amp; Health* 14, no. 3 (2021): 237–62, https://doi.org/10.1080/17533015.2021.2009529.

[113] Melinda A. Meyer DeMott et al., "A Controlled Early Group Intervention Study for Unaccompanied Minors: Can Expressive Arts Alleviate Symptoms of Trauma and Enhance Life Satisfaction?," *Scandinavian Journal of Psychology* 58, no. 6 (2017): 510–18, https://doi.org/10.1111/sjop.12395.

allows survivors to unlock emotions and regain accessibility to their emotions. For children, resuming play activities following a traumatic event signifies their ability to rebound from adversity. Play is inherently relational and fosters trust-development experiences. By engaging in imaginative and creative play, individuals can enhance their sense of self-identity and broaden their range of expression.[114]

In the context of art therapy, the idea of a play space becomes relevant. Play is inherently relational and fosters trust-development experiences. The play space is a transitional zone that allows trauma survivors to regain emotional accessibility. For children, in particular, resuming play activities following a traumatic event signifies their ability to rebound from adversity. Through engaging in imaginative and creative play, individuals can begin to reconnect with their inner selves and broaden their range of emotional expression.[115]

Art therapy provides a safe and supportive environment for individuals to explore their emotions and experiences through artistic expression. Individuals are encouraged to access their creative abilities and communicate their inner thoughts and feelings using various art materials and techniques. This process allows for a more robust understanding and processing of their trauma and the opportunity for personal development and healing. Art therapy offers a unique approach to trauma recovery by utilizing the power of imagination and creativity.[116]

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[114] Melinda A. Meyer DeMott et al., "A Controlled Early Group Intervention Study for Unaccompanied Minors: Can Expressive Arts Alleviate Symptoms of Trauma and Enhance Life Satisfaction?," *Scandinavian Journal of Psychology* 58, no. 6 (2017): 510–18, https://doi.org/10.1111/sjop.12395.

[115] Ibid., 511.

[116] Ibid., 512.

Eating Disorders

Eating disorders (EDs) have severe consequences on physical and psychosocial well-being and can even be life-threatening. Unfortunately, there are limited options for treating these disorders, and many individuals may experience barriers when seeking help. Individuals with eating disorders exhibit persistent abnormal eating behaviors and disrupted food consumption patterns that can adversely affect their health. This abnormal food intake can assume the form of excessive or inadequate eating, deviating from what is considered normal for that person.[117] The most common types of EDs include anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED). Furthermore, EDs pose a significant global health concern, with 1.9 million disability-adjusted life years attributed to AN and BN combined in 2013. Individuals with ED often experience co-occurring mental health disorders such as depression and anxiety.[118]

EDs are often comorbid with other mental health disorders, such as depression and anxiety. These additional conditions can further complicate the treatment and management of EDs, underscoring the need for comprehensive and integrated care approaches. Notable music programs have introduced techniques for dedicated treatment facilities incorporating cognitive-behavioral music therapy. This program addresses different facets of eating disorders, including cognitive distortions, stress management, boosting self-esteem, delving into underlying causes, and addressing behavioral concerns. Therapeutic sessions are in various formats, ranging from

[117] Ee Xuen Chang et al., "Music-Based Intervention Impacts for People with Eating Disorders: A Narrative Synthesis Systematic Review," *Journal of Music Therapy* 60, no. 2 (2023): 202–31, https://doi.org/10.1093/jmt/thac018.

[118] Ibid., 202.

large group settings within the inpatient community to smaller groups with ten or fewer residents and individual sessions.[119]

According to informal resident reports, these group sessions have been deemed successful from a therapeutic standpoint. Additionally, primary therapists have noted improvements in residents' insight and provided examples showcasing the effectiveness of the fundamental principles. This principle involves selecting music that aligns with a client's current mood and then modifying it to influence their emotional state. In this study, the music therapist collaborated with an intern and client to develop a playlist from depressive tones to hopeful melodies. Employing this playlist between therapy sessions enabled the client to select specific songs that matched her mood at any given time. As a result, the client reported experiencing beneficial shifts in her emotional well-being throughout the progression of the playlist.[120]

Studies have shown that music interventions can significantly benefit individuals diagnosed with anorexia nervosa (AN). During meal times, patients reported comfort and relief from anxiety through music.[121] Many participants experienced a soothing sensation throughout their bodies, resulting in heightened physical well-being and inner tranquility. Furthermore, reclining during the intervention promoted relaxation for most individuals. While there were some brief unpleasant sensations, most participants reported positive outcomes from the

[119] Ee Xuen Chang et al., "Music-Based Intervention Impacts for People with Eating Disorders: A Narrative Synthesis Systematic Review," *Journal of Music Therapy* 60, no. 2 (2023): 202–31, https://doi.org/10.1093/jmt/thac018.

[120] Jennifer Bibb, David Castle, and Richard Newton, "The Role of Music Therapy in Reducing Post Meal Related Anxiety for Patients with Anorexia Nervosa," *Journal of Eating Disorders* 3, no. 1 (2015), https://doi.org/10.1186/s40337-015-0088-5.

[121] Ibid.

sessions: approximately 80 percent of participants reflected on their current life circumstances after engaging in these music interventions.[122]

Music therapy in mental health care significantly correlates with the current emphasis on empowerment and consumer-led processes in contemporary recovery practices. These practices prioritize principles of self-determination and collaboration with clients, emphasizing their strengths and resources. Engaging with individuals who present with eating disorders during their mental health recovery can promote feelings of equality, especially in inpatient eating disorder settings where opportunities for self-determination may be limited.[123]

Conclusion

Music-based interventions significantly affect the brain, activating nerve cells and promoting neuroplasticity. These interventions extend beyond traditional music therapy treatments and encompass various educational aspects, such as listening to music, participating in music-based activities, or receiving formal music training. The transformative power of music is evident through the significant structural and functional changes observed in the brain's motor regions. Experience has shown that incorporating sensory input, multimodal stimulation, and extensive practice while honing motor skills is a highly effective intervention.

Music-based interventions elicit automatic responses and promote new neuron growth by connecting auditory and motor regions through basal ganglia pathways. To fully comprehend the therapeutic effects of these interventions, it is crucial to explore the relationship between

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[122] Jennifer Bibb, David Castle, and Richard Newton, "The Role of Music Therapy in Reducing Post Meal Related Anxiety for Patients with Anorexia Nervosa," *Journal of Eating Disorders* 3, no. 1 (2015), https://doi.org/10.1186/s40337-015-0088-5.

[123] Ee Xuen Chang et al., "Music-Based Intervention Impacts for People with Eating Disorders: A Narrative Synthesis Systematic Review," *Journal of Music Therapy* 60, no. 2 (2023): 202–31, https://doi.org/10.1093/jmt/thac018.

auditory, cognitive, and sensory pathways as sound initially engages with auditory neurological processes. Neurologists understand that engaging with music activates cognitive motor skills and influences reward pathways. As research continues to delve into this field of study, remarkable discoveries are waiting regarding the potential benefits of music-based interventions on human well-being.

Chapter Three: Methodology

This quantitative correlational study examines secondary students' challenges in maintaining positive mental health. It also explores how music performance anxiety can benefit these students by aiding in the accelerated recovery of social anxiety. The study adopts a quantitative approach guided by Edward Thorndike's learning theory of connectionism. Its goal is to gain a comparative understanding of individuals who consistently experience music performance anxiety within a controlled environment and its influence on efficiently processing symptoms of an anxiety disorder. The research focuses on data collected via a survey administered to secondary school-aged students, with questions centered around music performance anxiety and its effects on the students. Currently, there is limited research exploring the benefits of situational anxiety on clinically diagnosed anxiety disorders, despite situational anxiety being a common expectation and voluntary participation in performing arts settings. The objective is to comprehend the therapeutic benefits of micro-dosing the brain with music performance anxiety in a controlled environment and how it can contribute to the development of students' mental resilience.

Design

This study implemented a quantitative correlational to explore the potential connection between connectionism and the correlation between music performance anxiety and its impact on social anxiety reduction. The objective was to accurately predict changes in overall social anxiety by considering years of involvement in instrumental music and improvement in musical performance anxiety.

The research investigates the relationships between the independent variables of instrumental music experience and improvement in musical performance anxiety with the

dependent variable of expected changes in general anxiety disorder. While this design is suitable for examining associations, it cannot establish causal relationships. This research aimed to determine the strength of these associations and their predictive capability regarding an increase in the dependent variable.[124]

Research Question and Hypothesis

The following research question guided this study:

RQ: How accurately can expected changes in general anxiety disorder be predicted from a linear combination of instrumental music experience and improvement in musical performance anxiety?

The ongoing research delves into the intricate relationship between general and positive mental health. Specifically, it explores how various factors within a performance environment can influence overall mental well-being. One particular area of focus is understanding whether there are any notable correlations between the duration of involvement in instrumental performing arts and a decrease in music performance anxiety. This investigation aims to illuminate the potential connection between these variables and enhance our comprehension of mental well-being within this context.

The null hypothesis for this study was:

H_0: Expected changes in general anxiety disorder cannot be predicted from a linear combination of instrumental music experience and improvement in musical performance anxiety.

[124] "Libguides: Quantitative Research Methods: Regression and Correlation," Regression and Correlation Quantitative Research Methods, LibGuides at Duquesne University, accessed October 25, 2023, https://guides.library.duq.edu/c.php?g=844215&p=6035786.

Participants

Secondary school students comprised the population. All students participating must be enrolled in high school and also enrolled in an instrumental performance class. The students' grades ranged from ninth graders to twelfth graders. As the participants were underage, parents received consent forms a week before their involvement in the study. The survey was 100% voluntary and completely anonymous. The controlled aspect of the data collection was the instrumental class visited. Participating students were given another consent form outlining their refusal rights before administering the survey. This form was read as a script and explained about anonymous participation. All participants checked the box on the survey, proclaiming they understood and wished to continue.

Settings

Cypress Lake High School and South Fort Myers High School approved the data collection as part of the Lee County School District 18. Every survey was conducted exclusively in high schools approved by the Lee County District School Board. This ensures accurate and representative data collection of district students. Cypress Lake High School, located in Florida, is committed to providing a high-quality education to its diverse student population. The school offers a vibrant and engaging learning environment with 1,524 students, grades 9-12. One notable aspect of Cypress Lake High School is its student-to-teacher ratio, which stands at 22:1. This surpasses the average ratio in the state of Florida, which is 16:1, indicating that students at Cypress Lake High School benefit from smaller class sizes and more individualized attention.[125]

[125] "Cypress Lake High School (2023-24 Ranking) Fort Myers, FL," Public School Review, accessed November 16, 2023, http://www.publicschoolreview.com/cypress-lake-high-school-profile.

Regarding diversity, Cypress Lake High School boasts a minority enrollment rate of 52%. Most of the student population comprises Hispanic students, a significant portion of the school community. While slightly below the state average of 64% for schools with a majority Hispanic population, Cypress Lake High School remains committed to fostering an inclusive and welcoming environment for students from all backgrounds.[126] See figures below for demographic information.

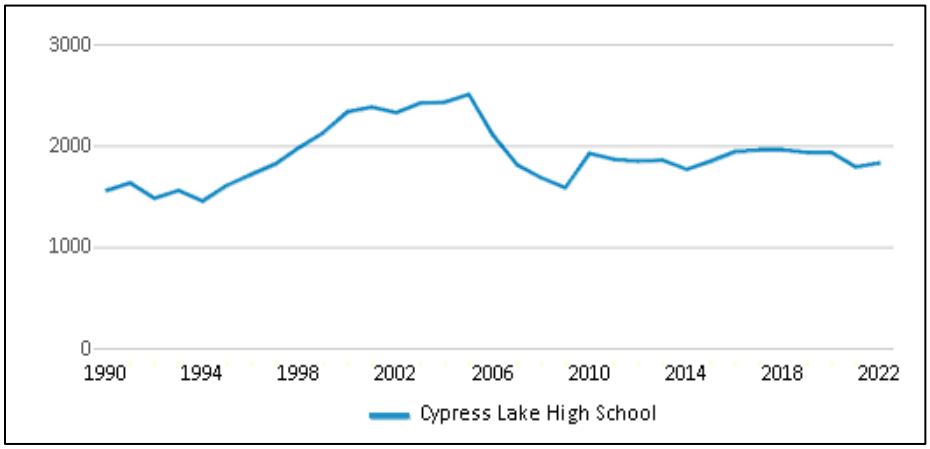

Figure 4. Cypress Lake High School Population
Note. Public School Review Demographics for Cypress Lake High School.[127]

[126] "Cypress Lake High School (2023-24 Ranking) Fort Myers, FL," Public School Review, accessed November 16, 2023, http://www.publicschoolreview.com/cypress-lake-high-school-profile.

[127] Ibid.

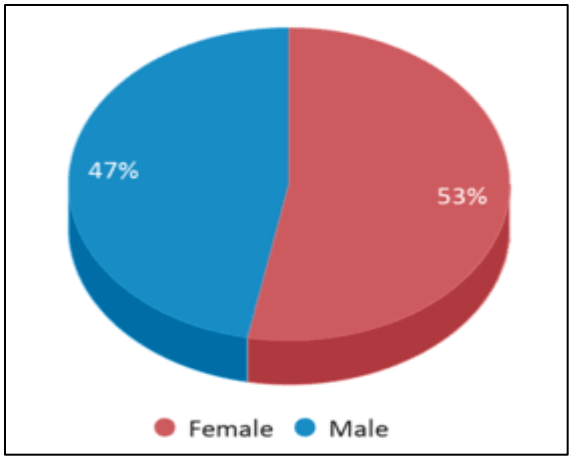

Figure 5. Cypress Lake High School Gender Percentage
Note. Public School Review Demographics for Cypress Lake High School.[128]

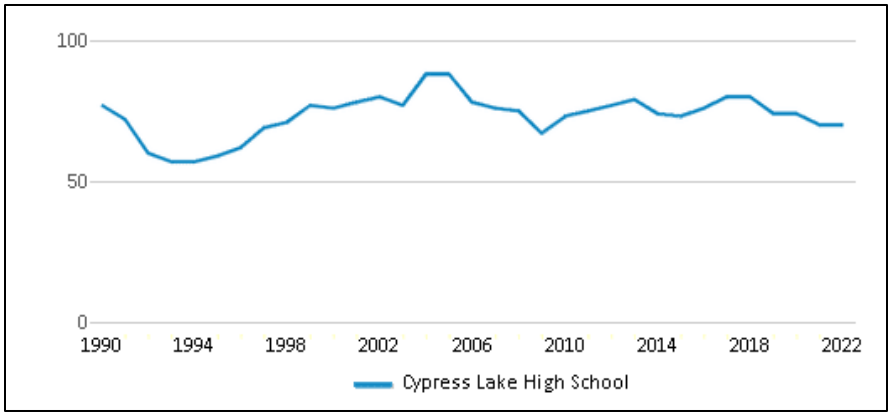

Figure 6. Cypress Lake High School Teacher Population
Note. Public School Review Demographics for Cypress Lake High School.[129]

[128] "Cypress Lake High School (2023-24 Ranking) Fort Myers, FL," Public School Review, accessed November 16, 2023, http://www.publicschoolreview.com/cypress-lake-high-school-profile.

[129] Ibid.

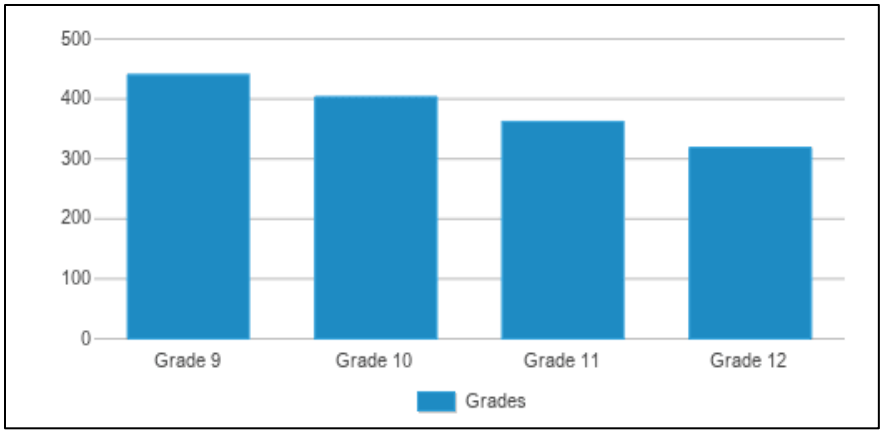

Figure 7. Cypress Lake High School Student Population Per Grade
Note. Public School Review Demographics for Cypress Lake High School.[130]

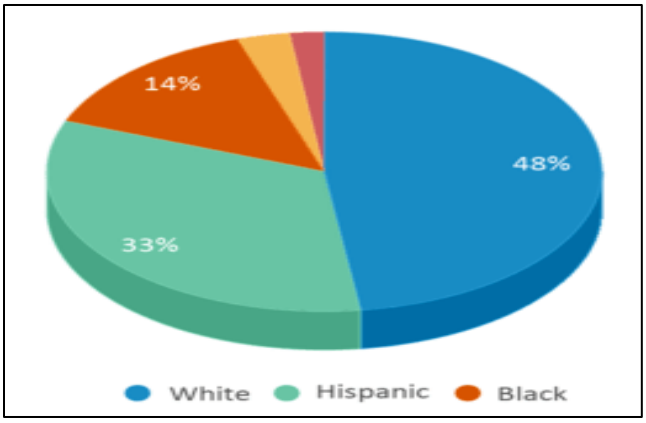

Figure 8. Cypress Lake High School Ethnic Demographic
Note. Public School Review Demographics for Cypress Lake High School.[131]

South Fort Myers High School is a comprehensive high school that caters to the academic needs of 1,854 students across grades 9 to 12. With a student-to-teacher ratio of 20:1, South Fort Myers High School strives to maintain smaller class sizes to ensure personalized attention and practical instruction. One notable aspect of South Fort Myers High School is its commendable

[130] "Cypress Lake High School (2023-24 Ranking) Fort Myers, FL," Public School Review, accessed November 16, 2023, http://www.publicschoolreview.com/cypress-lake-high-school-profile.

[131] Ibid.

commitment to diversity and inclusion. Most of the student body at the school consists of minority students, with Hispanic students comprising the majority. With 82% minority enrollment, the school surpasses the Florida state's average of 64%. South Fort Myers High School recognizes diversity's value in education and actively promotes an inclusive environment where all students feel valued and respected.[132] See figures below for demographic information.

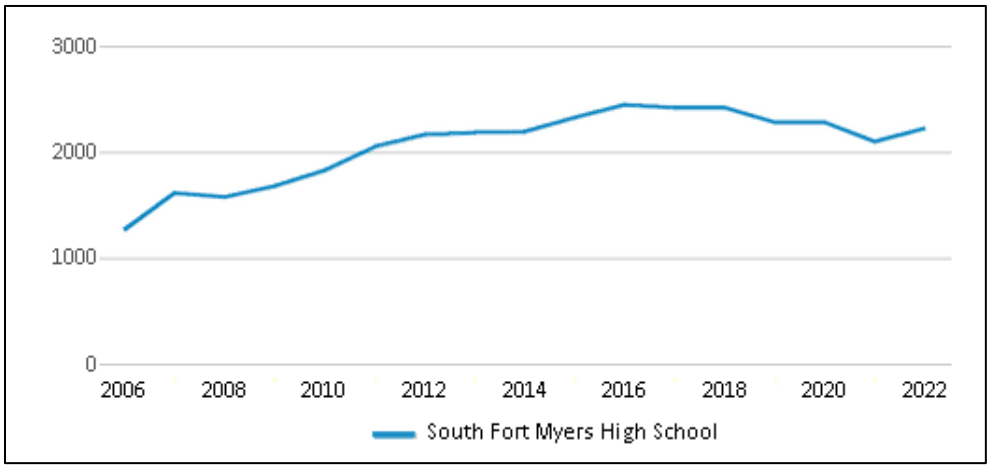

Figure 9. South Fort Myers High School Student Population
Note. Public School Review Demographics for South Fort Myers High School.[133]

[132] "South Fort Myers High School (2023-24 Ranking) Fort Myers, FL," Public School Review, accessed November 16, 2023, https://www.publicschoolreview.com/south-fort-myers-high-school-profile.

[133] Ibid.

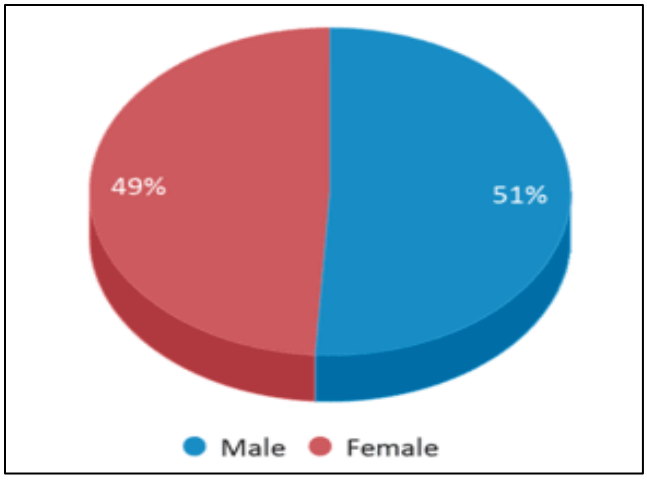

Figure 10. South Fort Myers High School Gender Percentage
Note. Public School Review Demographics for South Fort Myers High School.[134]

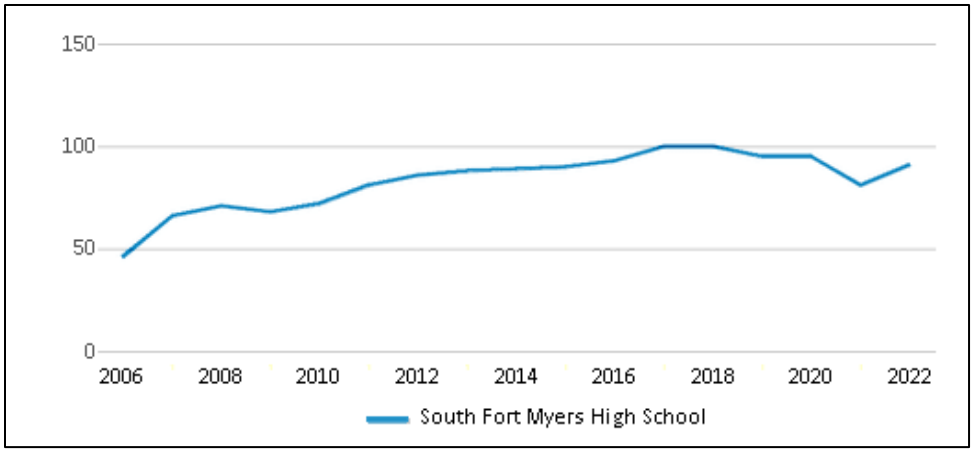

Figure 11. South Fort Myers Teacher Population
Note. Public School Review Demographics for South Fort Myers High School.[135]

[134] "South Fort Myers High School (2023-24 Ranking) Fort Myers, FL," Public School Review, accessed November 16, 2023, https://www.publicschoolreview.com/south-fort-myers-high-school-profile.

[135] Ibid.

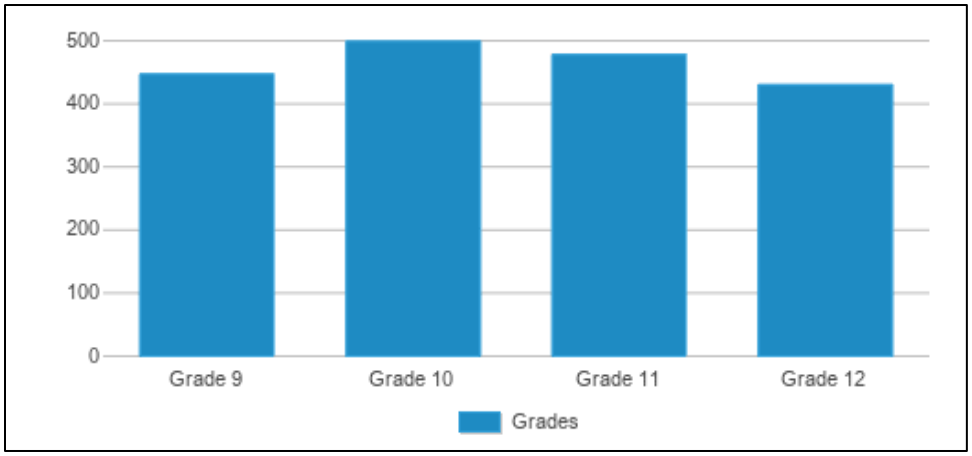

Figure 12. South Fort Myers High School Student Population Per Grade
Note. Public School Review Demographics for South Fort Myers High School.[136]

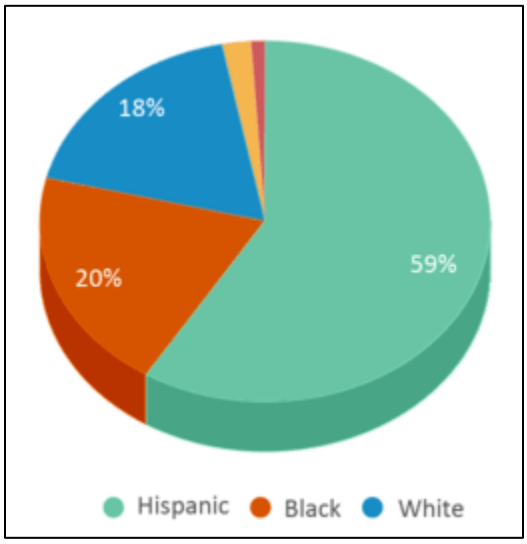

Figure 13. South Fort Myers High School Student Demographic Percentage
Note. Public School Review Demographics for South Fort Myers High School.[137]

[136] "South Fort Myers High School (2023-24 Ranking) Fort Myers, FL," Public School Review, accessed November 16, 2023, https://www.publicschoolreview.com/south-fort-myers-high-school-profile.

[137] Ibid.

Instrumentation

The Kenny Music Performance Anxiety Inventory (K-MPAI) is a comprehensive tool comprising forty items that assess anxiety in music performance based on an emotion-based theory. These items encompass various theoretical constructs proposed by Barlow, including the evocation of anxious thoughts such as uncontrollability and unpredictability, negative affect, attentional shifts related to situational cues, fear of negative evaluation, physiological arousal, and memory. There is a seven-point Likert scale for each of the items (0 = strongly disagree to 6 = strongly agree), with higher scores indicating more severe music performance anxiety (MPA) and depression on average. For the present study, the scores ranged from 39 to 185. On average, each survey took 25 minutes to administer.[138]

The K-MPAI provides valuable insights into the complex nature of anxiety in music performance. By assessing different dimensions of MPA and its underlying factors, this inventory offers a comprehensive approach to understanding the psychological distress experienced by musicians. It is an essential tool for researchers and practitioners in music psychology to comprehend better and address performance-related anxieties.[139]

Initial studies of the factorial structure of the K-MPAI involved a group of 379 professional orchestral musicians in Australia and 159 tertiary music students in New Zealand. Six factors identified the orchestral musicians through exploratory factor analysis with varimax rotation. These factors included proximal somatic anxiety and worried about performance; negative cognitions focused on self/another scrutiny, depression/hopelessness as psychological

[138] Dianna Theadora Kenny, "The Kenny Music Performance Anxiety Inventory (K-MPAI): Scale Construction, Cross-Cultural Validation, Theoretical Underpinnings, and Diagnostic and Therapeutic Utility," *Frontiers in Psychology* 14, (2023).

[139] Ibid.

vulnerability, parental empathy, concerns with memory, the generational transmission of anxiety, anxious apprehension (a weaker factor), and one item for biological vulnerability. Using Cronbach's alpha coefficient (α = 0.94), the researcher could accurately assess the internal consistency of tertiary-level music students.[140]

Anxiety measure	Sex	*N*	Mean	*SD*	Min	Max	*F*	Sig.
K-MPAI	Male	182	75.95	36.3	6	185	13.24	0.001
	Female	191	91.15	43.33	7	210		
	Total	373	83.73	40.72	6	210		

Figure 14. Australian Research Results for Kenny Music Performance Anxiety Inventory Per Gender
Note - Means, *SD*, minimum and maximum scores, *F* tests, and *p* values by sex.[141]

The Brazilian research aims to assess the validity of the Kenny Music Performance Anxiety Inventory (K-MPAI) in its Brazilian version. A sample of 230 amateur musicians was selected to complete the K-MPAI. The initial factor analysis identified eight factors, which accounted for 62.4% of the variance. However, due to the weak internal consistency values and factor composition, three factors were determined based on theoretical propositions and symptomatology aspects that guided the scale's construction. These factors were labeled as "Worries and insecurity" (α = 0.82), "Depression and hopelessness" (α = 0.77), and "Early parental relationships" (α = 0.57). Before the factorial analysis, a Kaiser-Meyer-Olkin

[140] Dianna Kenny, Tim Driscoll, and Bronwen Ackermann, "Psychological Well-Being in Professional Orchestral Musicians in Australia: A Descriptive Population Study," *Psychology of Music* 42, no. 2 (2012): 210–32, https://doi.org/10.1177/0305735612463950.

[141] Ibid., 210.

measurement calculated the test sample adequacy, yielding a favorable outcome (0.81). Additionally, Bartlett's test indicated statistical significance ($\chi 2 = 1364.43$, $p < 0.001$).[142]

Procedures

The researcher employed the Kenny Music Performance Anxiety Inventory (K-MPAI) as a tool for data collection. The instrument was carefully reproduced in Word to ensure the participants could easily understand and respond to the survey questions. During this process, close attention to formatting allowed for more precise details, such as the spacing between questions and answers. As a result, the survey presented more accurately and organized, making it easier for the participants to provide thoughtful and meaningful responses. It was necessary to modify the survey instrument to incorporate a question related to students' involvement duration in performing arts classes to maintain reliability and validity. This variable assessed whether students had been engaged in weekly meetings and had opportunities to serve for several years.[143]

To maintain the confidentiality of the participants, surveys were conducted using traditional pen-and-paper methods. To ensure anonymity and privacy, each participant received a similar writing instrument. A cover sheet accompanying each survey included a copy of the participant's consent form. It explicitly stated that participation was voluntary and that individuals had the right to decline at any time before indicating their consent and commencing the survey.

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[142] Ana Elisa Barbar, José Alexandre Souza, and Flávia de Osório, "Exploratory Factor Analysis of Kenny Music Performance Anxiety Inventory (K-MPAI) in a Brazilian Musician Sample," *Archives of Clinical Psychiatry (São Paulo)* 42, no. 5 (2015): 113–16, https://doi.org/10.1590/0101-60830000000060.

[143] Dianna T. Kenny, Essay, In *The Psychology of Music Performance Anxiety* (Oxford University and Press, 2011).

A range of approvals were necessary before commencing the research. The researcher first submitted a formal request to the District School Board of Lee County to conduct a study involving students enrolled in their secondary high school music programs. Liberty University's IRB Committee reviewed and approved this request. This study comprised 2023-2024 data. Additionally, it was necessary to obtain permission from the ensemble's directors to use class time for data collection through email.

Significantly, participants had ample opportunity to understand and exercise their rights before participating in the study. The survey's introduction occurred by email one week before its implementation in class, allowing participants' guardians to receive and comprehend the consent form outlining their right to decline participation if desired. The consent form was read as a script before participants were allowed to begin. Survey data only came from those who completed the designated documents with explicit consent.

The researcher manually collected the surveys in class and identified each participant with numbers from 1 to 87. The data contain no student information. The data review ensures it is free from spelling, grammar, and punctuation errors. The researcher transferred the scores using a Microsoft Excel spreadsheet, facilitating the categorization of different questions and efficiently calculating overall scores. After organizing the data, the variable information collected was transferred into the Statistical Package for the Social Sciences (SPSS) student edition, the statistical software program. The researcher securely stored the data on a password-protected computer in a locked office. This research study will preserve the data for five years following its conclusion.

Data Analysis

A multiple regression analysis effectively measures the relationship between the criterion variable of years of instrumental music experience and the possible prediction of a reduction in general anxiety symptoms. This type of analysis is most appropriate for the research question as it allows the researcher to determine the strength and direction of the relationship between involvement in instrumental performing arts and a decrease in music performance anxiety. Additionally, it can identify potential predictive causality between predictor and outcome variables, providing insights into each predictor variable's validity.

Dianna Kenny utilizes multiple regression analysis to examine whether the factorial structure remains robust across different populations of musicians with varying levels of expertise. She collected K-MPAI scores from 455 Peruvian tertiary music students (*mean* age = 21.19 years, *SD* = 3.13, range = 18–40 years) and 368 Australian professional orchestral musicians (mean age = 42.07 years, SD = 10.21, range = 18–68 years). Employing a high-order exploratory factor analysis with the Schmid-Leiman solution, she identified one high-order factor and two first-order factors for both samples using the Unweighted Least Squares extraction method and optimal implementation of parallel analysis.[144]

A comprehensive analysis identified all values and accurate entries within the data. To ensure the statistical software's accuracy and reliability, the SPSS student version performed various tests. Scatter plots examine the presence of bivariate outliers and determine if a linear relationship existed between predictor variables and combinations of both predictor and criterion variables. This linear relationship was crucial in determining the statistical power of the test.

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[144] Ana Elisa Barbar, José Alexandre Souza, and Flávia de Osório, "Exploratory Factor Analysis of Kenny Music Performance Anxiety Inventory (K-MPAI) in a Brazilian Musician Sample," *Archives of Clinical Psychiatry (São Paulo)* 42, no. 5 (2015): 113–16, https://doi.org/10.1590/0101-60830000000060.

Each pair of predictor variables (x, x), as well as between predictor variables (x) and criterion variable (y), were plotted in scatter plots with a specific focus on identifying any potential linear relationships.[145]

It is crucial to assess the presence of multicollinearity among predictor variables to ensure that they are not excessively similar. The objective was to establish if each predictor variable (x) exhibited a high correlation with another predictor variable (x), as this would result in redundant information about the criterion variable. The coefficients table generated in the SPSS output displays all variance inflation factors (VIFs), which indicate potential multicollinearity. If a VIF exceeds 10, it suggests a violation of the assumption.[146]

After confirming all assumptions and conducting a rigorous multiple regression analysis, the researcher found evidence to support a tentative predictive relationship between the criterion variable, the duration of instrumental music experience, and the potential reduction in general anxiety symptoms. Research shows that years of instrumental music performance can have an impact on reducing generalized anxiety disorder (GAD) scores. To evaluate the significance of this impact, we looked at the R2 statistic. The findings suggest that the coefficient related to years of instrumental music performance attributed to a notable decrease in GAD scores. Determining whether to accept or reject the null hypothesis required a confidence level of 95%, with a significance level of $\alpha = .05$, commonly used in multiple regression analysis. This analysis provides valuable insights into the potential role of instrumental music experience in reducing

[145] "Linear Regression," *Applied Univariate, Bivariate, and Multivariate Statistics*, (2021), 232–85, https://doi.org/10.1002/9781119583004.ch7.

[146] Ibid., 233.

general anxiety symptoms. It contributes to the understanding of the relationship between music and mental health.[147]

[147] Linear Regression," *Applied Univariate, Bivariate, and Multivariate Statistics* (2021), 232–85, https://doi.org/10.1002/9781119583004.ch7.

Chapter Four: Findings

This chapter presents the findings of the data analysis for this study. The study aims to explore the possibility of predicting changes in general anxiety disorder by examining the relationship between instrumental music experience and improvement in musical performance anxiety. This quantitative, predictive correlational study analyzes five predictor variables and one criterion variable. The predictor variables include factors such as the amount of instrumental music experience, the level of improvement in musical performance anxiety, and potentially other relevant variables. The criterion variable measures the changes in general anxiety disorder. The study's results include detailed descriptive statistics regarding the predictor and criterion variables and the statistical analysis conducted to determine their relationship. This analysis provides valuable insights into the potential effects of instrumental music experience and improvement in musical performance anxiety on general anxiety disorder. Overall, this chapter serves as a comprehensive examination of the data collected in the study, identifying the potential predictive power of these variables.

Research Question and Hypothesis

The following research question guided this study:

RQ: How accurately can expected changes in general anxiety disorder be predicted from a linear combination of instrumental music experience and improvement in musical performance anxiety?

The null hypothesis for this study was:

H_0: Expected changes in general anxiety disorder cannot be predicted from a linear combination of instrumental music experience and improvement in musical performance anxiety.

Descriptive Statistics

Secondary school students comprised the population. All students participating must be enrolled in high school and also enrolled in an instrumental performance class. The students' grades ranged from ninth to twelfth grade. The number of anonymous participants totaled 87. This satisfied the required minimum sample size of 66, assuming a minimum effect size with a statistical power of .7, $\alpha = .05$.

The descriptive statistics for the predictor variables are consistent years of instrumental music (YearsEXP), proximal somatic anxiety and worry about performance (S1), worry or dread (S2), memory (S5), and biological vulnerability (S8). The generalized anxiety disorder score total (GAD_TOT) is the continuous criterion variable. The portfolio review noted a sample size of ($N = 87$), as depicted in Table 1. The general anxiety disorder (GAD) score comprised the total sum of four sections of the Kenny Music Performance Anxiety Inventory. These sections, S3, S4, S6, and S7, comprise the GAD score. For the criterion variable, scores on the portfolio reviews ranged between 23 and 82, with a mean score of 53.

Table 1. Descriptive Statistics

Group	*N*	*Mean*	*Std. Deviation*
GAD_TOT	87	53.63	13.022
YearsEXP	87	4.94	22.607
S1	87	35.83	14.041
S2	87	21.71	10.958
S5	87	6.51	3.766
S8	87	11.75	1.900

N*ote.* SPSS Predictor variables: consistent years of instrumental music (YearsEXP), proximal somatic anxiety and worry about performance (S1), worry or dread (S2), memory (S5), and

biological vulnerability (S8); Criterion variable: generalized anxiety disorder score total (GAD_TOT).

Assumptions Testing

Multiple regression analysis is a statistical technique widely used in various fields. It allows researchers to understand the relationship between a dependent variable and multiple independent variables. However, to ensure the reliability and validity of the analysis, it is crucial to consider certain assumptions. These assumptions include linearity, independence of errors, homoscedasticity, normality of residuals, and absence of multicollinearity. Each of these assumptions is essential in ensuring that the analysis results are valid and accurate. By carefully considering these assumptions, the researcher can identify and address potential issues during the analysis, ultimately leading to a more robust and trustworthy data pool.

The initial analysis of a statistical model often involves examining the Durbin-Watson score, which measures the presence of autocorrelation among residuals. In the context of this analysis, the Durbin-Watson score was found to be 1.998, suggesting no correlational relationships between the residuals, indicating a random pattern. The score ranges between 0 and 4, with a value of 2 indicating no autocorrelation. Thus, the obtained score of 1.998 is close to the ideal value of 2, affirming the absence of any significant correlational relationships among the residuals. The lack of autocorrelation is crucial in statistical analysis, as it ensures that the estimated coefficients of the independent variables are unbiased and reliable. If autocorrelation were present, it would indicate that the model is mis-specified and that there are still unexplained patterns in the data. This would require further investigation and potentially more sophisticated modeling techniques.

A total of 7 scatter plots depicted the relationship between each pair of predictor variables (x, x) and the criterion variable (y). One can determine the presence of linearity by analyzing the

scatter plot matrix. Upon inspection, all pairs of variables exhibited a linear connection, excluding the standardized protected variable and residual plot. Therefore, based on these data, the assumption of a linear relationship is tenable. See the figure below for a visual representation of trendlines.

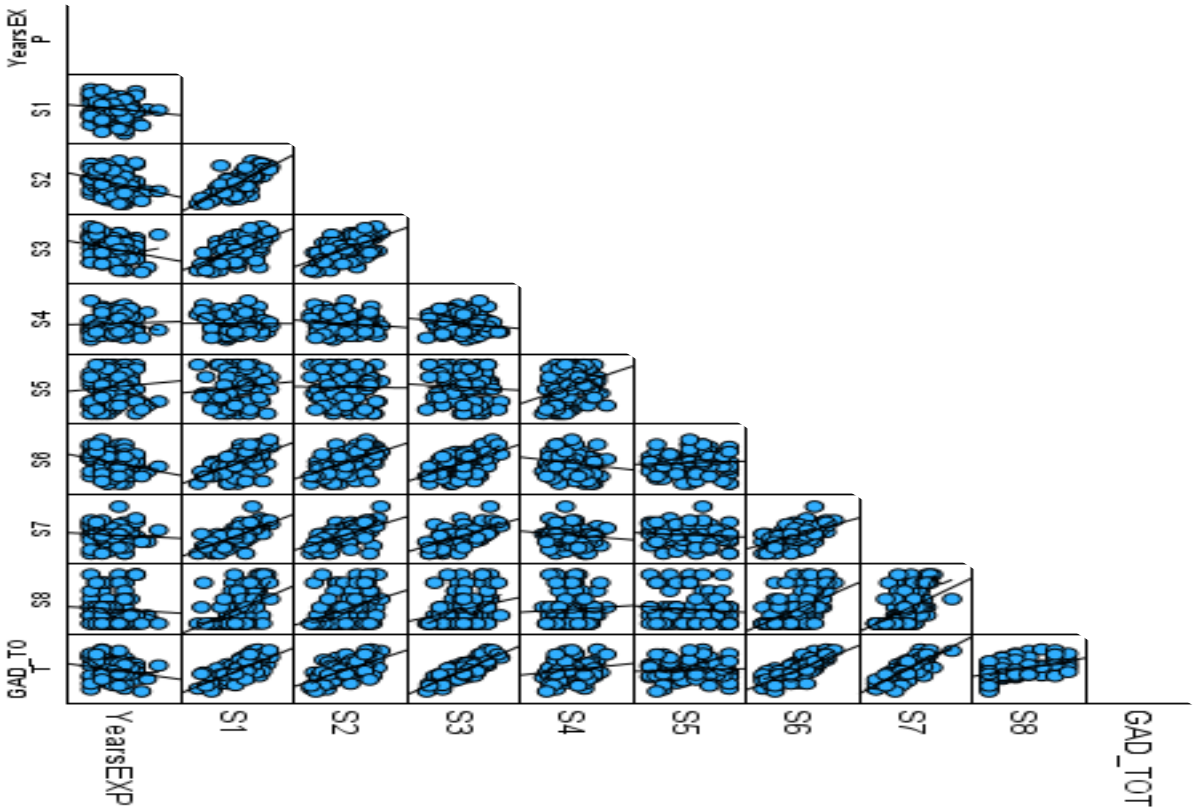

Figure 15. SPSS Scatterplot Matrix with Trendlines

Apart from generating scatter plots to evaluate the assumption of multivariate normal distribution, the researcher also computed the variance inflation factor (VIF) to assess the assumption of non-multicollinearity. The VIF values were all below 10, indicating no significant multicollinearity issues. However, a significant correlation exists between predictor variable S1 and predictor variable S2, which slightly violates the assumption. However, considering the

overall analysis, this assumption is primarily tenable. For a visual representation of these results, refer to Table 2 below.

Table 2. Collinearity Of Statistic

Model	Unstd.B	Coefficients Std. Error	Std. Coefficients Beta	t	Sig.	Collinearity Tolerance	Statistics VIF
GAD_TOT	32.911	3.790		8.684	<.001		
YearsEXP	-.527	.396	-.106	-1.331	.187	.890	1.123
S1	.450	.112	.485	4.004	<.001	.382	2.620
S2	.186	.142	.157	1.314	.193	.395	2.532
S5	.149	.267	.043	.561	.577	.942	1.061
S8	1.255	.577	.183	2.173	.033	.790	1.266

Note. SPSS Predictor variables: consistent years of instrumental music (YearsEXP), proximal somatic anxiety and worry about performance (S1), worry or dread (S2), memory (S5), and biological vulnerability (S8); Constant variable: generalized anxiety disorder score total (GAD_TOT).

Results

This analysis aimed to determine if changes in general anxiety disorder could be predicted based on a linear combination of instrumental music experience and improvement in musical performance anxiety. The results were statistically significant ($R^2 = .54$, $F = 19.44$, $p = .001$), indicating a relationship between the predictor variables and improved general anxiety disorder scores. Approximately 54% of the variance in general anxiety disorder scores can be attributed to the introduction of each predictor variable. Specifically, variables S1 and S8 most significantly affected the criterion variable. Overall, the findings lead to rejecting the null

hypothesis as there is evidence for instrumental music experience's predictive nature and improvement in musical performance anxiety on general anxiety disorder.

The effects of the five predictor variables and the one criterion variable were measured via regression coefficients. The coefficients analysis revealed essential findings regarding the relationship between predictor variables and generalized anxiety disorder scores. Consistent years of instrumental music (YearsEXP), worry or dread (S2), and Memory (S5) were not significantly predictive. However, proximal somatic anxiety and worry about performance (S1) and biological vulnerability (S8) demonstrated significant predictive anxiety scores. ((S1) p= <.001, (S8) p = .03). For a visual representation of these results, refer to Table 5 below.

Table 3. Regression Model Results

Model Summary b					
Model	*R*	R^2	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.739a	.546	.518	9.041	1.998

Note. SPSS Predictor variables: consistent years of instrumental music (YearsEXP), proximal somatic anxiety and worry about performance (S1), worry or dread (S2), memory (S5), and biological vulnerability (S8); Criterion variable: generalized anxiety disorder score total (GAD_TOT).

Table 4. ANOVA

Model	Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Regression	7960.767	5	1592.153	19.477	<.001b
Residual	6621.463	81	81.746		
Total	14582.230	86			

Note. Predictor variables: consistent years of instrumental music (YearsEXP), proximal somatic anxiety and worry about performance (S1), worry or dread (S2), memory (S5), and biological vulnerability (S8); Constant variable: generalized anxiety disorder score total (GAD_TOT).

Table 5. Regression Model Coefficients

Model	Unstd. B	t	Sig.	Statistics VIF
YearsEXP	-.527	-1.331	.187	1.123
S1	.450	4.004	<.001	2.620
S2	.186	1.314	.193	2.532
S5	.149	.561	.577	1.061
S8	1.255	2.173	.033	1.266

Note. SPSS Predictor variables: consistent years of instrumental music (YearsEXP), proximal somatic anxiety and worry about performance (S1), worry or dread (S2), memory (S5), and biological vulnerability (S8); Constant variable: generalized anxiety disorder score total (GAD_TOT).

Cohen's f^2 (R^2 / (1 - R^2)) is a popular measure used in statistical analysis to assess the effect size of a particular variable. It is derived by dividing the coefficient of determination, R^2 (R^2 = .54), by one minus the coefficient of determination, 1 - R^2 (.46). This ratio provides insight into the proportion of variance in the dependent variable that can be attributed to the independent variable. [f^2 (.54/ (1 - .54= .46)), f^2 = .24] Cohen's classification system, $f^2 \geq 0.02$, $f^2 \geq 0.15$, and $f^2 \geq 0.35$ correspond to small, medium, and large effect sizes. In this model, Cohen's f^2 is given a value of .24. This means that the independent variable can explain approximately 24% of the variance in the dependent variable. This effect size can be considered moderate, as it is neither particularly strong nor weak. Cohen's f^2 is a valuable tool in research and can help researchers understand the significance and impact of their findings. Providing a standardized estimate of the

effect size allows for comparisons across studies and provides a measure of the practical importance of the relationships being examined.[148]

[148] Jacob Cohen, *Statistical power analysis for the behavioral sciences*, 2nd ed. (Hillside, NJ: Lawrence Erlbaum Associates 1988)

Chapter Five: Conclusions

Overview

This chapter will explore the implications of the data analysis conducted for this study. The main focus of this study was to examine the potential for predicting changes in general anxiety disorder by exploring the relationship between instrumental music experience and improvements in musical performance anxiety. The researcher utilized a quantitative, predictive correlational approach to achieve this objective. This approach involved analyzing the relationship between five predictor variables and one criterion variable. This chapter presents and discusses the research findings and outlines their implications. Throughout the study, notes of any limitations provide well-informed recommendations for future research endeavors. This analysis provides a comprehensive understanding of the data and their potential influence on the profession.

Discussion

This study investigates the potential for predicting changes in general anxiety disorder through an examination of the relationship between instrumental music experience and improvements in musical performance anxiety. The research approach implemented in this study was a quantitative, predictive correlational design. The current study incorporates an analysis of five predictor variables, including the participation of consistent years of instrumental music (YearsEXP), proximal somatic anxiety and worries about performance (S1), worry or dread (S2), memory (S3), and biological vulnerability (S4). The continuous criterion variable for this study is the generalized anxiety disorder score total (GAD_TOT), measured via the Kenny Music Performance Anxiety Inventory.[149] By exploring these variables and their relationship to general

[149] Dianna Theadora Kenny, "The Kenny Music Performance Anxiety Inventory (K-MPAI): Scale Construction, Cross-Cultural Validation, Theoretical Underpinnings, and Diagnostic and Therapeutic Utility," *Frontiers in Psychology* 14, (2023): 1143359-1143359.

anxiety disorder, this study contributes to a greater understanding of the instrumental music experience on individuals' mental well-being. All students in this study are enrolled in a high school instrumental performance class. The participants ranged from ninth grade to twelfth grade. Participation in the survey was voluntary and anonymous to ensure the confidentiality of the responses.

The null hypothesis stated that there would be no significant predictive relationship between the generalized anxiety disorder score total (GAD_TOT) and a combination of predictor variables, which include consistent years of instrumental music (YearsEXP), proximal somatic anxiety, and worry about performance (S1), worry or dread (S2), memory (S3), and biological vulnerability (S4). However, based on the results, the researcher rejected this null hypothesis. Assessing the model's overall fit is crucial to begin interpreting the results. This is determined by examining the R-squared value, which represents the proportion of variance in the dependent variable explained by the independent variables. A higher R-squared value suggests a better fit of the model to the data.[150]

The regression model showed that the overall regression was statistically significant (R^2 = .54, F = 19.44, p = .001). The R^2 shows that 54% of the general anxiety disorder scores benefited from introducing each independent variable. These findings not only led to rejecting the null hypothesis but also provided evidence for how instrumental music experience and improvement in musical performance anxiety predicted decreased general anxiety disorder scores.

The R^2 value of .54 indicates that the variables can explain approximately 54% of the variation in the overall regression. A moderate level of predictability indicated that the predictor variables significantly affected the determination of the general regression. The F-value is a

[150] John Smith, "Multiple Regression Analysis of the Relationship Between X and Y," *Journal of Statistics* 5 (2023): *23–45*.

measure of the overall fit of the model. In this case, the $F = 19.44$, suggesting the model provided a statistically significant fit to the data and the relationship between the predictor and criterion variables was not due to chance. Examine the p-values associated with each coefficient. These values indicate the probability of observing a coefficient as significant as the one in the sample data, assuming that the actual coefficient is zero. A p-value less than 0.05 is typically statistically significant, indicating that the coefficient is unlikely to be zero in the population.[151]

Finally, the $p = .001$ reinforces the regression model's statistical significance. The *p*-value represents the probability of observing the data given that the null hypothesis is true. In this case, there is a very low probability that the relationship between the notable correlations between the duration of involvement in instrumental performing arts and a decrease in music performance anxiety and overall regression is due to chance alone.

Therefore, one can confidently conclude that the relationship is statistically significant. The regression model has shown that the variables significantly affect the overall consistency of the criterion variable. These variables explain approximately 54% of the variation in general regression. The statistical significance of the model, as indicated by the *F*-value and *p*-value, further supports the relationship. This analysis provides valuable insights into the factors contributing to the overall regression.

Implications

The implications of the regression model ($R^2 = .54$, $F = 19.44$, $p = .001$) in predicting the reduction of general anxiety scores are significant. These statistical measures provide essential information about the relationship between the independent and dependent variables.

[151] John Smith, "Multiple Regression Analysis of the Relationship Between X and Y," *Journal of Statistics* 5 (2023): 23–45.

Interventions encompassing the use of music and rhythm have the potential to go beyond simply providing entertainment or enjoyment. These interventions can foster integration, regulate emotions, and promote attunement within individuals. This is particularly important when it comes to alleviating stress, anxiety, and depression. Often, traditional forms of communication, such as language, may not effectively address the disorganized emotions and sensations associated with trauma. Music and expressive arts strategies can break through these limitations and reach individuals deeper in these situations. Their nonverbal nature allows for a more direct connection with the emotions and experiences of the individual. This is especially crucial in the context of traumatic stress, where dynamic and multisensory approaches are necessary for effective healing.[152]

The implications of these statistical measures suggest that the predictor variables significantly reduce general anxiety disorder scores. However, correlation does not imply causation. While the model establishes a statistically significant relationship between the predictor and criterion variables, it does not provide evidence of a causal relationship. To further understand the implications of the regression model, one must consider the specific predictor variables included in the analysis. By examining the coefficients associated with each predictor variable, it is possible to determine the strength and direction of the relationship.

The implications of these results are crucial for understanding the influence of music performance anxiety on general anxiety symptoms. This study suggests that individuals who experience higher levels of music performance anxiety are more likely to experience elevated levels of general anxiety symptoms. Understanding this relationship between music performance

[152] Carina Freitas et al., "Music Therapy for Adolescents with Psychiatric Disorders: An Overview," *Clinical Child Psychology and Psychiatry* 27, no. 3 (2022): 895–910, https://doi.org/10.1177/13591045221079161.

anxiety and general anxiety symptoms presents important implications for both musicians and mental health professionals. These findings emphasize the importance of mental health, as this study indicates that anxiety symptoms in one specific domain, music performance, can produce broader implications for overall anxiety levels. Addressing music performance anxiety may not only improve the individual's well-being with performing music but also positively affect his or her general anxiety symptoms.

Grace Chen's Music and Brain Circuitry research explores the relationship between music and cognitive functions.[153] By studying human subjects, Chen explores the impact of musical involvement on various cognitive abilities. The findings reveal that individuals who engage in music-based interventions experience autonomic responses and a remarkable advancement in advanced executive function. Longitudinal studies have demonstrated that individuals with extensive musical training exhibit significant development in specific executive functions such as verbal intelligence, working memory, abstraction, and psychomotor speed. Moreover, these skills remain intact over time when an individual is involved in music-based interventions.

According to the findings of this study, Generalized Anxiety Disorder (GAD) scores tend to decrease around the third year of continuous engagement with instrumental music, as indicated in Figure 21. These results have significant implications, suggesting that students should begin their involvement in instrumental music no later than sixth grade in order to fully experience the therapeutic advantages of anxiety symptom reduction during their high school years. This period is crucial for students as they face increased academic pressure, social challenges, and personal growth. By starting instrumental music early, students can develop

[153] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

coping mechanisms, enhance their emotional well-being, and potentially mitigate the adverse effects of anxiety. The study's findings highlight the importance of incorporating instrumental music programs into the educational curriculum to promote mental health and support students' overall well-being during their crucial formative years.

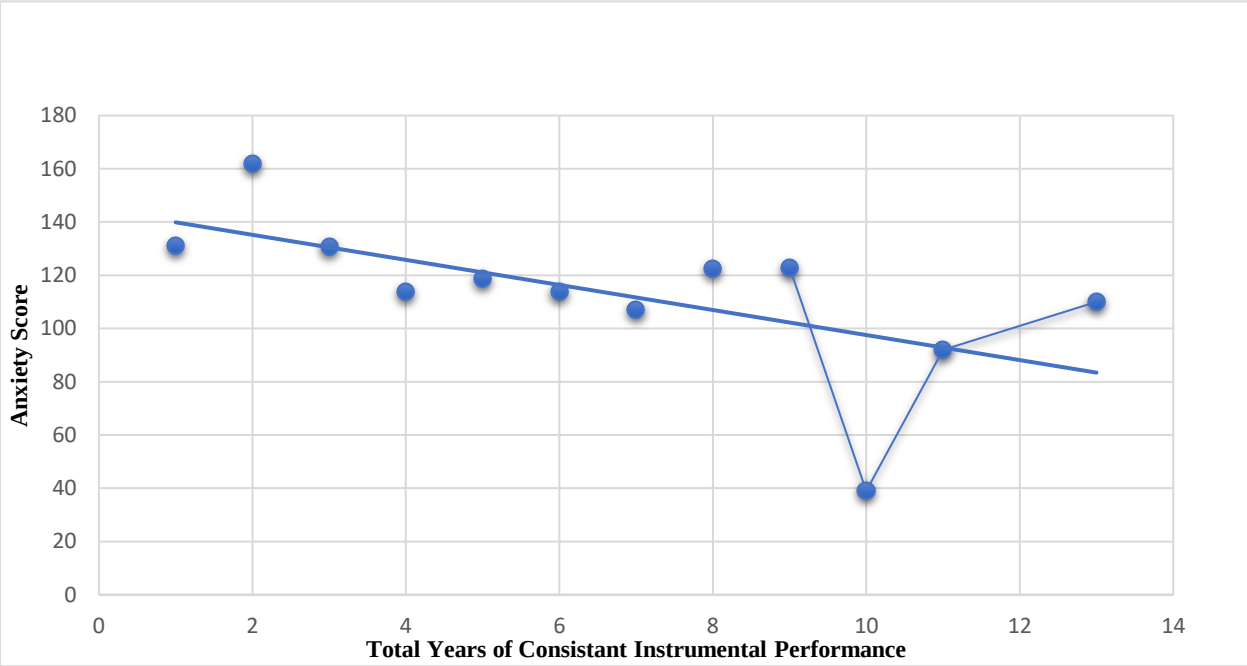

Figure 16. Average Music Performance Anxiety Score Based on Years of Consistent Instrumental Performance

Note – Raw data from the Kenny Music Performance Anxiety Inventory Excel spreadsheet.[154]

Limitations

There are certain limitations to consider when conducting a survey study on the effect of music performance anxiety on general anxiety disorder, particularly when the study is anonymous and voluntary. Respondents may feel more comfortable disclosing personal information if their identity is protected. However, this anonymity may also lead to individuals

[154] Dianna T. Kenny, Essay, *The Psychology of Music Performance Anxiety* (Oxford University and Press, 2011).

providing false or exaggerated responses, either to make themselves appear more or less anxious. This can affect the reliability and validity of survey data as responses may not accurately reflect the true prevalence of music performance anxiety and its influence on general anxiety disorder.

The voluntary nature of the survey can introduce selection bias. Only individuals who are interested or concerned about music performance anxiety and general anxiety disorder may choose to participate. This can result in a sample that is not representative of the general population or a specific target population, such as musicians or individuals with a history of anxiety disorders. Therefore, the survey findings may not be applicable or generalizable to the broader population. Additionally, the lack of control over participant characteristics and behaviors can affect the study's internal validity. Without the ability to ensure randomization or control for confounding variables, it becomes challenging to establish causal relationships between music performance anxiety and general anxiety disorder. Other factors, such as prior experience with anxiety disorders or individual coping mechanisms, may also influence the outcomes of the study.

Anonymous surveys may lack the opportunity to gather additional information or conduct follow-up interviews. In-depth interviews can provide contextual information and a deeper understanding of the experiences of individuals with music performance anxiety and general anxiety disorder. While these studies provide valuable insights into the relationship between instrumental music experience and improvement in musical performance anxiety, it is essential to acknowledge that individual experiences and factors can also influence anxiety levels. Factors such as self-esteem, perfectionism, and previous traumatic experiences can impact an individual's anxiety levels and their ability to cope with performance-related stress. Without this qualitative data, the study may lack a comprehensive perspective.

Another limitation of this study was the subject matter's intimidating nature. Although the researcher gained permission from the district school board to administer the study, the principals at the schools were uncomfortable with the focus on mental health. Although the student participants were very optimistic about the subject matter and even excited about the emphasis on their demographic, very few directors or administrators responded to inquiries about the data research.

Recommendations for Future Research

The study on the effect of music performance anxiety on general anxiety disorder is a significant topic in the music education and mental health professions. It explores the relationship between specific anxieties musicians experience during performances and the broader influence on their overall mental well-being. Although there is existing research on music performance anxiety, further investigation is still needed.[155] Future studies should focus on understanding the underlying mechanisms that connect music performance anxiety with general anxiety disorder. The investigation of physiological, cognitive, and emotional factors that contribute to the development and perpetuation of anxiety disorders is a critical mission. By identifying these mechanisms, researchers can develop more effective interventions and treatment strategies for individuals struggling with these conditions.

Recommendations that would increase the accuracy of further studies include the following:

[155] Wen Grace Chen et al., "Music and Brain Circuitry: Strategies for Strengthening Evidence-Based Research for Music-Based Interventions," *The Journal of Neuroscience* 42, no. 45 (2022): 8498–8507, https://doi.org/10.1523/jneurosci.1135-22.2022.

1. Although the study did meet the minimum participation requirements, a larger sample size would create a more precise and accurate representation of the research. A more comprehensive data analysis would help achieve higher confidence in the results.
2. Repeat the study with volunteer participants in the same demographic without anonymity. Removing anonymity would lessen the perception of possible bias or inaccurate responses.
3. Provide a detailed explanation of the methodology for calculating the participant's consistent years of music performance experiences. Although this was verbally explained, having written parameters for this criterion variable would add validity to the data. This would create a more reliable and replicable way of measuring the participant's experience level.
4. Conduct similar research that includes additional predictor variables such as gender identity or race. Examining the factors above would provide a more comprehensive understanding of their influence on the experience of music performance.
5. Repeat the study after improvements in assessment and participation involvement. The study can yield more accurate and reliable results by updating and refining the assessment methods and encouraging greater participation.
6. Broaden the research to include more music performing arts classes, such as chorus or marching band. This would provide a more comprehensive perspective on the influence of music performance experience across different contexts and settings. By including a more comprehensive range of music classes, the study can capture a more diverse sample and offer a more comprehensive understanding of the topic.

The research conducted has shown that instrumental music experience has a significant and positive impact on reducing musical performance anxiety and general anxiety symptoms. Multiple factors contribute to the process of learning and performing music. Regular exposure to performing allows individuals to become more comfortable in front of an audience and gradually decreases their anxiety levels. Additionally, playing a musical instrument produces a calming effect on individuals, helping to alleviate anxiety and promote a sense of relaxation and focus. Moreover, the presence and support of fellow musicians provide a strong sense of camaraderie and belonging, creating a supportive environment that helps to reduce anxiety. However, it is crucial to acknowledge that each individual's experiences and unique factors may influence their anxiety levels differently, and a generalized prediction for changes in general anxiety disorder may not be entirely foreseeable.

Therefore, it is necessary to consider these individual differences when considering the influence of instrumental music experience on general anxiety reduction. Further research in this field is essential to gain a more comprehensive understanding of the intricate relationship between instrumental music experience, music performance anxiety, and general anxiety symptoms. By exploring this concept further, researchers can discover more detailed insights and potentially develop targeted interventions that can effectively address and alleviate multiple forms of anxiety.

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Appendices

Appendix A

Kenny Music Performance Anxiety Inventory (K-MPAI) and scoring form

Survey # _____

Kenny Music Performance Anxiety Inventory (K-MPAI) and scoring form

Total number of years participating in an instrumental ensemble: ____ years

(6 Strongly Disagree to 0 Strongly Agree)

K_1	I generally feel in control of my life	6	5	4	3	2	1	0
K_2	I find it easy to trust others	6	5	4	3	2	1	0
K_3	Sometimes I feel depressed without knowing why	6	5	4	3	2	1	0
K_4	I often find it difficult to work up the energy to do things	6	5	4	3	2	1	0
K_5	Excessive worrying is a characteristic of my family	6	5	4	3	2	1	0
K_6	I often feel that life has not much to offer me	6	5	4	3	2	1	0
K_7	Even if I work hard in preparation for a performance, I am likely to make mistakes	6	5	4	3	2	1	0
K_8	I find it difficult to depend on others	6	5	4	3	2	1	0
K_9	My parents were mostly responsive to my needs	6	5	4	3	2	1	0
K_10	Prior to, or during a performance, I get feelings akin to panic	6	5	4	3	2	1	0
K_11	I never know before a concert whether I will perform well	6	5	4	3	2	1	0
K_12	Prior to, or during a performance, I experience dry mouth	6	5	4	3	2	1	0
K_13	I often feel that I am not worth much as a person	6	5	4	3	2	1	0
K_14	During a performance I find myself thinking about whether I'll even get through it	6	5	4	3	2	1	0
K_15	Thinking about the evaluation I may get interferes with my performance	6	5	4	3	2	1	0
K_16	Prior to, or during a performance, I feel sick or faint or have a churning in my stomach	6	5	4	3	2	1	0
K_17	Prior to, or during a performance, I feel sick or faint or have a churning in my stomach	6	5	4	3	2	1	0
K_18	I am often concerned about a negative reaction from the audience	6	5	4	3	2	1	0
K_19	Sometimes I feel anxious for no particular reason	6	5	4	3	2	1	0
K_20	From early in my music studies, I remember being anxious about performing	6	5	4	3	2	1	0
K_21	I worry that one bad performance may ruin my career	6	5	4	3	2	1	0
K_22	Prior to, or during a performance, I experience increased heart rate like pounding in my chest	6	5	4	3	2	1	0
K_23	My parents almost always listened to me	6	5	4	3	2	1	0

Survey # _____

K_24	I give up worthwhile performance opportunities	6	5	4	3	2	1	0
K_25	After the performance, I worry about whether I played well enough	6	5	4	3	2	1	0
K_26	My worry and nervousness about my performance interferes with my focus and concentration	6	5	4	3	2	1	0
K_27	As a child, I often felt sad	6	5	4	3	2	1	0
K_28	I often prepare for a concert with a sense of dread and impending disaster	6	5	4	3	2	1	0
K_29	One or both of my parents were overly anxious	6	5	4	3	2	1	0
K_30	Prior to, or during a performance, I have increased muscle tension	6	5	4	3	2	1	0
K_31	I often feel that I have nothing to look forward to	6	5	4	3	2	1	0
K_32	After the performance, I replay it in my mind over and over	6	5	4	3	2	1	0
K_33	My parents encouraged me to try new things	6	5	4	3	2	1	0
K_34	I worry so much before a performance, I cannot sleep	6	5	4	3	2	1	0
K_35	When performing without music, my memory is reliable	6	5	4	3	2	1	0
K_36	Prior to, or during a performance, I experience shaking or trembling or tremor	6	5	4	3	2	1	0
K_37	I am confident playing from memory	6	5	4	3	2	1	0
K_38	I am concerned about being scrutinized by others	6	5	4	3	2	1	0
K_39	I am concerned about my own judgement of how I will perform	6	5	4	3	2	1	0
K_40	I remain committed to performing even though it causes me great anxiety	6	5	4	3	2	1	0

Staci Hatmaker

Liberty University

School of *Music*

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Music Education

Survey # _____

K-MPAI© (Kenny, 2009, 2011) FACTORS	*SCORE*	*%*
1. ***Proximal somatic anxiety and worry about performance***		
K_10 Prior to, or during a performance, I get feelings akin to panic		
K_12 Prior to, or during a performance, I experience dry mouth		
K_14 During a performance I find myself thinking about whether I'll even get through it		
K_16 Prior to, or during a performance, I feel sick or faint or have a churning in my stomach		
K_22 Prior to, or during a performance, I experience increased heart rate like pounding in my chest		
K_26 My worry and nervousness about my performance interferes with my focus and concentration		
K_28 I often prepare for a concert with a sense of dread and impending disaster		
K_30 Prior to, or during a performance, I have increased muscle tension		
K_34 I worry so much before a performance, I cannot sleep		
K_36 Prior to, or during a performance, I experience shaking or trembling or tremor		
K_40 I remain committed to performing even though it causes me significant anxiety		
TOTAL/66		
2. Worry/dread (Negative cognitions) focused on self/other scrutiny		
K_7 Even if I work hard in preparation for a performance, I am likely to make mistakes		
K_15 Thinking about the evaluation I may get interferes with my performance		
K_18 I am often concerned about a negative reaction from the audience		
K_21 I worry that one bad performance may ruin my career		
K_25 After the performance, I worry about whether I played well enough		
K_32 After the performance, I replay it in my mind over and over		
K_38 I am concerned about being scrutinized by others		
K_39 I am concerned about my own judgment of how I performed		
TOTAL/48		
3. ***Depression/hopelessness (Psychological vulnerability)***		
K_1 I generally feel in control of my life (-)*		
K_2 I find it easy to trust others (-)*		
K_3 Sometimes I feel depressed without knowing why		
K_4 I often find it difficult to work up the energy to do things		
K_6 I often feel that life has not much to offer me		
K_8 I find it difficult to depend on others		
K_13 I often feel that I am not worth much as a person		
K_31 I often feel that I have nothing to look forward to		
TOTAL/48		
4. Parental empathy		
K_9 My parents were mostly responsive to my needs (-)*		
K_23 My parents always listened to me (-)*		
K_27 As a child, I often felt sad		
K_33 My parents encouraged me to try new things (-)*		
TOTAL/24		
5. Memory		
K_35 When performing without music, my memory is reliable (-)*		
K_37 I am confident playing from memory (-)*		
TOTAL/12		
6. Generational transmission of anxiety		
K_5 Excessive worrying is a characteristic of my family		
K_19 Sometimes I feel anxious for no particular reason		
K_29 One or both of my parents were overly anxious		
TOTAL/18		
7. Anxious apprehension		
K_11 I never know before a concert whether I will perform well		
K_17 Even in the most stressful performance situations, I am confident that I will perform well (-)*		
K_24 I give up worthwhile performance opportunities due to anxiety		
TOTAL/18		
8. Biological vulnerability		
K_20 From early in my music studies, I remember being anxious about performing **TOTAL/6**		
OVERALL TOTAL/240		

Appendix B

Research Permission Request Lee County

PERSONAL | PASSIONATE | PROGRESSIVE

THE SCHOOL DISTRICT OF LEE COUNTY
Kimberly Sass
Coordinator– Accountability, Research & Assessment
2855 Colonial Boulevard, Fort Myers, FL 33966 | [redacted]

Dear Donna-Ann,

Our District Research Committee has reviewed your proposed study, **THE EFFECTS OF HIGH SCHOOL INSTRUMENTAL MUSIC PERFORMANCE ANXIETY ON THE ACCELERATED RECOVERY OF SOCIAL ANXIETY**. After careful consideration and the additional information provided, the District has approved your request. Please note that the district requires a copy of your final research when completed.

Should you have any questions regarding the recommendations made by the review committee or need additional information, please feel free to contact me via email to [redacted]

Thank you for your interest in conducting research in The School District of Lee County.

Sincerely,

Kimberly Sass
Coordinator- Accountability, Research & Assessment

Appendix C

IRB Approval Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

July 19, 2023

Staci Hatmaker
Nathan Street

Re: IRB Approval - IRB-FY22-23-1331 THE EFFECTS OF HIGH SCHOOL INSTRUMENTAL MUSIC PERFORMANCE ANXIETY ON THE ACCELERATED RECOVERY OF SOCIAL ANXIETY

Dear Staci Hatmaker, Nathan Street,

We are pleased to inform you that your study has been approved by the Liberty University Institutional Review Board (IRB). This approval is extended to you for one year from the following date: July 19, 2023. If you need to make changes to the methodology as it pertains to human subjects, you must submit a modification to the IRB. Modifications can be completed through your Cayuse IRB account.

Your study falls under the expedited review category (45 CFR 46.110), which is applicable to specific, minimal risk studies and minor changes to approved studies for the following reason(s):

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.)

For a PDF of your approval letter, click on your study number in the My Studies card on your Cayuse dashboard. Next, click the Submissions bar beside the Study Details bar on the Study Details page. Finally, click Initial under Submission Type and choose the Letters tab toward the bottom of the Submission Details page. Your stamped consent form(s) and final versions of your study documents can be found on the same page under the Attachments tab. Your stamped consent form(s) should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document(s) should be made available without alteration.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

G. Michele Baker, PhD, CIP
Administrative Chair
Research Ethics Office

Appendix D

Recruitment Email

April 1, 2023

Kim Saas
Lee County Schools
[redacted]

Dear Kim Saas

As a graduate student in the School of Music at Liberty University, I am conducting research as part of my thesis and Doctor of Music Education degree requirements. The title of my research project is *The Effects of High School Instrumental Music Performance Anxiety on The Accelerated Recovery of Social Anxiety.* I am contacting you to gain permission to do an anonymous survey in high school instrumental classes. I have spoken with Dr. Shawn Bradley, and he has offered his classroom.

Participants will be asked to complete the attached anonymous survey. Participants will be presented with informed consent information before participating. Participating in this study is entirely voluntary, and participants are welcome to discontinue participation at any time.

Thank you for considering my request.

Sincerely,

Staci Hatmaker
Former Band Director at South Fort Myers HS
Doctoral Candidate

Appendix E

Parent Opt-Out Consent Form

Parental Opt-Out

Title of the Project:
THE EFFECTS OF HIGH SCHOOL INSTRUMENTAL MUSIC PERFORMANCE ANXIETY ON THE ACCELERATED RECOVERY OF SOCIAL ANXIETY

Principal Investigator: Staci Hatmaker - Doctoral Candidate
Department of Music Liberty University

Invitation to be part of a Research Study

Your child is invited to participate in a research study. To participate, he or she must be in high school and enrolled in an instrumental performance class. (Band/Orchestra) Taking part in this research project is voluntary and completely anonymous.

Please take time to read this entire form and ask questions before deciding whether to allow your child to take part in this research project.

What is the study about and why are we doing it?

The purpose of the study is to examine the challenges secondary students encounter in sustaining positive mental health and how the benefits of music performance anxiety in secondary school students can aid in the accelerated recovery of social anxiety.

What will participants be asked to do in this study?

If you agree to allow your child to be in this study, I will ask her or him to do the following:

1. Participate in an in-person anonymous survey referencing different types of anxiety. The survey will be in paper form and a pencil will be used to answer the question. We will use the first question as an example, so the format is understood. It should take approximately 20 minutes to complete the procedure listed.

How could participants or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society include aiding in the development of more positive mental health in secondary school-aged students.

What risks might you experience from being in this study?

The risks involved in this study are minimal, meaning they are equal to the risks you would encounter in everyday life.

How will personal information be protected?

The records of this study will be kept private. Research records will be stored securely, and only the researcher will have access to the records.

- Participant responses will be anonymous.
- Data will be stored on a password-locked computer and surveys in a locked drawer. After five years, all electronic records will be deleted, and all hardcopy records will be shredded.

How will participants be compensated for being part of the study?

Participants will not be compensated for participating in this study.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether to allow your child to participate will not affect your or his or her current or future relations with Liberty University. If you decide to allow your child to participate, she or he is free to not answer any question or withdraw at any time prior to submitting the survey without affecting those relationships.

What should be done if a participant wishes to withdraw from the study?

If you choose to withdraw your child from the study or your child chooses to withdraw, please inform the researcher that you or your child wishes to discontinue his or her participation and should not submit the study materials. Your child's responses will not be recorded or included in the study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study is Staci Hatmaker. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact her at sh[redacted]
You may also contact the researcher's faculty sponsor, Dr. Nathan Street [redacted]

Whom do you contact if you have questions about rights as a research participant?

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA, 24515; our phone number is 434-592-5530, and our email address is irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Opt-Out

If you would prefer that your child NOT PARTICIPATE in this study, please respond to this attached email opting out to your child's teacher or sign this document and send it in with your child by (TBD).

_____
Printed Child's/Student's Name

_____
Parent/Guardian's Signature Date