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Feasibility and Effectiveness of Self-Administered Mood Vectoring Playlists in the Treatment of Anxiety Symptoms

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FEASIBILITY AND EFFECTIVENESS OF SELF-ADMINISTERED MOOD VECTORING PLAYLISTS IN THE TREATMENT OF ANXIETY SYMPTOMS

By

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Abstract

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This is a mixed-methods pre-experimental clinical effectiveness trial that examines the effectiveness of a self-administered one-directional mood vectoring playlist in the management of symptoms of anxiety. This study used the Spielberger State Trait Anxiety Inventory, as well as a self-report Likert-type scale where participants rated their anxiety symptom severity, to explore the impact of the playlist intervention. Qualitative interviews sought to identify themes common among participants who were daily high responders and those who were daily low responders to the intervention in order to determine for whom this intervention would be most or least effective.

Management of anxiety symptoms is particularly important at the moment, as mental health concerns and levels of anxiety are rising amid coronavirus lockdowns and stay at home orders. This intervention has a strong basis in music therapy research, neurological research, and psychotherapy treatments that are effectively used in the management of anxiety symptoms. Findings indicated a significant relationship between the intervention and a reduction in both state and trait anxiety scores over the full two-week course of treatment ($p < 0.001$). There was also a significant relationship found from pre-listening to post-listening on a daily basis ($p = 0.003$). This study has a small sample size and results should be interpreted with caution, but this is an indication that further studies on this intervention are warranted.

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CHAPTER 1: INTRODUCTION

Anxiety is a condition that adults in America are experiencing at all-time high levels during the COVID-19 pandemic. In June of 2020, the CDC released a study indicating that 31% of adults reported experiencing acute symptoms of anxiety, while 26% of adults reported an increase in trauma/stressor-related disorder symptoms, 13% reported an increase in their substance use, and 11% seriously considered suicide (Czeisler et al., 2020). These are devastatingly high rates that are indicative of the impact that the pandemic and the requisite mitigation efforts have had on the prevalence of mental health conditions. While the vaccine has been approved and is being distributed stressors related to the pandemic, such as job loss, financial distress, relationship stress, and anxiety will linger for some time and this country will still be dealing with the social and emotional ramifications of the pandemic for many years to come.

While there are many routes to treat anxiety both pharmacological and non-pharmacological, skills-based therapies such as cognitive behavioral therapy and Dialectical Behavior Therapy are currently the gold standards for effective management of symptoms of dysregulated emotions, particularly anxiety (O'Toole et al., 2015; Moscovitch. et al., 2012; Sehatti et al., 2019; Neacsiu et al., 2014; Lothes II & Mochrie, 2017). Studies have also demonstrated that receptive music therapy interventions have the potential to stimulate neurological structures implicated in emotion regulation (Moore, 2013) and have been shown to be effective in the management of disorders featuring dysregulated emotions, including anxiety (de la Torre-Luque et al., 2017; Bidabadi & Mehryar, 2015; Landis-Shack et al., 2017; Carr et al.,2012; Beck et al., 2018). This study is a pre-experimental clinical feasibility trial examining

the effectiveness of one-directional mood vectoring playlists in the treatment of emotion dysregulation.

Background

Even before COVID-19 and the associated impact on the emotional lives of Americans, mental health conditions were concerningly prevalent, directly effecting 50% of Americans at some point in their lives (American Psychological Association, 2018). This is greater than the number of people who will at some point receive a diagnosis of cancer or coronary disease (American Cancer Society, 2018; American Heart Association, 2017), two of the health conditions responsible for the most adult deaths previous to the COVID-19 pandemic. The number of American adults currently diagnosed with an anxiety disorder is 31%, which matches the percentage of adults expected to experience anxiety at some point in their adulthood previous to the pandemic (CDC, 2020; American Psychiatric Association, 2013; National Institute of Mental Health, 2017). These numbers indicate that there will likely be a sharp increase in the percentage of adults who are diagnosed with an anxiety disorder at some point in their lives. In addition to anxiety, many of the most commonly diagnosed disorders include emotional dysregulation as one of the main diagnostic criteria (National Institute of Mental Health, 2017; American Psychiatric Association, 2015).

Symptoms of anxiety disorders can have a significant impact on a person's life, as well as their daily functioning. In addition to worry that the person finds difficult to control, they may also experience fatigue, restlessness, difficulty concentrating, muscle tension, irritability, and difficulty with sleep (American Psychiatric Association, 2015). These can cause difficulties in people's personal lives as well as their professional lives. There are also significant health risks associated with prolonged physiological symptoms of anxiety, including tachycardia, an increase

in blood pressure, and decreased heart rate variability (Johns Hopkins Medicine, 2021). These increase a person's risk of developing coronary disease, weakening of the heart muscle, risk of cardiac arrest, and risk of an acute heart attack.

As many people grapple with the mental health challenges they experience, it is likely that many will turn to music listening as a way to manage those struggles. In a survey study by Bautch (2019), 84% or participants stated that they currently use music listening as a way to assist them in regulating their emotions. For many people this is a healthy adaptive response to difficult circumstances. However, as McFerran et al. (2010) noted in their study, persons who are struggling emotionally often choose music that reinforces negative emotions and intensify rumination, worsening symptoms of anxiety and depression. This suggests that the creation of playlists to assist with symptoms of anxiety should occur under the supervision of a board-certified music therapist. The effectiveness of receptive music listening as a means of reducing levels of state anxiety was demonstrated in a study (De La Torre-Luque et al., 2017) where the treatment group showed significantly lower levels of state anxiety than the control group. Music therapy interventions were also shown to reduce symptoms of anxiety disorders, and to assist in management of the arousal symptoms in persons with a diagnosis of PTSD, which rely on the same neurological activation pattern as the anxiety response (Landis-Shack et al., 2017; Carr et al., 2012; Beck et al., 2018).

Receptive music therapy interventions have also demonstrated effectiveness in managing symptoms of emotional dysregulation (Baker et al., 2017; Plener et al., 2010; Strehlow, & Linder, 2016). Basic research into the neurological effects of music listening indicate direct effects on structures which are implicated in the process of regulating emotions. These include the anterior cingulate cortex (ACC), the orbitofrontal cortex (OFC), the lateral prefrontal cortex

(PFC), and the amygdala (Moore, 2013) among others. Receptive music listening has also been shown to trigger a response in the limbic and the paralimbic systems, improving functional connectivity of the limbic regions which are crucial in the regulation of symptoms of anxiety (Brown et al., 2004; Alluri et al, 2015).

The field of music therapy originated in the management of symptoms of trauma-related disorders, namely 'shell shock' as it was called in the 1940's. It was observed that receptive music experiences reduced agitation and promoted a greater state of calm in soldiers returning from war and experiencing what we now know to be PTSD. There has been extensive research into the use of music therapy interventions used to manage anxiety, including music assisted relaxation, guided imagery and music, receptive music listening, and improvisation (Wurjatmiko, 2019; Karadag et al., 2019; Ribeiro et al., 2018; Millet & Gooding, 2017; Pavlov et al., 2017; Hwang et al., 2013; Alam et al., 2016; Hammer, 1996; Bradt & Teague, 2018; Zarate, 2016; Hense et al., 2018). Many of these interventions, however, require the presence of a music therapist, and a patient does not generally have access to said intervention unless they are in a session. Music assisted relaxation and receptive music listening are the exceptions to this.

The present study will address the use of one-directional mood vectoring playlists in the treatment of symptoms of anxiety. For the purposes of this study, Shatin's (1970) definition of mood vectoring will be used, which is "The directed alteration of mood through music- an alteration from one affective pole to it's [sic] opposite or it's [sic] contrast" (p. 81).

Description of the Problem

Existing research indicates that receptive music experiences are associated with shifts in activation patterns of neural structures associated with the experience of anxiety, including the ACC, OFC, lateral PFC, and amygdala (Blood & Zatorre, 2001; Brown et al., 2004,

Mitterschiffthaler et al., 2007; Berns & Moore, 2013; Berns et al., 2010, Flores-Gutierrez et al., 2007; Koelsch et al., 2006; Levitin, 2013; Alluri et al, 2015; Hou et al., 2017). Additionally, receptive music experiences have been shown to have an impact on the activation of the limbic and paralimbic systems which mediate the autonomic nervous system (ANS), as well as improving functional connectivity of the limbic regions (Brown et al., 2004; Alluri et al., 2015). There has also been a great deal of research that shows the effect that receptive music therapy interventions have in the management of anxiety (Baker et al., 2017; Plener et al., 2010; Strehlow, & Linder, 2016).

While there have been many studies examining the neurological response to music, as well as the use of music therapy interventions to treat symptoms of anxiety, there has been very little research into the effectiveness of playlist interventions specifically. However, Garrido et al. conducted a study in 2016 in which he examined the effects of playlists on mood in participants. No long-term effects were noted, but the playlist utilized in the study consisted of music that was either completely sad or completely happy. There was no shift in emotion in the happy music or sad music condition. This study examines a playlist intervention in which there is a deliberate shift from music reflecting the participant's anxious emotions to music reflecting a state of calm, which I am hoping to induce. While there is a significant amount of research into patterns of neurological activation in response to music listening, as well as the effectiveness of receptive music therapy interventions in the management of anxiety symptoms, there is not a study into the effectiveness of one-directional mood vectoring playlists on symptoms of anxiety.

Proposed Intervention

This study will include the implementation of a one-directional mood vectoring playlist, transitioning the participant from a state of anxiety to a state of calm. Music will be selected by

the participant from their personal collection of music and will be arranged into the intervention playlist in collaboration with a board-certified music therapist. Analysis will also focus on the feasibility of the intervention, identifying barriers to faithful adherence of the protocol.

Theoretical Framework

This study is a feasibility trial of the effectiveness of receptive music therapy intervention of a one-directional mood vectoring playlists in the treatment of symptoms of anxiety. Quantitative data identified effectiveness for immediate symptom relief, as well as symptom relief over the full two-week intervention period. Measures for the quantitative data included a self-report diary card with a Likert-type scale, as well as the Spielberger State Trait Anxiety Inventory (STAI) (1984). Interviews were also used to capture participants' experiences with the intervention as well as their perception and perceived challenges. This data in conjunction with quantitative data could assist practitioners in identification of patients who may benefit from the intervention, as well as those who may be better served by an alternative treatment option. A semantic approach was taken when synthesizing the quantitative and qualitative data according to the protocol outlined by Braun and Clarke (2006). Their process includes six steps: becoming familiar with the data, generating initial codes, searching for themes, reviewing themes, defining themes, and writing up results.

While the creation of one-directional mood vectoring playlists using the Healthy-Unhealthy Uses of Music Scale (HUMS) has been studied (Hense et al., 2018), the effectiveness of the actual playlist intervention has not. The research supporting the development of the one-directional mood vectoring playlist is based on the HUMS study, as well as the iso-principle as outlined in Heidersheit and Madison's study (2015). The iso-principle indicates that one must first match the mood of the patient before attempting to gradually shift toward the desired

emotion and change. In an earlier survey study by Bautch (2019), they found that 73.45% of participants reported that they listened to music that matched their current emotions. This echoed findings of Hense et al. (2018), which identified this as potentially damaging for patients who have a diagnosis of a mood disorder. Patients with this kind of a diagnosis demonstrated a tendency toward rumination, which then reinforced negatively valanced emotions. This intervention is also consistent with the principles of Neurologic Music Therapy (NMT) as it relies on neural correlates to facilitate a shift in the activation patterns that occur during an anxiety response.

Research Purposes

The overall purpose of the current study is to explore the feasibility of using a self-administered playlist intervention to address anxiety symptoms. The following aims of the study are as follows:

Does the use of a mood vectoring playlist intervention result in a decrease of anxiety?

Research Questions

The specific research questions are as follows:

1. To what extent does a course of treatment involving a one-directional mood vectoring playlist impact state anxiety?
2. To what extent does a course of treatment involving a one-directional mood vectoring playlist impact trait anxiety?
3. To what extent does the one-directional mood vectoring playlist intervention impact daily anxiety, pre to post per administration?
4. To what extent does a course of treatment involving a one-directional mood vectoring playlist impact state anxiety in participants with high pretest trait anxiety?
5. To what extent does a course of treatment involving a one-directional mood vectoring playlist impact trait anxiety in participants with high pretest trait anxiety?

6. To what extent does the one-directional mood vectoring playlist intervention impact daily anxiety, pre to post per administration in participants with high pretest trait anxiety?
7. What is the feasibility of using a self-administered mood vectoring playlist?
8. What barriers to implementation and perceived benefits do research participants experience when using the mood vectoring playlist intervention?
9. What is the perceived effectiveness of the intervention among participants at high versus low levels?

Description of the Study

This study will examine the effectiveness and feasibility of the one-directional mood vectoring playlist on symptoms of anxiety. All participants will take part in the intervention. Measures of the dependent variable will be a Likert-style diary card and exit interview, along with the Spielberger State Trait Anxiety Inventory (Spielberger, 1972; Spielberger et al., 1983).

Significance of the Study

Many studies have identified links between receptive music experiences and neurological structures implicated in effective regulation of emotions and anxiety (Alluri et al., 2015; Baker et al., 2017; Bautch, 2019; Beck et al., 2018; Bidabadi & Mehryar, 2015; Blood & Zatorre, 2001; Brown et al., 2004; Carr et al., 2012; Flores-Gutiérrez & Terán Camarena, 2015; Garrido et al., 2016; Hou et al., 2017; Jasemi et al., 2016; Koelsch et al., 2016; Krahé & Bieneck, 2012; Landis-Shack et al., 2017; Levitin, 2013; McFerran et al., 2010; Mitterschiffthaler et al., 2017; Nguyen & Graham, 2017; Sena Moore, 2013; Shatin, 1970). This study builds upon this basic research to fully utilize the neurological effects of music in support of effective management of anxiety symptoms. This study could potentially identify an intervention that a patient could self-administer when needed, improving outcomes and empowering patients in their own treatment plan.

As has also been noted, it is possible to use music in an unhealthy way (Hense et al., 2018; McFerran et al., 2010). As such, it is crucial to have a board-certified music therapist assist in the creation of the playlist to minimize the possibility of increasing rumination and reinforcing negative patterns of emotion and behavior. The music therapist can ensure the structural and expressionistic qualities of the music are supportive of the goals of the participant and improve the likelihood of a positive outcome.

CHAPTER 2: REVIEW OF LITERATURE

The intervention being examined in this study has its foundations in well-established research in the fields of music therapy and psychotherapy. One of the earliest uses of music therapy was as a means of assisting soldiers returning from war to manage arousal symptoms of PTSD. Since then, both basic and clinical research has established music therapy as an effective method for treating symptoms of anxiety. Music therapy has long used therapeutic playlists in the treatment of anxiety. They have not, however, had the same amount of research support that other music therapy interventions such as music assisted relaxation (MAR) or mindfulness and music interventions. In psychotherapy, treatments for the regulation of anxiety symptoms involve skills-based therapies that give patients tools that they can use when needed. Cognitive behavior therapy (CBT) and Dialectical Behavior Therapy (DBT) are two of the treatments most frequently used to assist with mood disorders at present. Given this information, this study focuses on managing symptoms of anxiety using a skills-based approach to this music therapy intervention.

Psychotherapy and Management of Anxiety

This study focuses on a skills-based management of symptoms of anxiety, and the stress response. Adaptive skills of emotion regulation have been linked to significantly lower rates of mental health diagnoses (Compare et al., 2014), while maladaptive strategies of managing emotions have been linked to higher rates of mental health diagnoses. This was particularly strong when examining high rates of rumination, as well as emotion suppression. These indicate that promotion of adaptive skills and a decrease of rumination will assist in minimizing the detrimental physiological effects of anxiety.

Current treatment models most frequently used in the management of anxiety are skills-based behavioral treatment models. Treatments such as Cognitive Behavioral Therapy (CBT) and Dialectical Behavior Therapy (DBT) are two specific behavioral treatments that are commonly acknowledged as effective in the management of anxiety. In a meta-analysis, Hunot et al. (2007) found that CBT was the treatment for generalized anxiety disorder (GAD) that had the strongest research support in favor of its effectiveness. Similar results were found in the Cochrane review (James et al., 2015) focused on the effectiveness of CBT in the treatment of anxiety disorders in youth. While there has not been a Cochrane review dedicated solely to the effectiveness of DBT, it has been included in a meta-analysis examining treatment of depression which is otherwise treatment-resistant (2018), and one identifying it as a highly effective way of reducing self-harm behaviors (2016). DBT has also been included in a meta-analysis by Panos et al. (2014) which found it to significantly reduce emotional distress and promote emotion regulation. This study includes a skills-based approach much like those used in CBT and DBT and aligns with treatment models that are well supported by research.

Music Therapy and Anxiety

Therapeutic Function of Music (TFM)

The therapeutic function of music (TFM) must be taken into account when examining the purpose served by music in an intervention (Hanson-Abromeit, 2013). This refers to what purpose the music itself serves in the intervention. When the TFM is clear, it assists in the selection of the best music for said intervention to facilitate the achievement of goals. When attempting to manage symptoms of anxiety, one will attempt to select music that will use the iso-principle as defined by Altschuler (1945). This calls for matching the participant's level of their current emotion that the therapist is attempting to change, and then gradually shifting to music

that will promote the emotion which the therapist is attempting to induce. Iso-principle is not only used in therapeutic playlists, but throughout music therapy in active and receptive interventions alike. The therapeutic function of the music in this intervention is to serve as the vectoring agent, shifting the participant from a state of anxiety into a state of calm in a stepwise manner. When selecting songs to assist in the management of anxiety symptoms, it is important to consider structural and referential characteristics of the music in order to have an optimal response.

Structural and Referential Characteristics of Musical Stimuli

Structural and referential characteristics of the musical stimuli are crucial to consider when selecting music for the intervention. Structural characteristics refer to aspects of the music that are inherent in the music, and do not rely on the personal associations that a participant may have. Songs selected for the final stimuli must have structural characteristics considered relaxing. Hooper (2012) identified components of relaxing music, including a familiar, predictable form, relatively stable tempo and volume, and stable textures. The harmonies should be predictable, and the melodic timbre needs to be gentle with only gradual shifts, minimal accents, and high amounts of repetition. In their 2017 study, Matney reinforced the importance of structural characteristics of music in selecting pieces for managing anxiety levels in order to optimize positive outcomes. Musical stimuli closer to the beginning of the playlist may include a wide variety of structural characteristics, as the participants may gravitate towards either structural or referential experiences of anxiety. The final musical stimuli, though, must include both structural and referential characteristics that induce a state of calm. Identification of characteristics under consideration during the creation of the playlist align with those outlined by Robb et al. (2018).

Referential characteristics are aspects of the music that are personal to each participant, such as autobiographical memories and associations, or emotional responses to lyrics. Listening to music that is associated with personal memories has been shown to increase the activity in the lateral parietal, temporal, medial prefrontal, and posterior cingulate cortexes (Ford et al., 2011; Janata, 2009). Music that is associated with autobiographical memories also impact the participant's perception of the valence of a piece and shifts the emotional experience of the participant while listening (Hodges, 2019; Vuoskoski et al., 2012). These effects were even stronger in participants who displayed high levels of trait empathy. As such, both structural and referential characteristics must be taken into consideration when selecting music for the one-directional mood vectoring playlists, in order to maximize potential benefits of the intervention. This is further reinforcement as to why it is important for a music therapist to assist in the creation of the playlist, as they have the training to balance the structural and referential characteristics in the development of the personalized intervention.

Lyrics are another component must be considered. Words have a strong impact on perception of the valence of music (Stratton et al., 1991). The effect size was particularly strong when words were perceived as highly positive or highly negative. These associations with words are a powerful component of music included in the selection of music for mood regulation, and should be taken into consideration in therapeutic playlist development.

Considerations for Patients with Mood Disorders

We must take into consideration certain characteristics of the music and patterns of listening when working with participants who may have a mood disorder. Referential characteristics are particularly relevant when working with this population, as they are shown to be particularly influenced by the perceived positivity and negativity of the music (Bautch, 2019);

Dillman et al., 2008; Hense et al., 2018). This is particularly pronounced when working with adolescents with a mood disorder, as they are noted to use music to increase rumination and reinforce neural patterns of activity that intensify physiological and emotional symptoms (Thompson et al., 2014; McFerran & Saarikallio, 2014). Taken to the extreme, unhealthy use of music was linked to behaviors that are symptomatic of mental illness, such as self-harm (Cheong-Clinch & McFerran, 2016). In this population, one also needs to be cautious of potential triggers and associations with previous experiences (Bibb, 2016), again emphasizing the importance of working with participants in order to minimize any potentially adverse reactions and maximize positive effects. This is one of the many reasons why it is important for a person to work with a music therapist to create the playlist instead of simply doing so independently.

Receptive Interventions

Music therapy interventions can be divided into the categories of active and receptive. Active interventions involve the participant taking part in the musical experience, often playing some form of instrument. Receptive interventions involve the participant listening to the music and experiencing it in a more physically passive manner. This study involves receptive interventions. Receptive music therapy interventions are commonly used as a tool for managing symptoms of anxiety, and have shown effectiveness with a wide variety of populations including solid organ transplant recipients, hospice caregivers, skilled nursing facility residents, cancer patients, patients undergoing medical procedures (Madson & Silverman 2010; Cepeda et al., 2006; Pittman et al., 2011; Tam et al., 2008; Klassen et al. 2008,) patients with coronary heart disease, patients on hospice care (Choi, 2010,) patients with mental health disorders (de l'Etoile, 2002; Gold et al., 2004) patients with cancer (Jasemi et al., 2016,) and people who were

otherwise healthy (Nilsson, 2008; Knight et al., 2001.) Some receptive music therapy techniques to assist with anxiety include substituting new emotional responses for old, maladaptive responses (Gyurak et al., 2011; McRae et al., 2010; Ochsner et al., 2005). Receptive music therapy techniques can alleviate distress of a particular event, and can also facilitate effortful and explicit strategies for management of strong emotions (de Manzano et al., 2012; Fratianne et al., 2001; Gyurak et al., 2011; Jerde et al., 2011; Knösche et al., 2005; Satoh et al., 2001; Tam et al., 2010).

Iso-principle and Mood Vectoring

The iso-principle is a principle of music therapy which states that one must begin with music that matches the participant's mood before attempting to create the desired change (Altschuler, 1945; Metzner, 2016). Several studies have additionally noted the sense of commonality and community that people experience when listening to sad music when they felt sad (Friedman et al., 2012; Huron, 2011; Knobloch et al., 2004; Sena Moore, 2013; Zillmann, 2000). Participants in several studies stated that they felt connected through a common affective state and that they experienced a reduction in the sense of isolation. This can be a validating experience for participants and increase their receptiveness for the intervention.

Once the participant's mood has been matched by their preferred music, the next step is to begin the gradual shift from their state of anxiety to a state of calm. This shift from one emotion to another is called mood vectoring, and music is a particularly effective tool to support positive or relaxed affect (Altschuler, 1945; Bautch, 2019; Bibb, 2016; Flores-Gutiérrez & Terán Camarena, 2015; Garrido et al., 2016; Koelsch et al., 2006; Shatin, 1970). Unfortunately, most of the research supporting musical mood induction focus on a single emotion, such as the study conducted by Garrido et al. (2016) in which they assigned participants to either happy or sad

music listening groups for a period of four weeks. They did not find any significant long-term effects, and the mild effects that were found were even weaker in participants with high tendencies toward rumination, which is common in persons with anxiety disorders. Findings of the Garrido et al. study showed that the participants became increasingly aware of the way that they used music, and that they were more deliberate in their selections. They also observed that researcher-selected music was effective only for a single listening session, but that programs focused on raising a participant's awareness of their use of music had the potential to create long-term changes in the way that participants used music in their everyday lives.

Seminal research into music induced mood vectoring was conducted by Shatin in 1970. They studied a variety of continuums and found that the vectoring effect was strongest shifting from restless to serene. This is very similar to the continuum addressed in this study, which is from a state of anxiety to a state of calm. Shatin noted that the effects were strongest when a participant was familiar with the musical stimuli used. This again reinforces the importance of creating the playlist in collaboration in order to take personal preferences into account.

The Healthy-Unhealthy Uses of Music Scale (HUMS)

The study examining the validation of the Healthy-Unhealthy Uses of Music Scale (HUMS) is one of the primary bases of the intervention used in this thesis. The measure was used to create a therapeutic mood vectoring playlist (Hense et al., 2018). Healthy music use was defined as using music to promote social connection, mood enhancement, and distraction. Unhealthy music use was defined as using music to facilitate avoidant coping strategies, rumination, mood worsening, and increasing symptoms of psychopathology (Garrido & Schubert, 2013; McFerran et al, 2014; McFerran & Saarikallio, 2014; Miranda & Claes, 2009; Saarikallio & Erkkilä, 2007; Thompson et al., 2014; Van den Tol & Edwards, 2014). The

HUMS was used to create a mood vectoring playlist, beginning with an emotion that was causing the participant distress, and shifting to an emotion that they wished to achieve. There were 13 inpatient participants in the study, and 12 stated that they experienced immediate relief upon the first use of the playlist. This same intervention was then tested by McFerran et al. (2018) in an outpatient setting, again using the HUMS. They found that the participants felt empowered to make deliberate choices about their use of music and were better able to change their mood when needed. This reinforces the importance and increased effect size when participants had autonomy in selecting the music used in their interventions (Knappe & Pinquart, 2009; Leftcourt, 1976; Saarikallio, 2012).

Affect Induction in Psychotherapy and Music Therapy

Affect/mood induction procedures are procedures used to induce a desired mood in the participant. Velten was one of the pioneers of mood induction procedures (Kenealy, 1986). Participants would read provided statements about themselves. They ranged from positive to negative, and results were statistically significant, but only had a mild effect size (Lewis et. al, 1988). Shortly following this, Pignatiello et al. (1989) compared the Velten mood induction procedure and examined whether it was comparable to musical mood induction. The musical mood induction condition showed effectiveness equivalent to the Velten mood induction procedure and demonstrated greater reactivity in physiological measures of heart rate and systolic blood pressure.

Very recently, Joseph et al. (2020) conducted a meta-analysis focusing on affect induction procedures. Included in the study were mood induction techniques of Velten, imagination, autobiographical recall, film, reading a story, music/sounds, pictures, feedback, coping challenge, manipulation of face/body, jokes/cartoons, odor, and video recording/social

pressure. They discovered that it was more challenging to induce positive affective states than negative, and that this was particularly pronounced when the participant had a diagnosis of a mood disorder. This indicates that it is challenging to induce a positive mood in a participant who has anxiety, which is what this study is attempting. One other result from the aforementioned meta-analysis is that affect induction was more successful when participants were given instructions that were truthful instead of trying to conceal the intent. They also found that musical mood induction procedures showed greatest effectiveness when they were paired with another technique, such as film or autobiographical recall (Joseph et al., 2020). As such, the music used in the playlists in this study will be participant-selected music that is personally significant to them.

Neural Basis/Correlates of Anxiety and Receptive Music

The functioning of the autonomic nervous system (ANS) is crucial to an understanding of the anxiety response. The ANS is the portion of the nervous system that controls functions of the body not under conscious control (Richards et al., 2000; Rozenman et al., 2017; Pohjavaara, 2003; Legge, 2015; Lee et al., 2016). The portion of the ANS that is active during the sympathetic nervous system (SNS) which manages the body's response to a perceived threat. This is active when someone is experiencing symptoms of anxiety, and while it is a necessary and helpful response, it can become maladaptive and increase risk of adverse health outcomes when hyperactive as they are in a person with anxiety (Johns Hopkins Medicine, 2021). When a person is feeling calm and relaxed the parasympathetic nervous system (PSNS) is engaged. This is the part of the ANS that stimulates biological functioning occurring when a person is safe and/or at rest, such as seeking sustenance, healthy digestive processes, and sexual arousal (Richards et al., 2000; Rozenman et al., 2017; Pohjavaara, 2003). The SNS and PSNS have an

antagonistic relationship, and this relationship seeks to facilitate a shift from SNS arousal to PSNS engagement.

The amygdala is also crucial to understanding anxiety, as it is at the center of processing intense emotions. The structure is an essential component of the limbic system, and demonstrates high levels of activity during SNS activation (Rasia-Filho et al., 2000). The amygdala connects with the prefrontal cortex (PFC) which moderates amygdala reactivity (Kim et al., 2011). This is significant, as the PFC manages executive function and cognitive processes that are important in mindful regulation of emotions. High levels of activation in the amygdala have also been noted when a person listens to music that is considered tonally minor, dissonant, negative, or unpleasant (Koelsch et al., 2006; Lerner et al., 2009; Mitterschiffthaler et al., 2007: Pallsen et al., 2005; Sena Moore, 2013). The amygdala was downregulated, though, when participants listened to music that they found pleasant, or resulted in chills (Blood & Zatorre, 2001; Koelsch et al., 2006; Sena Moore, 2013). This is a part of why it is important to have a music therapist assisting in the creation of therapeutic interventions, so that explicit characteristics of music that influence emotion are taken into consideration. It is crucial to take into consideration the participant's musical preferences, but a music therapist will know how to select and arrange music that will optimize activation patterns that facilitate effective management of symptoms of anxiety and minimize the possibility of an adverse reaction.

The PFC is the part of the brain in charge of problem solving and executive function, and also shows activated when someone is successfully managing symptoms of anxiety. This is particularly noted in the medial PFC, orbitofrontal cortex (OFC) (Compare, 2013). PFC activation is affected by a participant's perception of likability, familiarity, emotional intensity of the music, and music preference (Berns et al., 2010; Berns & Moore, 2012; Blood & Zatorre,

2001; Florez-Gutiérrez et al., 2007; Sena Moore, 2013;). This again supports other information on the neurological structures of the importance of working with a music therapist in order to optimize the effect of the music on anxiety symptoms.

CHAPTER 3: METHODOLOGY

Research Design

This is a mixed methods pilot study using a one group, pretest-posttest pre-experimental design in which the group serves as their own control. This study examines the feasibility of utilizing a mood vectoring intervention, and its impact on reducing anxiety symptoms. It also examines the experience of participants using the intervention to determine factors in feasibility and potential contraindications. Aside from this particular intervention, this study is also examining the feasibility of self-administered interventions utilized after a psychoeducational session.

Participants

The sample was recruited online through social media and e-mail and consisted of adults residing in America. Participants were between the ages of 18 and 70 years and reported experiencing symptoms of anxiety on a regular basis. While a clinical diagnosis of anxiety was not a requirement, participants were asked if they had experienced anxiety symptoms for at least 6 months, which is informed by the diagnostic criteria for Generalized Anxiety Disorder in the DSM-V (APA, 2013.) No diagnoses were made within this study. Exclusionary criteria included being unable to speak and write English or having a medical condition causing hearing impairment. Participants were required to have access to a computer and a device on which they can listen to recorded music. The participants were able to make contact with me via phone or e-mail, whichever was more convenient for them. All meetings took place online via Zoom (https://pacific.zoom.us/) in accordance with COVID-19 precautions. A sample script for

instructions participants were given in the meeting during the psychoeducational component is located in Appendix A.

Study Variables

The independent variable in this study is use of the mood vectoring playlist. The dependent variable is anxiety, which is divided into state anxiety, trait anxiety, and momentary anxiety. Momentary anxiety is measured by the Likert-style scale. The other dependent measure is the Spielberger State Trait Anxiety Inventory (STAI). The STAI is an interval level self-report questionnaire consisting of 40 questions split evenly between the state and trait subsections. The state portion measures anxiety that is present in the moment, whereas the trait portion measures the way a participant generally feels.

Instrumentation and Data Collection

Momentary Anxiety

The measurement of momentary anxiety involved a Likert-type item, ranking anxiety on a scale of 1-5. Participants completed this ordinal measure before and after each administration of the playlist, approximately 14 times. The difference between the pre- and post-intervention momentary anxiety scores was computed and an arithmetic average of pre-post change computed. Analysis conducted on this measure used the difference between the mean pre-listening score and the mean post-listening score. Among the Google Docs in the apparatus is the diary card, which is a Likert-type scale used to measure pre- and post-listening anxiety is an ordinal measure and ranges from low anxiety represented by a 1 to high anxiety represented by a 5. This measure was designed to be as convenient as possible so that it would not serve as an additional barrier to treatment effectiveness. A copy of the diary card can be seen in figure 1.

	Pre-listening anxiety (1-5)	Post-listening anxiety (1-5)	Activity
Date:			

Figure 1. Sample diary card

State and trait anxiety. The self-report dependent measure is the STAI and the self-report diary card. The STAI (Spielberger, 1972; Spielberger et al, 1983) is strongly recommended as a measure for anxiety levels (Vitasari et al., 2011) as it shows strong reliability, construct validity, and coefficient correlation of the State and Trait portions. Coefficient alpha ranged from .86-.95 for the State portion, and .89-.91 for the Trait portion. Test-Retest reliability was high with an average of .32 for State and .75 for Trait after 104 days. Correlation between State and Trait sections range between .59-.75. There is high correlation between the STAI and other anxiety measures, such as the IPAT and TMAS (r = .73-.85) indicating sufficient validity in measuring the dependent variable.

Interviews. Interviews were recorded using iTalk on a password-protected device. A copy of the interview questions is included in Appendix C. All interview questions were designed to address the research questions. Presentation of anxiety or emotion can be idiosyncratic, and interview questions allow for the collection of data regarding participants' perception of effectiveness. The question focused on perceived barriers was designed to assist in measuring the feasibility of the intervention. Data from interviews was examined independently, as well as in conjunction with information gleaned from quantitative data.

Apparatus and Materials

This study required a digital copy of the STAI. A self-report diary card was kept using a Google document, a copy of which is included in the procedure section. Participants were also given access to a Google document with instructions for the intervention, which was explained

during the initial meeting, and is located in Appendix B. Participants logged all data on Google Docs that could only be accessed by that specific participant and me. They received a link to an online document that detailed activities that they could take part in while listening to the music. These activities included drawing/art, imagery, movement, or breathing exercises. It also involved them using their personal music listening device. All meetings took place online over Zoom in order to conform to COVID-19 mitigation protocols. Participants additionally received their playlist, which they listened to on their preferred personal music listening device.

Procedure

Music Listening Intervention

The one-directional mood vectoring playlist consisted of seven songs, with the initial song representing the highest level of anxiety, and the final song representing a low level of anxiety. Playlists were not to last beyond 20 minutes. This period was selected so that the length of the intervention would not be a significant burden to participation and compliance with the protocol. Playlists were created collaboratively. Once the 1st and 7th song were identified, the participant identified a song that represented the half-way point between the high and low anxiety songs. That song became the 4th in the playlist. Once the 1st, 4th, and 7th songs were identified, the participant identified two songs that stepped from high anxiety to the half-way point song. Those songs became the 2nd and 3rd pieces. Once those were identified, the participant identified two songs that stepped from the halfway point to the low anxiety song, and those became the 5th and 6th pieces. At this point, the playlist was completed.

Participants were instructed to first identify the song that most closely matched the level of anxiety they were experiencing. From there, they listened through to the end of the playlist. This was done in order to minimize the risk of increasing levels of anxiety. A participant would

only listen to the playlist beginning with the 1st song if they were experiencing a high level of anxiety at that point in time. The median song that a participant started with is included in participant data in Appendix D, and a visual representation of initial songs is included in Appendix E.

Participants were instructed to listen to the music in whatever way was most convenient for them, whether that was free field or with headphones or earbuds. There was also not a specific time of day at which the participants were instructed to listen. This left more opportunities for other variables outside of the experiment to impact the study but increased the feasibility of the intervention.

Additional Procedure

After the participants read and signed the informed consent document (Appendix F), the psychoeducational component was implemented as the procedure for the treatment was explained. Together, the participant and I collaborated to create a playlist of participant preferred music lasting no more than 20 minutes, which vectored from dysregulated anxiety to a regulated emotional state and instructed them in how to use said playlist as well as the options for activities to take part in during music listening. Activities included movement, drawing/art, breathing exercises, or imagery. Music was selected from the participant's collection in collaboration and followed guidelines for appropriate music for relaxation in the final pieces of the playlist. Guidelines for relaxing properties of music aligned with the findings of Wolfe, O'Connell, and Waldon's study (2002) in conjunction with the low-arousal properties of Hanson-Abromeit and Sena Moore's study (2015). This combination of patient preferred music and incorporation of the relaxing properties of specific musical qualities are expected to reduce a participant's level of anxiety given neural correlates as well as results from previous studies on

the effects of music on emotion (Shatin, 1970; Stratton and Zalanowski, 1991; Sena Moore, 2013; Mitterschiffthaler et al., 2007; Levitin, 2013; Koelsch et al., 2006; Hou et al., 2017; Flores-Gutiérrez and Terán Camarena, 2015; Flores-Gutiérez et al., 2007; de la Torre-Luque, 2017; Brown et al., 2004; Blood and Zatorre, 2001; Alluri et al., 2015). Participants were instructed in use of the website for recording data and using the apparatus. I reviewed the procedure and allowed time for any questions they had, as well as scheduling the final meeting time. They also provided the participant with the link for the digital version of the STAI.

The participants were instructed to engage in the listening intervention daily for 2 weeks. The participants took the STAI before the first time using the intervention, and after the final time using the intervention. They also filled out the self-report diary card as a fidelity check and measure of the dependent variable (see Figure 1: Sample diary card). I contacted them via email weekly to conduct a fidelity check and answer any questions the participant had.

At the final session, I provided the link for the posttest STAI, and conducted the exit interview. The link for the posttest STAI was not given until at least 24 hours after the final administration of the protocol so participants could not take it immediately following the intervention, which would potentially impact results. Participants were asked what challenges/barriers there were to completing the protocol, what perceived changes they noticed in their mood, and what their experience was like using the intervention. They then were asked if they have any other questions or observations on the process that they would like to share. A visual representation of the progression of the study is included below in Figure 2.

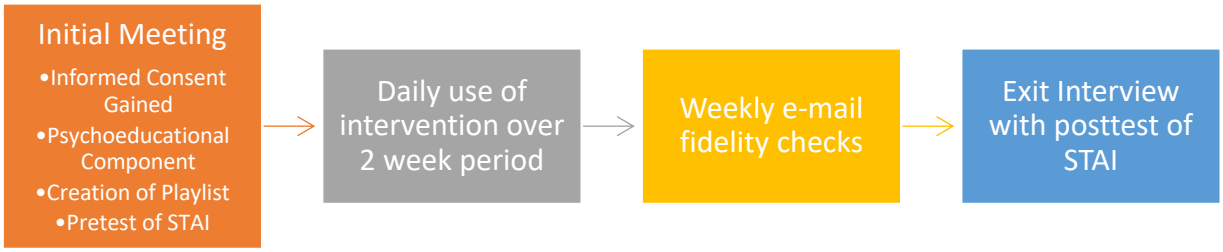

Figure 2. Progression of study

Analysis

Quantitative Analysis

Descriptive analysis was conducted examining the age and gender of participants. Additionally, inferential statistical tests were run on STAI scores and momentary anxiety levels as are outlined below. For the first research question (To what extent does a course of treatment involving a one-directional mood vectoring playlist impact state anxiety?), a two-tailed dependent samples *t*-test was used to compare pre and posttest state anxiety scores from the STAI (p= .05). Similarly, for the second research question (To what extent does a course of treatment involving a one-directional mood vectoring playlist impact trait anxiety?), a separate two-tailed dependent samples *t*-test was used to compare pre and posttest trait anxiety scores from the STAI (p = .05). The fourth and fifth research questions examine state and trait anxiety scores, using only participants whose pretest trait anxiety were at or above the 85th percentile in order to examine the effectiveness of participants with high trait anxiety. For all *t*-test analyses the following assumptions were met/explored; the dependent variables (STAI state and trait anxiety scores) are measured along an interval scale, the two sets of scores (pre and posttest scores) are matched/paired, outliers were examined, Shapiro-Wilk normality tests were run to examine the distributions of differences (Aron, 2013). All effect sizes were interpreted

according to Cohen. A Cohen's $d = 0.2$ is considered small, a $d = 0.5$ is considered medium, and a $d = 0.8$ is considered large (Cohen, 1988).

For the third research question (To what extent does the one-directional mood vectoring playlist intervention impact daily anxiety, pre to post per administration?) a Wilcoxon signed rank test was used to compare pre- and post-listening anxiety levels on the Likert-type scale ($p = .05$). A Wilcoxon signed rank test was selected because the Likert-type scale is an ordinal level of measurement, making a non-parametric test the appropriate choice. Similarly, the sixth research question examines pre to post administration anxiety levels in participants with a pretest trait anxiety score at or above the 85th percentile. For both Wilcoxon signed rank tests the following assumptions were met/explored; the dependent variables (Likert-type scale anxiety ratings) are measured along an ordinal scale, and the two sets of score (pre- and post-listening scores) are matched/paired and are independent of other sets of scores in the analysis. An examination of r will be used to determine effect size according to Cohen's thresholds (1988). The effect size is considered low if $r = .1$, medium if $r = .3$, and large if $r = .5$ or higher.

Qualitative Analysis

Qualitative analysis for this study will follow the six-step procedure for thematic analysis outlined by Braun and Clarke (2006) and a semantic approach, which involves only on the direct information participants give instead of attempting to extrapolate meaning. The initial step of the Braun and Clarke protocol is to familiarize oneself with the data. Recordings were reviewed several times before transcriptions were taken, and then double-checked against the recordings again. The second step is to create codes for the data within which the themes will fall. The third step involved creating preliminary themes that fit into those codes. Once that is completed, the themes must be reviewed to see if they are appropriate or if there are any adjustments to be

made. Once themes and codes are finalized, definitions are written to create clarity, and results are discussed.

Role as the Researcher

As a researcher, I played multiple roles in this study. I conducted all recruitment and analysis procedures and was also the music therapist who facilitated the intervention with all participants. When designing the intervention I was aware of how high anxiety levels are in the current climate, and attempted to craft the intervention in a way that would put as little pressure as possible on participants so that they would not be discouraged and would not experience the intervention as a significant intrusion on their lives and schedules. The topic of anxiety is one that is of interest to me, as my family has a history of anxiety disorders. Additionally, as a clinician and a person I have a strong interest in how things function and the reason why people react in specific ways, giving me a natural curiosity into neuroscience. Music is the way that I look to address anxiety largely due to my history as a professional vocalist, my work as a music therapist, and the strong calming reaction that I've personally experienced in response to music. The use of music in management of anxiety through the lens of neuroscience is a direct result of the way I view the world, my clinical interest, and my personal history.

Mixed Analysis

The mixed analysis uses blending to synthesize the quantitative data gathered on which participants were daily high responders, who had a mean difference in pre- to post-listening anxiety levels at or above the composite mean, which was 1.29 on the Likert-type scale, with the responses that participants gave in their interviews (McMillan & Schumacher, 2010). Data is presented below in tables, separated out by high and daily low responders to give a visual representation of general trends. This can assist in identifying which themes may mean that a

person may be more or less inclined to have a high response to these therapeutic playlist interventions.

CHAPTER 4: RESULTS

Descriptive Analysis

Sample Characteristics

The sample consisted of 11 participants located in the United States and recruited through social media. Of the 13 participants who consented to take part, 11 completed the study. The three who did not follow through with the study cited external stressors that prevented them from continuing their participation. One of the 11 participants who agreed to participate did not comply with timing of the pre-test and post-test, and as such their STAI scores were not included in analysis. Their daily anxiety scores, however, were included as that data was all completed in a timely manner. All participants were between the ages of 18 and 70 years and all spoke English fluently. There were no participants who were diagnosed with a medical condition that would cause hearing problems. Gender and age ranges of participants are included below in table 1 below.

Table 1
Sample Characteristics

			mean	mean		State		Trait	
Participant	Gender	Age Range	pre-listening	post-listening	mean difference	pre	post	pre	post
1	Female	18-29	2.43	1.43	1	82	62	90	72
2	Female	30-49	1.43	1.14	0.29	50	16	78	22
3	Female	18-29	2.57	1.71	0.86	89	79	97	87
4	Female	50-70	4.07	2.21	1.86	100	99	100	100
6	Female	18-29							
7	Male	30-49	3.86	2.07	1.79	90	66	94	81
8	Female	18-29	2.36	1.57	0.79				
9	Female	30-49	2.5	2.0	0.5	92	52	93	72
10	Female	30-49	4.21	1.5	2.71	93	84	93	93
11	Male	18-29	4.11	2.56	1.5	76	66	100	98

(Table 1 Continued)

Participant	Gender	Age Range	mean pre-listening	mean post-listening	mean difference	State		Trait	
						pre	post	pre	post
13	Female	30-49	3.0	1.5	1.55	44	40	59	42
14	Female	30-49							
15	Male	18-29	3.17	2.36	1.35	82	50	87	52

Quantitative Descriptive Analysis

Participants' pretest percentile ranks on the trait portion of the STAI ranged from 59 to 100 with a composite mean of 89.1. Their posttest percentile ranks on the trait section of the STAI ranged from 22 to 100 with a composite mean of 72.1. This gave a difference in composite means between pre and posttest of 17.

Participants' pretest percentile ranks on the state portion of the STAI ranged from 44 to 100 with a composite mean of 79.8. Their posttest percentile ranks on the state section of the STAI ranged from 16 to 99 with a composite mean of 61.4. This gave a difference in composite means between pre and posttest of 18.4. STAI data broken down by participant is included in Appendix G.

The difference between participants' momentary anxiety scores ranged from 0.29 to 2.71, with a composite mean of 1.29. Data broken down to individual participants' mean anxiety scores are found in Appendix E. Pre and post listening means broken down by participant can be found in Appendix H.

Participants' mean anxiety level of the song they initiated their playlist with ranged from 2.5 to 6.29. These are reverse ordered, as the seven songs of the playlist started with the 1 representing the greatest level of anxiety and decreasing in level of anxiety as the playlist continued. Detailed results can be found in Appendix H.

Inferential Analyses

Data is presented by research question below, after which all inferential data pertaining to research questions 1-6 are compiled into Table 2.

Table 2
Inferential Data, Research Questions 1-6

		State		Trait		Pre-post Listening		
Group	*df*	*p*	*d*	*p*	*d*	*change*	*p*	*r*
All	8	*0.026	0.90	**0.001	0.84	-2.93	**0.003	-0.88
high trait	6	*0.028	1.31	**0.001	1.103	-2.67	**0.007	-0.63

*$p<0.05$. **$p<0.01$.

Research Question 1

The first research question asked: To what extent does a course of treatment involving a one-directional mood vectoring playlist impact state anxiety? This research question examined the effects (pre- to post-program) of the entire music listening program on state anxiety. The null and alternative hypotheses were as follows:

> H_0: There is no difference between pre and posttest STAI state anxiety scores following a course of treatment using a one-directional mood vectoring playlist.
>
> H_a: There is a difference between pre and posttest in STAI state anxiety scores following a course of treatment using a one-directional mood vectoring playlist.

The results of a two-tailed, dependent samples *t*-test were significant, $t(9) = 2.67$, $p = .026$, $d = 0.90$, wherein there was a significant decrease in state anxiety scores from pre-program ($M = 47$, $SD = 11.40$) to post-program ($M = 38.4$, $SD = 7.23$). An examination of Cohen's *d* suggests a large clinical effect.

Research Question 2

The second research question asked: To what extent does a course of treatment involving a one-directional mood vectoring playlist impact trait anxiety? This question examined whether there was a change (pre to post-program) in trait anxiety. The null and alternative hypotheses were as follows:

> H_0: There will be no significant change in STAI trait anxiety scores following a course of treatment using a one-directional mood vectoring playlist.
>
> H_a: There will be a significant change in STAI trait anxiety scores following a course of treatment using a one-directional mood vectoring playlist.

The results of a two-tailed, dependent samples *t*-test were significant, $t(9) = 5.396$, $p = .001$, $d = 0.84$, wherein there was a significant decrease in trait anxiety scores from pre-program ($M = 50.9$, $SD = 8.6$) to post-program ($M = 43.0$, $SD = 10.06$). An examination of Cohen's d suggests a large clinical effect.

Research Question 3

The third research question asked: To what extent does the one-directional mood vectoring playlist intervention impact daily anxiety, pre to post per administration? This research question examined the impact of the music listening intervention for each daily administration of the listening playlist. The null and alternative hypotheses were as follows:

> H_0: There is no difference between pre and posttest daily anxiety scores following a single administration of the one-directional mood vectoring playlist.
>
> H_a: There is a difference between pre and posttest daily anxiety scores following a single administration of the one-directional mood vectoring playlist.

A dependent Wilcoxon signed-ranks test indicated that the median posttest daily anxiety scores ($Mdn = 3.11$), were significantly lower than the pretest daily anxiety scores ($Mdn = 1.82$), $z =$ -

2.93, $p = .003$, $r = -.88$. Examination of the effect size using r followed parameters as laid out by Cohen and were found to be large (Cohen, 1988).

Research Question 4

The fourth research question asked: To what extent does a course of treatment involving a one-directional mood vectoring playlist impact state anxiety in participants with high pretest trait anxiety scores? This research question examined the effects (pre- to post-program) of the entire music listening program on state anxiety for participants with pretest trait anxiety score at or above the 85th percentile. The null and alternative hypotheses were as follows:

> H_0: There is no difference between pre and posttest STAI state anxiety scores following a course of treatment using a one-directional mood vectoring playlist when used by participants with a high pretest score of trait anxiety.
>
> H_a: There is a difference between pre and posttest in STAI state anxiety scores following a course of treatment using a one-directional mood vectoring playlist when used by participants with a high pretest score of trait anxiety.

The results of a two-tailed, dependent samples t-test were significant, $t(7) = 2.75$, $p = .028$, $d = 1.311$, wherein there was a significant decrease in state anxiety scores from pre-program ($M = 50.75$, $SD = 9.35$) to post-program ($M = 40.50$, $SD = 5.90$). An examination of Cohen's d suggests a large clinical effect.

Research Question 5

The fifth research question asked: To what extent does a course of treatment involving a one-directional mood vectoring playlist impact trait anxiety in participants with high pretest trait anxiety scores? This question examined whether there was a change (pre to post-program) in trait anxiety for participants with pretest trait anxiety score at or above the 85th percentile. The null and alternative hypotheses were as follows:

> H_0: There will be no significant change in STAI trait anxiety scores following a course of treatment using a one-directional mood vectoring playlist when used by participants with a high pretest score of trait anxiety.
>
> H_a: There will be a significant change in STAI trait anxiety scores following a course of treatment using a one-directional mood vectoring playlist when used by participants with a high pretest score of trait anxiety.

The results of a two-tailed, dependent samples t-test were significant, $t(7) = 5.21$, $p = .001$, $d = 1.103$, wherein there was a significant decrease in state anxiety scores from pre-program ($M = 54.13$, $SD = 5.87$) to post-program ($M = 46.13$, $SD = 8.41$). An examination of Cohen's d suggests a large clinical effect.

Research Question 6

The sixth research question asked: To what extent does the one-directional mood vectoring playlist intervention impact daily anxiety, pre to post per administration in participants with high pretest trait anxiety? This research question examined the impact of the music listening intervention for each daily administration of the listening playlist for participants with pretest trait anxiety score at or above the 85th percentile. The null and alternative hypotheses were as follows:

> H_0: There is no difference between pre and posttest daily anxiety scores following a single administration of the one-directional mood vectoring playlist in participants with a high pretest score of trait anxiety.
>
> H_a: There is a difference between pre and posttest daily anxiety scores following a single administration of the one-directional mood vectoring playlist in participants with a high pretest score of trait anxiety.

A dependent Wilcoxon signed-ranks test indicated that the median posttest daily anxiety scores ($Mdn = 3.40$), were significantly lower than the pretest daily anxiety scores ($Mdn = 1.92$), $z = -2.67$, $p = .007$, $r = -.63$. Examination of the effect size using r followed parameters as laid out by Cohen and were found to be large (Cohen, 1988).

Other Quantitative Analyses

Participants were asked to take part in an activity while listening to their playlist in order to improve attentiveness and mindfulness in the listening task. Upon visual examination, data on the activities that participants selected did not appear to have any relation to whether the participant was a high or low responder to the intervention. A graphic representation of which activities participants took part in is displayed in Appendix I.

Qualitative Analysis

Research Question 8

What barriers to implementation and perceived benefits do research participants experience when using the mood vectoring playlist intervention?

I used qualitative analysis to address the 8th research question by following the 6-step process of Braun and Clarke (2006), with a semantic approach that focused solely on direct information provided in the interviews, instead of attempting to extrapolate potential meanings from the participants' statements. The first step was to become familiar with the data. This involved listening to the interviews several times before completing the transcription, and then checking the transcription against the recording. The second step was to sift through the transcripts looking for codes. As was mentioned before, I took a semantic approach focusing on the information that was directly stated in interviews. I re-read the transcripts to identify which codes were mentioned most. Once codes were identified, they were separated into broader themes of which they were representative. Those themes were as follows; 'awareness,' 'alteration of arousal,' active management,' and 'balancing with life responsibilities.' Codes for the theme of 'awareness' were as follows; 'mindfulness,' 'emotional awareness,' 'clear minded,' and 'gratitude.' Codes for the theme of 'alteration of arousal' were as follows; 'relaxed,' 'calm,'

'decreased somatic symptoms,' and 'more energy.' Codes for the theme of 'active management' were as follows; 'empowered with a tool,' 'positive coping,' and 'positive outlook.' Codes for the theme of 'balancing with life responsibilities' were as follows; 'finding time,' 'not enough time,' 'children,' 'forgot,' and 'no barriers.' Once those codes and themes had been identified, I reviewed them and condensed the 'finding time' and 'not enough time' themes in 'balancing with life responsibilities' into just 'finding time' since they are so similar and both express the experience of lack of time being an issue. In the 'alteration of arousal,' I combined the themes of 'relaxed' and 'calm' into 'relaxed/calm' as they are a similar state of arousal and convey such similar experiences. I did preserve the wording of both, though, so that if could be noted that information from both themes are in that category. Further details on thematic analysis are found in Table 3, including supporting quotations.

Table 3
Thematic Analysis

Themes	Codes	Supporting Quotations
Awareness: An increase in awareness of emotions and/or experience	Mindfulness: Increased mindfulness and awareness of present experience	"I guess I felt more aware of what was actually happening. Sometimes I get so… you know… in my head"
		"I think it made me more mindful, after listening."
		"I think I'm just more mindful about my feelings now. Because I was, like, paying more attention."
	Emotional awareness: Increased awareness of emotions	"I think I actually noticed how I was feeling. I don't do that a lot. Just kind of keep moving forward, because what else are you going to

(Table 3 Continued)

Themes	Codes	Supporting Quotations
		do? But I actually realized I'm pretty stressed out a lot."
		"Probably just more aware of my anxiety and where it was."
		"I'm more aware of how I actually feel. Usually I just push it down so I don't have to really deal with it. But yeah, with having to do the rating thing, it made me think about it."
	Clear minded: Feelings of a greater sense of mental clarity	"It was like it cleared out the cobwebs. Things felt better after listening."
		"My mind felt more clear, like, uh, I didn't have as much going on in my mind. Those thoughts just went away."
	Gratitude: Increased feelings of gratitude and gratefulness	"It made me feel really aware and grateful for what I do have instead of focusing on what I don't."
		"Gratitude. More gratitude."
Alterations of arousal: A shift in arousal state from high to low or low to high	Relaxed/Calm: Feeling a greater sense of relaxation, peace, or calm	"I feel calmer. Yeah, not as stressed. Calm."
		"Well, calmer, definitely."
		"More relaxed than before. Yeah. More relaxed."
		"Calmer, and probably more patient. But really calmer."

(Table 3 Continued)

Themes	Codes	Supporting Quotations
	Decreased somatic symptoms: Fewer physical symptoms of anxiety such as tension, rapid breathing, or shakiness	"My breathing relaxed and I didn't feel like my shoulders were so tight."
		"Just my whole body felt more relaxed. It was like that tension melted away."
	More energy: Feeling an increase of energy	"It was kind of weird, but I felt more energized, which is weird, right?"
		"I felt like I actually was going to make it through my day, like I had the energy to do it."
Active management: Increased ability to actively manage symptoms	Empowered with a tool: Feeling a greater sense of agency and empowerment, and like they have a tool to assist them with anxiety symptoms	"It's like I have this tool now that I can use, and it's just music that I like. The coloring helped too."
		"I feel less worried about the anxiety because I, like, just start thinking about the music if I get stressed. Even that helps, and I know I can always listen. It's on my phone."
	Positive coping: An increase in ability to cope with emotions in a positive way	"I think I'm handling my anxiety better. I don't worry about it as much and feel like I'm better at managing it. Not like I don't get it or something, but I can take it better."
	Positive outlook: Feeling more positive about life	"It made me feel kind of happy and positive about everything. Like, it's going to be okay, you know?"

(Table 3 Continued)

Themes	Codes	Supporting Quotations
		"Definitely more positive. Just, in general."
		"I just feel better about things in life. Like, more positive."
Balancing with life responsibilities: Balancing other life responsibilities while prioritizing symptom management	Finding time: Challenges finding enough time to participate in the intervention	"Time. That was really the big thing."
		"It was just hard to find time, and I wasn't able to listen at the same time every day, which would have been nice."
	Children: Challenges with children interrupting the intervention, or requesting assistance during the time set aside for the intervention.	"Kids. I mean… yeah. Kids. I love them, but they made it hard sometimes."
		"It was just hard to get enough time alone, because [*name omitted*] needs a lot of attention right now."
	Forgot: Challenges remembering to take part in the intervention	"Just forgetting to do it until later and then realizing I forgot to do it"
		"Sometimes I just didn't remember when I meant to do it."
	No barriers: There were no barriers that caused issues with prioritizing treatment	"Not really any"
		"I don't know. I mean, I don't think there were any"

Mixed Analysis

Qualitative data was synthesized using the tables below, examining whether there were themes from the qualitative codes that were particularly common among high or daily low responders. For the purposes of mixed analysis, daily high responders were identified as those who scored above the composite mean difference in momentary anxiety scores which is 1.29. Daily low responders were identified as those who scored below that composite mean. While there were no clear delineations between high and daily low responders, a general overview has been provided with tables showing individual participant responses.

Research Question 9

The ninth research question asked: What is the perceived effectiveness of the intervention among participants at high versus low levels?

This research question examined which themes pertaining to perceived effectiveness were noted by participants who were high versus daily low responders. High responders were participants whose mean daily change score was above the mean for all participants, and lo responders were participants whose mean daily change score was below the mean for all participants.

Over the course of the interview, the theme of awareness came up repeatedly. The codes within that theme included feeling increasingly clear minded, an increase in mindfulness, and feeling more aware of their emotions. Daily high responders reported all three of these, while only two daily low responders stated that they experienced greater clarity of mind, and one stated that they were increasingly mindful. Daily high responders, on the other hand, all reported an increase in awareness of emotions. Other than participant 7, all daily high responders reported an increase in mindfulness, and other than participant 7 and 11, they also reported being

increasingly clear minded. While two daily high responders reported feelings of gratitude, those statements were not as prevalent as other codes.

Responses by participant are detailed in tables 4 and 5 below.

Table 4
Awareness in Daily High Responders

Participant	Clear minded	Mindfulness	Emotion awareness	Gratitude
4	X	X	X	
7			X	
10	X	X	X	X
11		X	X	
13	X	X	X	X
15	X	X	X	

Table 5
Awareness in Daily Low Responders

Participant	Clear minded	Mindfulness	Emotion awareness	Gratitude
1				
2				
3				
8	X			
9	X	X		

During final interviews, the next theme that arose was that of alteration of arousal, either from high to low, or from low to high. The codes identified within that theme were feeling more relaxed and/or calm, noticing a decrease in somatic symptoms of anxiety, and an increase in energy. While there was not a clear delineation between high and low responders, the code of 'more energy' was mentioned more frequently by participants identified as low responders. This

is fairly consistent with understanding of the functioning of the intervention, as anxiety is an emotion which is associated with elevated levels of energy.

Responses by participant are detailed in tables 6 and 7 below.

Table 6
Alteration of Arousal in Daily High Responders

Participant	Relaxed/ Calm	Decreased somatic symptoms	More Energy
4	X	X	
7	X		
10			X
11			
13			
15	X	X	

Table 7
Alteration of Arousal in Daily Low Responders

Participant	Relaxed/ Calm	Decreased somatic symptoms	More Energy
1	X		
2			X
3			X
8	X		
9		X	

Another theme that was identified upon examination of the interview transcripts was that of active management. Codes within that theme were participants feeling empowered with a tool, feeling an increase in their ability to cope with symptoms in a positive way, and having a more positive outlook on their symptoms and on life. Here again there is a clear difference between daily high responders and low. While the code of having a more positive outlook was

distributed fairly evenly between high and daily low responders, few daily low responders reported codes included in this theme. Daily high responders, on the other hand, overwhelmingly reported feeling better able to cope with their symptoms in a positive way. With the exception of participants 11 and 13, daily high responders additionally stated that they felt empowered with a new tool for managing their symptoms.

Responses by participant are detailed in tables 8 and 9 below.

Table 8
Active Management in Daily High Responders

Participant	Empowered with a Tool	Positive Coping	Positive Outlook
4	X	X	X
7	X	X	X
10	X	X	
11		X	
13			X
15	X	X	

Table 9
Active Management in Daily Low Responders

Participant	Empowered with a Tool	Positive Coping	Positive Outlook
1			X
2			X
3			
8			
9	X		

The final theme that was identified from the interviews was that of balancing life responsibilities with managing symptoms. The codes within this theme were having difficulty

finding time to complete the intervention, not noticing anything that became a barrier to completion of the intervention, forgetting until later in the day, and difficulties finding time away from children. Interestingly enough, the high responder group noted more barriers than the daily low responders. 'Finding time' and 'children' were distributed fairly evenly between high and low responding groups. More low than daily high responders stated that they did not report significant barriers to completing the treatment. However, high participants reported having challenges with forgetting to complete the intervention until later in the day at an elevated rate compared to the low responding group.

Responses by participant are detailed in tables 10 and 11 below.

Table 10
Balancing with Life Responsibilities in Daily High Responders

Participant	Finding time	No barriers	Forgot	Children
4			X	
7		X		
10	X			X
11	X		X	
13			X	
15	X		X	

Table 11
Balancing with Life Responsibilities in Daily Low Responders

Participant	Finding time	No barriers	Forgot	Children
1	X			
2		X		
3			X	
8		X		
9	X			X

CHAPTER 5: DISCUSSION

Overall Findings

The purpose of this study was to determine the effectiveness of a one-directional mood vectoring playlist on symptoms of anxiety. This study used a pre-experimental single group design, where participants were their own control. Participants were trained to use the one-directional mood vectoring playlist and used the intervention for 2 weeks with approximately 14 administrations total. Statistical analysis indicated that there were significant changes to both state and trait anxiety from pre to post study, both with large clinical effects. This was determined using a two-tailed dependent samples *t*-test. Additionally, significant changes were found in daily self-reported anxiety from pre to post listening, and also had a large effect size.

In addition to analyzing the STAI pre and posttests of all participants, data were separated out for those participants with high pretest scores of trait anxiety in order to identify whether or not this intervention is effective specifically for those persons with high trait anxiety. Findings indicated that there were still significant changes in both state and trait anxiety when only data from participants with high pretest trait anxiety scores were analyzed.

Qualitative data was coded and analyzed, but there was not a clear delineation of themes found in the interviews between participants who had a high response and those who had a low response. Interviews centered around barriers to faithful adherence to the protocol, as well as perceptions regarding mood changes from pre to post listening as well as over the course of the full experiment.

Findings by Outcome

Quantitative Analyses

The initial data analysis for this mixed-methods study began with the quantitative data, in order to determine whether the intervention was effective. This was done using pretest and posttest scores of the STAI, as well as daily self-report scores. Data was then broken down that data into those who were daily high responders and who were daily low responders to the intervention in order to facilitate the incorporation of qualitative data. This was done with the goal of determining for whom this intervention might be particularly well or poorly suited.

State anxiety. State anxiety is the component of anxiety that fluctuates in response to stimuli. Incidents of acute anxiety symptoms are generally attributed to state anxiety. This is also the type of anxiety that is more responsive to interventions, as it is not a component of one's personality, but rather a response to stimuli perceived as stressful or threatening. This variable was examined in research questions 1 and 4. Findings in state anxiety using the STAI showed a significant change between the pretest and posttest in participants, indicating that the intervention may be successful in helping participants to manage their levels of state anxiety over time. The significant findings also occurred when data from participants with high levels of trait anxiety on the pretest were examined separately, demonstrating effectiveness with this population. These findings could occur due to perceived mastery over the elevated levels of anxiety, as they have a new tool they can use when needed. It could also be a result of an alteration in the neurologic activation patterns in response to the music stimuli. As always, there are limitations to this study, and results must be interpreted with caution.

Trait anxiety. Findings in trait anxiety using the STAI showed a significant change between the pretest and posttest in participants. Trait anxiety is the component of anxiety

thought to remain stable and is not altered by temporary stressors. This variable was examined in research questions 2 and 5. Findings were inconsistent with the conceptualization of trait anxiety as a constant and unchanging score. In this study, trait anxiety levels were shown to decrease over the course of the study. This was unanticipated and could have several potential causes which may be related to the intervention, but which may also be related to error. Initially the STAI was intended to be taken in person, but out of necessity were done online due to COVID-19 mitigation requirements. If it had occurred in person, I would have been able to provide additional clarity on the difference between the trait and state portions of the STAI, but was unable to due to the necessity of online administration. Performance on the posttest could have been influenced by their experience taking the pretest, which may account for the unlikely relationship between the two administrations. Additionally, the participants may not be representative of the target population. It is likely that people who would volunteer for a study of this nature are more responsive to music than others. They also likely have an internal locus of control, and the agency to work to alter their experience of anxiety.

If the findings are not a result of a threat to internal validity, and the intervention does indeed lower levels of trait anxiety, this would be a curious finding. It is possible that the regular music listening could influence the neurologic activation patterns and assist in more effective emotion regulation on a basic level. Another possibility is that the participant may feel that they have a tool which they can use in order to better manage intense moments of state anxiety, which may give them a better sense of mastery over their anxiety in general and thus reduce their trait anxiety.

Momentary anxiety levels. Self-report anxiety levels from pre to post individual administration of the intervention were examined to identify how a single administration affected

anxiety levels. These findings showed a significant change for the median change between pre-listening and post-listening. This is important to discuss separate from the STAI state and trait scores which were taken at the beginning and conclusion of the study, because it indicates the effectiveness of reducing symptoms of anxiety in the moment as opposed to over an extended period of time. While both functions are important, it is important to isolate how effectively an intervention reduces symptoms immediately as well as over an extended period of time. Findings indicated that there was a significant relationship between listening to the playlist and a decrease in self-reported levels of anxiety, indicating that this could potentially be an effective intervention to manage symptoms when needed.

Qualitative Analysis

Qualitative analysis identified four themes from the interviews, including 'awareness,' 'alteration of arousal,' 'active management,' and 'balancing life responsibilities.' When examining 'awareness,' most participants gravitated toward 'clear minded,' 'mindfulness,' and 'emotion awareness.' This is highly relevant, as it aligns with skills that are taught and facilitated in psychotherapeutic treatments for anxiety, such as CBT and DBT. When 'alteration of arousal' was examined, most participants experienced either an increase in relaxation or calm, or a decrease in somatic symptoms. Both of these are indicative of a downregulation of the SNS and engagement of the PSNS, which are a crucial component of reducing symptoms of anxiety. The theme of 'active management' revealed that about half of participants felt that they were better able to actively manage their anxiety symptoms at the conclusion of the study. It should be noted, that as only half of the participants reported this, the other half did not experience an increase in their ability to actively manage symptoms. This indicate that patients are more likely to experience an increase in awareness and engagement of the PSNS. Barriers that were noted

throughout were forgetting and having difficulty finding time, which can be managed by scheduling in a specific time to complete the intervention. The combination of an increase in awareness, engagement of the PSNS, and barriers which are fairly easily managed, is supportive of use of this intervention in a clinical setting.

Mixed Analysis

Mixed analysis was done through the lens of bifurcating participants into groups of who were daily high responders to the intervention, and who were daily low responders. Once determination of those groups took place, the data that was gathered during the final interviews and analyzed in the qualitative analysis was examined to see if there were codes or themes that were common to all daily high responders or all daily low responders.

Awareness. Under the theme of 'awareness', there was a clear delineation in response pattern. Daily high responders overwhelmingly showed more codes in this theme, particularly in the codes of 'mindfulness,' 'emotional awareness,' and 'clear minded.' Every participant who was a high responder reported an increase in awareness of emotions, whereas no participants who were a low responder mentioned that code. While two participants identified as daily low responders reported that they felt increasingly clear minded than they had previously, only one stated that they felt an increase in mindfulness. This suggests that the theme of 'awareness' is associated with participants who responded particularly well to the intervention.

Alteration of arousal. The theme of 'alteration of arousal' did not show a strong difference in response pattern between high- and low- responding participants. Responses to all codes were divided fairly evenly between high- and low- responding participants. This indicates that there is likely little or no relationship between how strongly a participant responds to the intervention, and whether or not they not they experienced a shift in their arousal state.

Active management. This theme also showed a pattern between how strongly a participant responded to the intervention and whether or not they reported codes under the theme. Of the low responding participants, one stated that they felt empowered with a tool for regulating their anxiety, and two reported having a more positive outlook regarding their symptoms. None of them reported feeling able to cope in a more positive way. Participants who were identified as daily high responders overwhelmingly reported that they felt able to cope in a more positive way and felt empowered with a tool. Half of the participants who had a strong response to the intervention reported having a more positive outlook. The discrepancy between the two groups indicates that participants who have a strong response to this intervention are likely to report greater ability to actively manage symptoms.

Balancing life responsibilities. For the final theme, 'balancing with life responsibilities,' high responding participants tended to cite either difficulty finding time, or occasionally forgetting that they needed to administer the intervention until later on in the day. The code of 'finding time' was divided evenly between high and low responding participants, as was the code of 'children.' Interestingly enough, more participants who were identified as daily low responders stated that they did not experience any barriers to adhering to the treatment, as opposed to the high responding participants. Also, significantly more high responding participants reported difficulties with remembering to do the intervention until later in the day than the single low responding participant who mentioned the code. This surprising finding could be explained by examining the response patterns of the daily low responders across all themes. They reported fewer codes and did not give as much information in general during their interviews, when compared to participants who were identified as daily high responders. It is possible that they had just as much trouble, if not more, balancing time for symptom

management with life responsibilities, but did not report them. This could be out of a desire to demonstrate to the researcher that they had followed the protocol and done what they had said they would do. It could also indicate that patients who are less verbally responsive may not respond as strongly to the intervention. Future research could also examine internal versus external locus of control as a covariate to see if that has an impact on response patterns.

Feasibility

In the examination of both effectiveness and barriers that the participants experienced, this study demonstrated that it is possible for a receptive music therapy intervention to be self-administered. This opens the door to possible future research that could identify other interventions that a patient could use at their discretion. Self-administration empowers patients to take a more active role in their well-being, giving them tools that they can rely on when they do not have access to a music therapist in that moment.

Adjustments can be made in order to minimize some of the barriers that were identified by participants. One way to avoid the barrier of 'forgetting' would be to have the participant plan a time of day when they would use the intervention and instruct them to set an alarm to remind them. If they had a conflict at that time on a certain day, they could shift the alarm so that they did not forget. Both of these could also assist in the barrier of finding time. Once a patient selects a time and commits to devoting that time to their intervention, they do not have to focus on figuring out when they will have time to complete it. Additionally, engaging in the intervention at a consistent time could serve to increase effectiveness. Behaviorism indicates that keeping conditions consistent in every use of an intervention may help program said conditions to serve as a cue in the future that the result of said intervention is about to happen.

The participants who identified children as a challenge in completing the protocol could select a time when their children were at school, napping, or after their bedtime.

Limitations

Within every study there are limitations, and caution that must be taken in the interpretation of the results. Errors can be made in the process of creating and running an experiment that can lead to inaccuracies in the form of internal and external threats to validity. Studies with high internal validity are well contained and controlled, with as many variables as possible accounted for (McMillan & Schumacher, 2010). A study which has low internal validity has findings which are imprecise, as confounding variables may have impacted them. This can additionally cause difficulties with the external threats to validity, as findings can then not be generalized. A study which has poor external validity has findings that are not easily generalizable, and therefore are often not helpful or able to be used in a clinical setting (McMillan & Schumacher, 2010).

The experimental procedure occurred during stay-at-home orders during the coronavirus pandemic, which is a stressor that is not commonly present. While all participants were experiencing some degree of quarantining, not all participants would be equally impacted. This experiment occurred during a time when many people were experiencing financial stressors, job losses, and serious concerns for safety. Not all people were experiencing the same degree of distress from these events, though. As such, all findings must be viewed through that historical lens, and the events that occurred concurrently with the intervention. This study was intended to measure anxiety that the participants experience in their daily lives, but it ended up happening at a time when there may be a greater amount of anxiety in the environment than one would typically experience.

Internal Validity

Something to take under consideration is that results should be interpreted with caution due to the small sample size. This was a pilot study, and all results would need to be confirmed by a study with a larger sample size. One other significant consideration in the interpretation of this study is that it was initially conceived of before the coronavirus pandemic. Adjustments were made so that all meetings could occur on the online platform of Zoom, and all STAI assessments took place on the MindGarden (www.MindGarden.com) online platform. While the logistics were fairly easily adjusted, the context of administering an intervention of this nature during a global pandemic may have impacted the results of this study.

Additionally, it is possible that not all participants adhered to the protocol in the way that it was presented to them. This study examines the use of a self-administered playlist, which leaves opportunities for error in the administration of the intervention. It is also possible that there was a placebo effect, and that the participants' symptoms improved because they were asked to pay closer attention to their emotions in order to complete the Likert-type scale. There is also the possibility of error in the participants' completion of the STAI, because they had to be completed on the online platform instead of in person, as was originally planned.

There were two participants who signed the informed consent form but did not engage in the intervention or any of the other components of the study. Both participants contacted the researcher and stated that they had life circumstances which were time consuming, and they could not complete the study. While I do not believe that this attrition had a significant effect on the results, it is possible that there may have been an impact.

External Validity

The results of this study must be interpreted with caution, as it was a pilot study with a small sample size. There is high ecological validity, as the intervention was administered much in the way that it is intended to be used in a clinical setting. Participants self-administered the intervention in the course of their every-day lives, tracked their data on a diary card, and reported their progress. None of this occurred within a controlled environment, which sacrifices a degree of internal validity, but makes it more generalizable to other populations. Another consideration is that the data for this study was collected over the summer of 2020 when much of the country was under stay-at-home orders due to the pandemic. It is possible that the social interaction that participants experienced during the initial and final meetings impacted the results. Many people were experiencing feelings of isolation, and the meetings may have assisted in alleviating that in some way. This impact would not have been due to the intervention, but rather the social interaction.

Selection bias. There is a threat to the external validity, though, in the form of selection bias. The sample was collected on a volunteer basis, and there is a possibility that there are certain characteristics about persons who would demonstrate interest in participation in a music therapy study which may make them more responsive to this intervention than the general population. This study was not limited by geographical region because all recruitment and meetings happened online, and participant ages ranged from 20 to 63. That being said, this was a small sample of volunteers, and it is possible that there are characteristics about this group which may make them respond more strongly than others. There was not an equal representation of the different age groups in the study, which doesn't allow this study to examine if a person's age impacts their response to this intervention. Given that technology is involved as a significant

component, it is possible that people in younger age ranges may be more comfortable or receptive to this intervention than people who are not used to listening to music on a portable device.

Hawthorne effect. There is also a potential threat to external validity in that the participants may have wished to help the researcher, demonstrating pro-social behavior known as the Hawthorne effect. I was upfront with the participants about the focus of the study and this information was included in the informed consent form which each participant signed. As such, participants may have perceived more of a difference than they actually experienced, wishing to assist the researcher in 'succeeding', which could cause inaccuracies in the data collected.

Other Applications

This is an experiment with high external validity, and as such can be easily generalized to other populations. This could be particularly useful in the field of education. For example, a music therapist could consult with an instructor to assist them in the creation of a playlist for a child who struggled with dysregulated anxiety. A space in the classroom could be identified where they would be allowed to listen to their playlist on headphones when they became symptomatic. Additionally, the understanding of how music can impact anxiety could be used in elementary school classrooms to assist children in returning to focused coursework following fire drills. These can be distressing events for young children who do not always have the vocabulary for verbal processing. An early elementary school instructor could follow a fire drill with a class 'dance party' incorporating movement in order to assist the children with completing the cycle of heightened arousal. Each subsequent song could be increasingly calmer until the children were ready to return to their work.

It could also be used in a performance setting with a group who was experiencing high levels of anxiety or dysregulation of emotions. If a group had experienced a traumatic event, such as the loss of one of the participants or leader, or an upsetting event that was a common experience, a music therapist would be able to consult with the conductor and help them to shape the order of future rehearsals in a way that would be supportive of healthy emotion regulation and a reduction in symptoms of anxiety. This second scenario would need to be examined further in another study, though, to see if performing a mood-vectoring program would have similar results to listening to a mood-vectoring playlist.

Conclusion

The one-directional mood vectoring playlist is a tool for management of symptoms of anxiety, which is grounded in research in the field of music therapy, neurology, and psychotherapy. This is a self-administered intervention, which requires the participant to use a playlist daily. While there are some limitations with this study, findings would seem to suggest that this could be a highly effective intervention. No adverse or negative effects were reported by study participants, and all participants reported at least some perceived benefit.

Future research should be done using a larger sample size which may be more representative of the target population. Additionally, a randomized controlled trial model could be used to draw stronger conclusions about causation. If possible, the music therapist who completes the psychoeducational component and assist in the creation of the playlist should be separate from the researcher who conducts the exit interview and analyzes the data in order to reduce experimenter bias. It would also be helpful for future researchers to conduct the study once the coronavirus pandemic is over and people are going about their daily lives in a manner that is normal for them. One other possibility for future research would be to investigate a

different type of therapeutic playlist which is not one-directional to see what the impact is if it shifts between arousal states.

Another consideration with this playlist intervention is, like with any skill, practice is important. One cannot expect the same level of effectiveness if this skill is not practiced in times when a person is not experiencing a significant anxiety response. That is why I designed this intervention to be used daily, regardless of how symptomatic a participant is. Theoretically, the participant will experience greater relief when using it during an anxiety response if they have practiced it's use during periods of moderate, mild, or no anxiety. One other possibility for future studies would be to further limit the activity options, as this would allow for greater targeted clinical decision making.

Secondary data analysis could additionally examine the dose relationship with listening time by calculating the total amount of time that participants listened to their playlists and analyzing potential relationships with responsiveness to the intervention. One could also analyze the data using change scores for state anxiety scores on the STAI as opposed to the daily Likert-type scale. This would inform the researcher on the impact that the intervention has over the course of the study on state anxiety as opposed to momentary anxiety. This would be particularly interesting, as there were participants who showed large changes in their momentary anxiety but smaller changes in their state anxiety scores, and vice versa.

In addition to examining the effectiveness of this particular intervention, the findings of this study indicate that self-administrated interventions could be helpful, which is significant as a patient is not always around their music therapist when they struggle with anxiety. A tool to assist in regulation of symptoms could empower a patient to effectively manage their symptoms, and to take an active role in facilitating their own healing.

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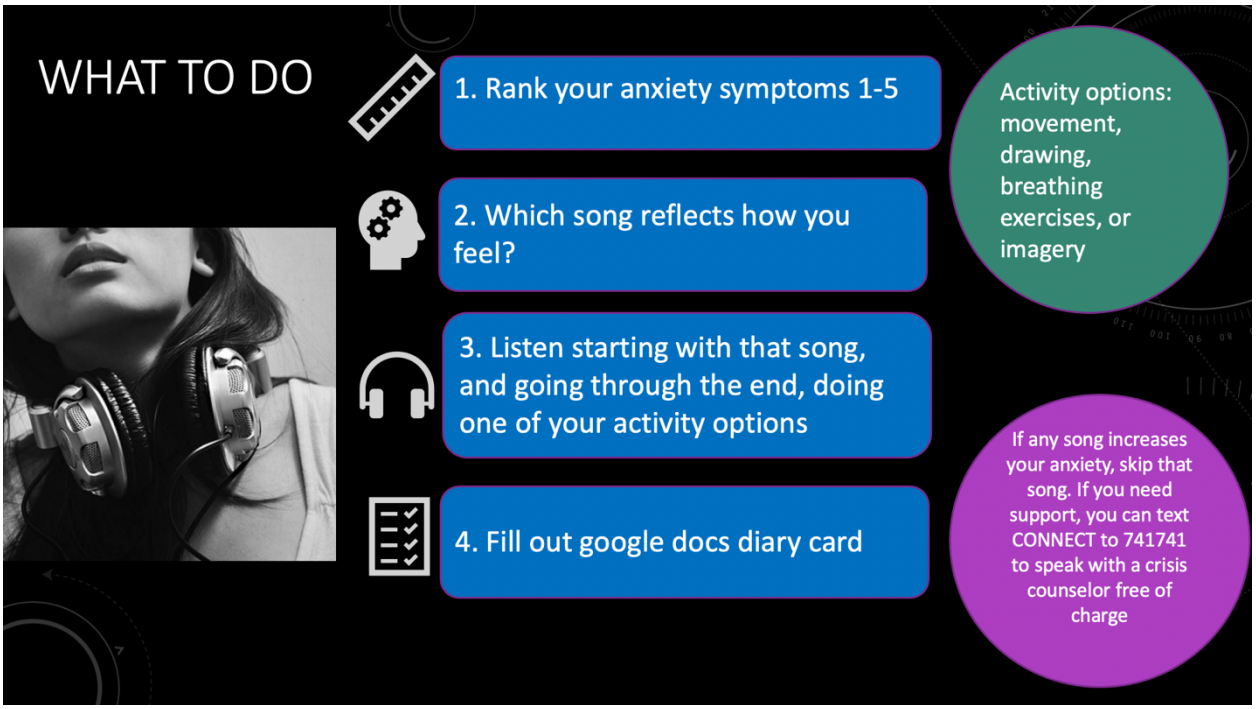
APPENDIX A: SAMPLE SCRIPT

When you sit down to do the study for the day, the first think you are going to do is rank your anxiety symptoms on a scale of 1 to 5, with 1 being low anxiety and 5 being high anxiety. Then you are going to look at your playlist and decide which song most closely matches how you are feeling at that moment. Then you will listen to your playlist starting with that song and listening through to the end. This means you may listen to a different number of songs each day, and that's totally fine! You can also listen to it at different times in the day, if that is what is most convenient. While listening, you will take part in one of the activity options, such as mindfulness, breathing, art, or movement. This helps you to focus in on the music. It is so easy to think "Oh, I should answer that one e-mail from work", and it more often than not turns into at least 15 to 20 minutes of mostly work. The activity really helps you to focus in on this time as self-care and gives you that freedom from work. Once you've finished listening, then rank your anxiety again on that same scale of 1-5. The link to the handout is in the e-mail I sent you, and of course you can always contact me if you have any questions. I'll also contact you halfway through the study just to check in and see how things are going and if you have any questions. Do you have any questions for me right now?

APPENDIX B: PARTICIPANT HANDOUT



APPENDIX C: EXIT INTERVIEW QUESTIONS

1. What barriers to listening to the playlist on a daily basis did you encounter?
2. What changes in your mood after listening to the playlist did you notice?
3. Which activity did you take part in while listening to the playlist?
4. Were there any barriers to taking part in whichever activity you chose to do while listening to the playlist, and if so, what were they and how did you manage them?
5. Did you feel any difference in your mood over the course of the study? If so, please describe the change.
6. What else would you like to comment on?
7. Are there any questions that you have?

APPENDIX D: RESULTS BY PARTICIPANT

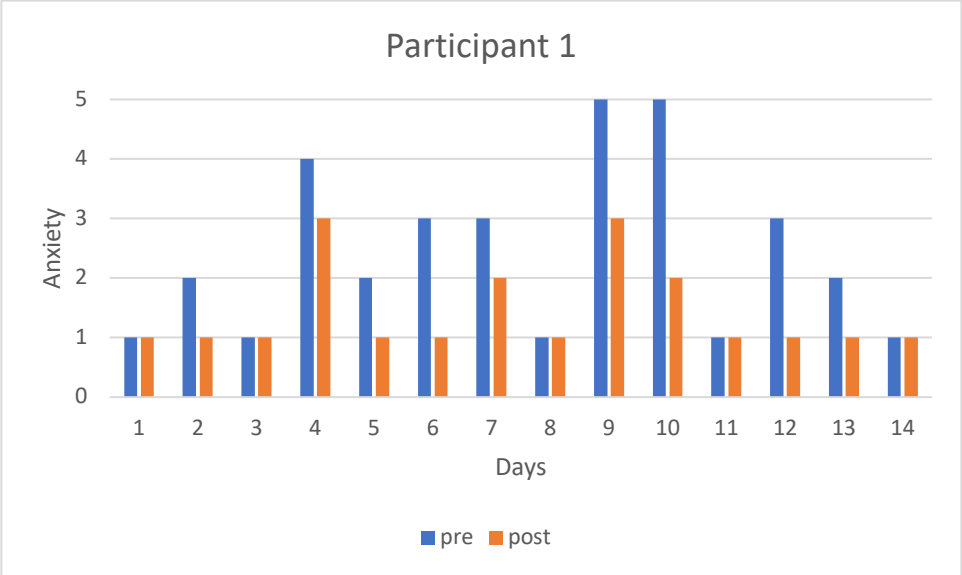


Figure 3. Participant 1 pre to post listening anxiety

Table 12
Participant 1 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	2.43	3.11
Post-intervention	1.43	1.82
Pre-post difference	1	1.29
Starting Song	2.5	5.05
Trait Anxiety		
Pre-program	90	89.1
Post-program	72	72.1
STAI Anxiety		
Pre-program	82	79.8
Post-program	68	61.4

Table 13
Participant 1 Songs

Number	Song	Artist
1	*My Shot*	Lin Manuel Miranda
2	*Truth Hurts*	Lizzo
3	*High Hopes*	Panic! At the Disco
4	*Burn*	Lin Manuel Miranda
5	*White Flag*	Dido
6	*Sweet Baby James*	James Taylor
7	*Skye Boat Song*	Dominik Hauser

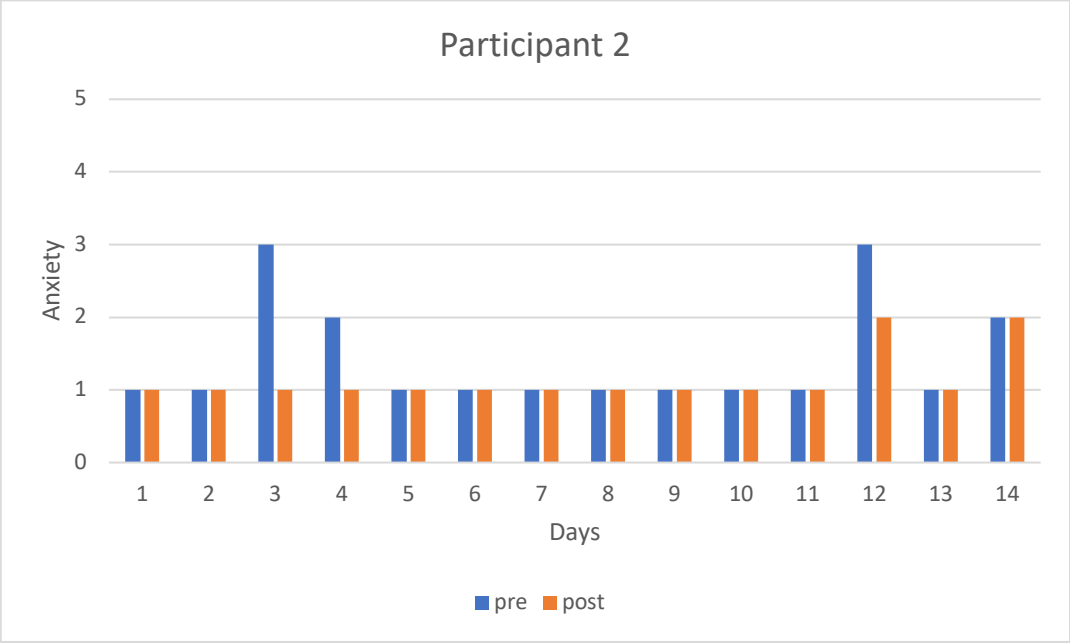


Figure 4. Participant 2 pre to post listening anxiety

Table 14
Participant 2 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	1.43	3.11
Post-intervention	1.14	1.82
Pre-post difference	0.29	1.29
Starting Song	5.57	5.05
Trait Anxiety		
Pre-program	78	89.1
Post-program	22	72.1
STAI Anxiety		
Pre-program	50	79.8
Post-program	16	61.4

Table 15
Participant 2 Songs

Number	Song	Artist
1	*I Hope You Dance*	Lee Ann Womack
2	*While You Still Can*	Brothers Osborne
3	*Cowboy Take Me Away*	Dixie Chicks
4	*Sorry Not Sorry*	Demi Lovato
5	*Drunk on a Plane*	Dierks Bentley
6	*Shoot Me Straight*	Brothers Osborne
7	*It Takes 2*	Rob Base and DJ E-Z Rock

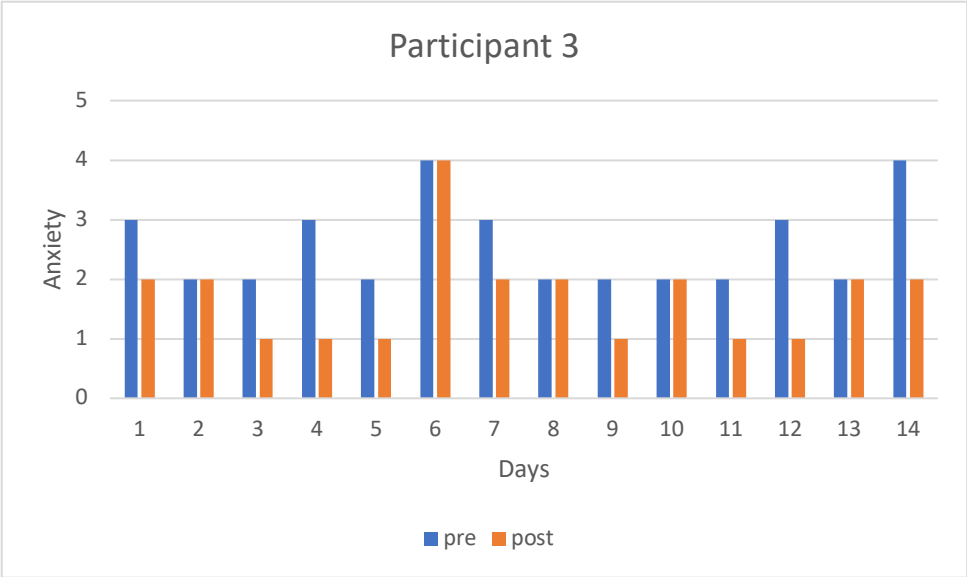


Figure 5. Participant 3 pre to post listening anxiety

Table 16
Participant 3 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	2.57	3.11
Post-intervention	1.71	1.82
Pre-post difference	0.86	1.29
Starting Song	4	5.05
Trait Anxiety		
Pre-program	97	89.1
Post-program	89	72.1
STAI Anxiety		
Pre-program	89	79.8
Post-program	79	61.4

Table 17
Participant 3 Songs

Number	Song	Artist
1	*Emergency*	Paramore
2	*Take What You Want*	Post Malone
3	*Mind is a Prison*	Alec Benjamin
4	*Don't Let Me Fall*	B.o.B.
5	*Look Up Child*	Lauren Daigle
6	*3 Things*	Jason Mraz
7	*Clarity*	John Mayer

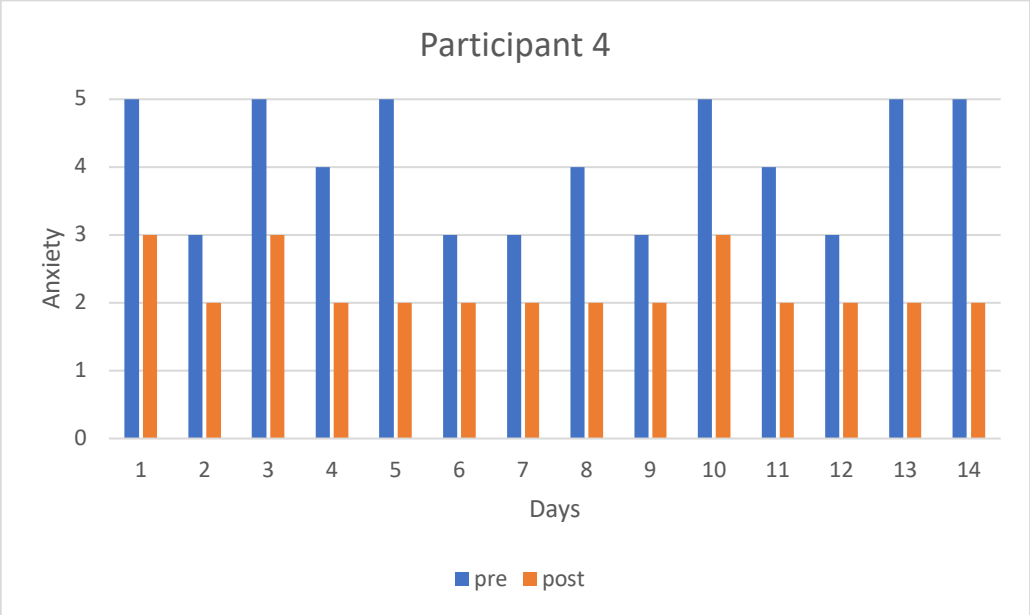


Figure 6. Participant 4 pre to post listening anxiety

Table 18
Participant 4 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	4.07	3.11
Post-intervention	2.21	1.82
Pre-post difference	1.86	1.29
Starting Song	5.71	5.05
Trait Anxiety		
Pre-program	100	89.1
Post-program	100	72.1
STAI Anxiety		
Pre-program	100	79.8
Post-program	99	61.4

Table 19
Participant 4 Songs

Number	Song	Artist
1	*Lost Boy*	Ruth B.
2	*World on Fire*	Sarah McLachlan
3	*Speechless*	Naomi Scott
4	*You Will Be Found*	Ben Platt
5	*Awake*	John Mayer
6	*Rise Up*	Andra Day
7	*Brave*	Sarah Bareilles

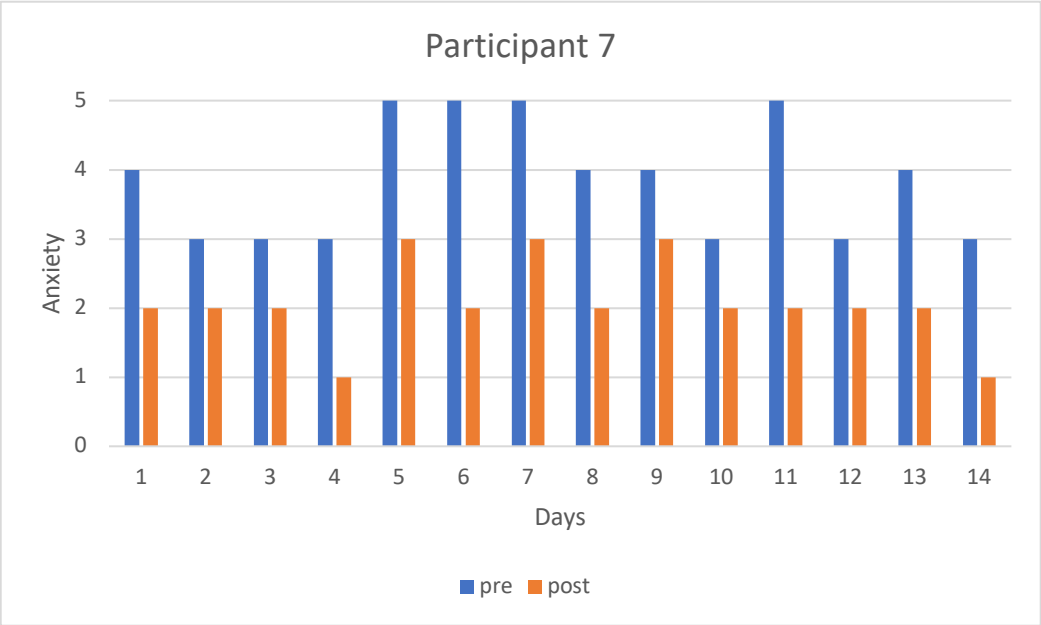


Figure 7. Participant 7 pre to post listening anxiety

Table 20
Participant 7 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	3.86	3.11
Post-intervention	2.07	1.82
Pre-post difference	1.79	1.29
Starting Song	6.07	5.05
Trait Anxiety		
Pre-program	94	89.1
Post-program	81	72.1
STAI Anxiety		
Pre-program	90	79.8
Post-program	66	61.4

Table 21
Participant 7 Songs

Number	Song	Artist
1	*Save Me from What I Want*	St. Vincent
2	*Mephisto*	King Miek
3	*If You're Listening*	Steven Dunn
4	*To the Great Unknown*	Cloud Cult
5	*All Some Kind of Dream*	Josh Ritter
6	*Show the Way*	David Wilcox
7	*Crowded Table*	The Highwomen

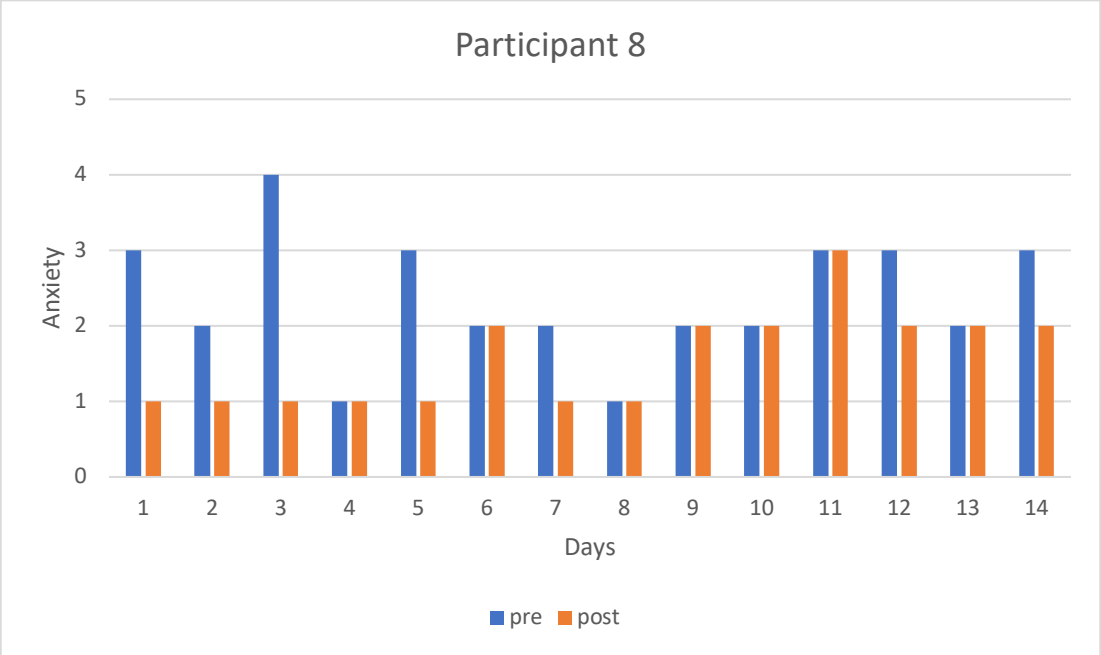


Figure 8. Participant 8 pre to post listening anxiety

Table 22
Participant 8 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	2.36	3.11
Post-intervention	1.57	1.82
Pre-post difference	0.79	1.29
Starting Song	5.64	5.05
Trait Anxiety		
Pre-program	N/A	89.1
Post-program	N/A	72.1
STAI Anxiety		
Pre-program	N/A	79.8
Post-program	N/A	61.4

Table 23
Participant 8 Songs

Number	Song	Artist
1	*A Million Ways*	Okgo
2	*Caring is Creepy*	The Shins
3	*Dc10*	Victor Wooten
4	*What You Won't Do for Love*	Victor Wooten
5	*Fly Me to the Moon*	Kaikane
6	*Requiem for a Tower*	Music Works
7	*The Vision*	Victor Wooten

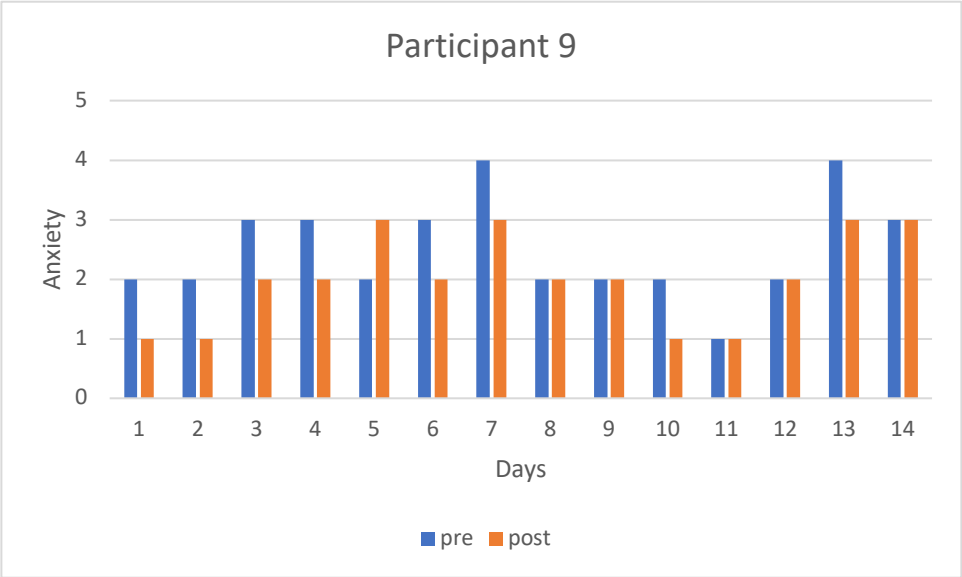


Figure 9. Participant 9 pre to post listening anxiety

Table 24
Participant 9 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	2.5	3.11
Post-intervention	2	1.82
Pre-post difference	0.5	1.29
Starting Song	5.43	5.05
Trait Anxiety		
Pre-program	93	89.1
Post-program	72	72.1
STAI Anxiety		
Pre-program	92	79.8
Post-program	52	61.4

Table 25
Participant 9 Songs

Number	Song	Artist
1	*The Only Living Boy in NY*	Simon and Garfunkel
2	*The Widower*	Horse Feathers
3	*Wildfire*	Mandolin Orange
4	*Love the Way You Walk*	Blitzen Trapper
5	*Mystery of Love*	Sufjan Stevens
6	*Belly of June*	Horse Feathers
7	*Harmony Hall*	Vampire Weekend

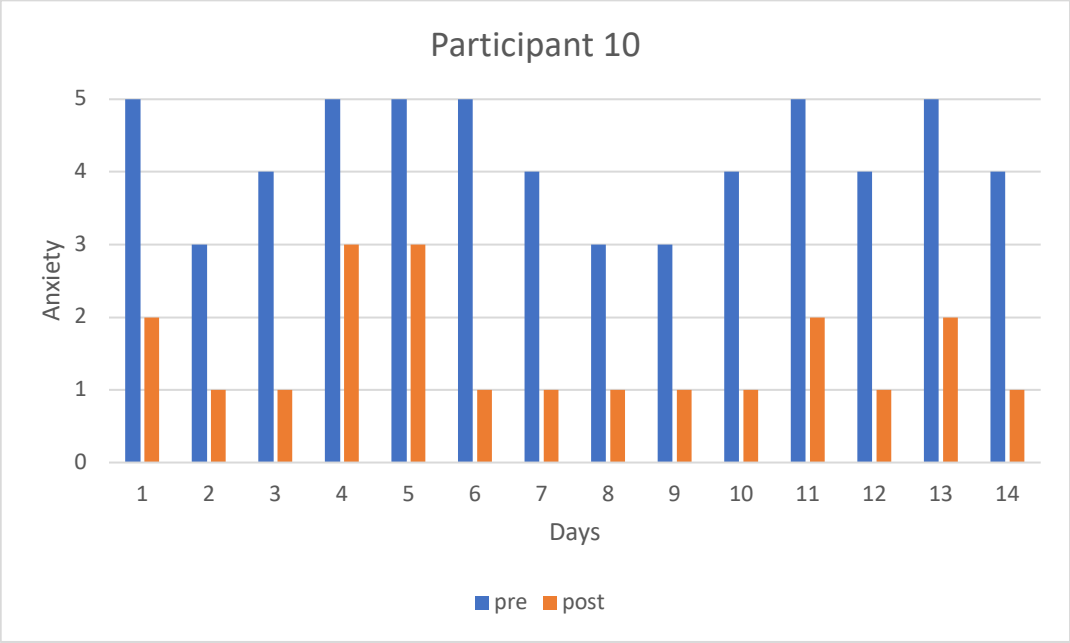


Figure 10. Participant 10 pre to post listening anxiety

Table 26
Participant 10 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	4.21	3.11
Post-intervention	1.5	1.82
Pre-post difference	2.71	1.29
Starting Song	6.29	5.05
Trait Anxiety		
Pre-program	93	89.1
Post-program	93	72.1
STAI Anxiety		
Pre-program	93	79.8
Post-program	84	61.4

Table 27
Participant 10 Songs

Number	Song	Artist
1	*Oceans*	Hillsong United
2	*Dunes*	Alabama Shakes
3	*Here Comes the Sun*	James Taylor and YoYo Ma
4	*One Day Like This*	Elbow
5	*Fe*	Maná
6	*Beautiful Day*	U2
7	*This is Me*	Keala Settle

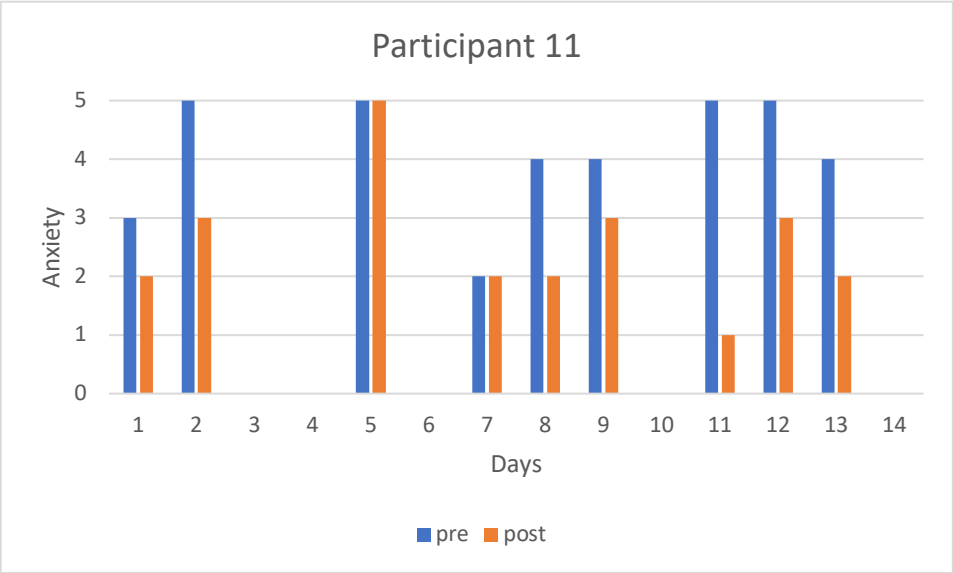


Figure 11. Participant 11 pre to post listening anxiety

Table 28
Participant 11 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	4.11	3.11
Post-intervention	2.56	1.82
Pre-post difference	1.55	1.29
Starting Song	5.33	5.05
Trait Anxiety		
Pre-program	100	89.1
Post-program	98	72.1
STAI Anxiety		
Pre-program	76	79.8
Post-program	66	61.4

Table 29
Participant 11 Songs

Number	Song	Artist
1	*I'm Here*	Cynthia Erivo
2	*Shiny*	Jemaine Clement
3	*A Safe Place to Land*	Sara Bareilles and John Legend
4	*Saint Honesty*	Sara Bareilles
5	*Meadowlark*	Liz Callaway
6	*Unbreakable Smile*	Tori Kelly
7	*Don't Start Now*	Dua Lipa

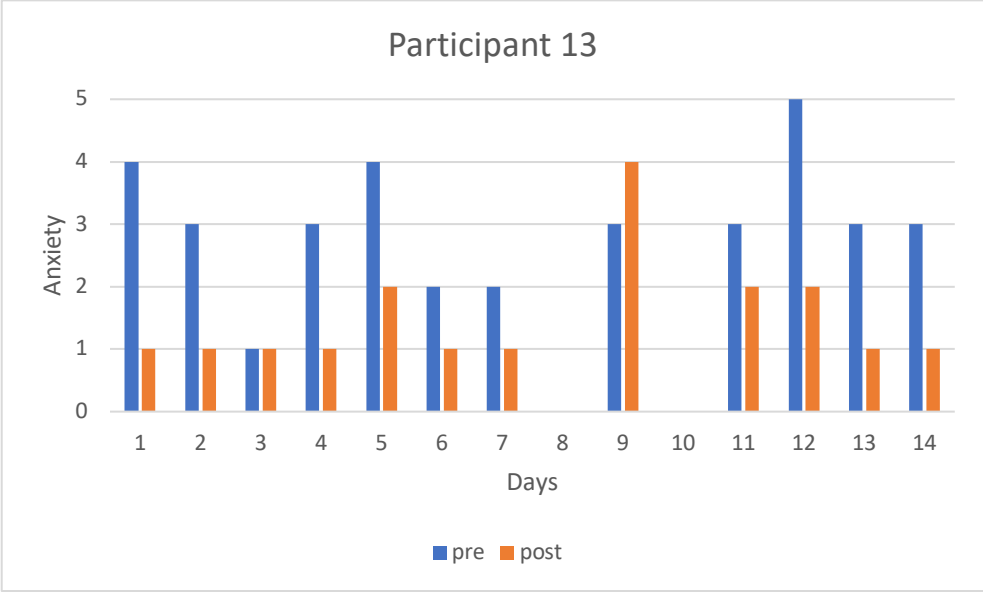


Figure 12. Participant 13 pre to post listening anxiety

Table 30
Participant 13 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	3	3.11
Post-intervention	1.5	1.82
Pre-post difference	1.5	1.29
Starting Song	4.5	5.05
Trait Anxiety		
Pre-program	59	89.1
Post-program	42	72.1
STAI Anxiety		
Pre-program	44	79.8
Post-program	40	61.4

Table 31
Participant 13 Songs

Number	Song	Artist
1	*Seven Days of Lonely*	I Nine
2	*Rock Bottom*	Hailee Steinfeld
3	*High of 75*	Reliant K
4	*Fight Song*	Rachel Platten
5	*Miss Movin'*	Fifth Harmony
6	*Best Love Song*	T-Pain
7	*When Can I See You Again*	Owl City

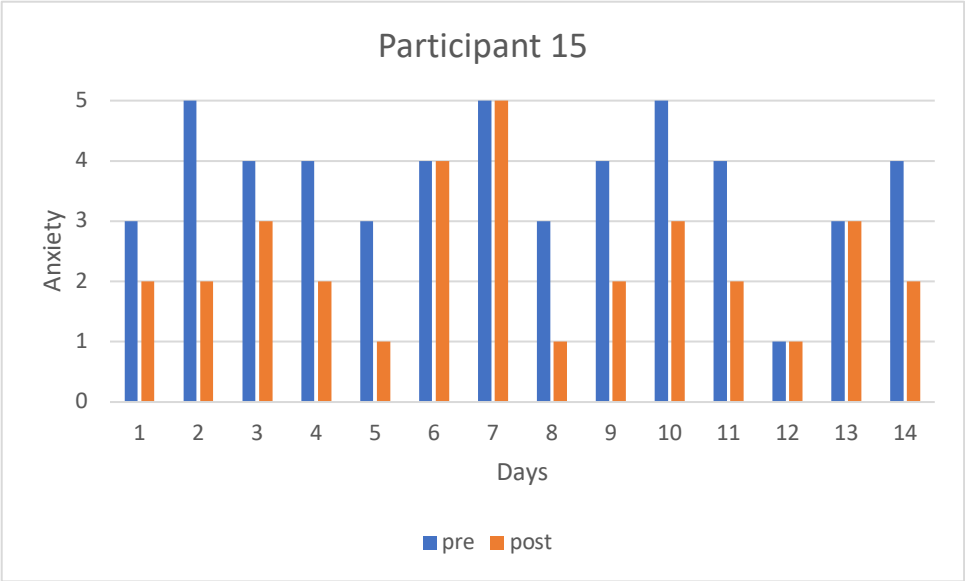


Figure 13. Participant 15 pre to post listening anxiety

Table 32
Participant 15 Data

Measure	Participant Mean Scores	Group Mean Scores
Momentary Anxiety		
Pre-intervention	3.71	3.11
Post-intervention	2.36	1.82
Pre-post difference	1.35	1.29
Starting Song	4.5	5.05
Trait Anxiety		
Pre-program	87	89.1
Post-program	52	72.1
STAI Anxiety		
Pre-program	82	79.8
Post-program	50	61.4

Table 33
Participant 15 Songs

Number	Song	Artist
1	*Drinkin' Me Lonely*	Chris Young
2	*I'm Not Okay*	MCR
3	*Anyone*	Demi Lovato
4	*Mercy*	Shawn Mendes
5	*Someone You Loved*	Lewis Capaldi
6	*Here You Come Again*	Dolly Parton
7	*Halo*	Beyoncé

APPENDIX E: MEAN ANXIETY LEVEL OF INITIAL SONG

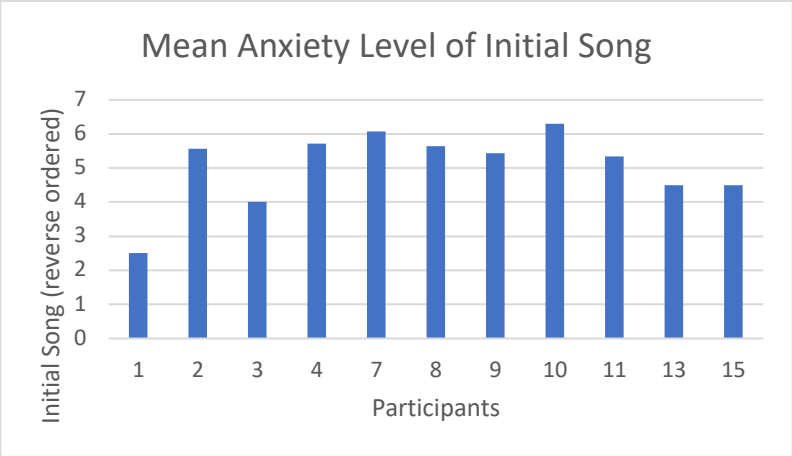


Figure 14. Mean anxiety level of initial song

APPENDIX F: INFORMED CONSENT FORM

University of the Pacific, Conservatory of Music
RESEARCH SUBJECT'S CONSENT TO PARTICIPATE IN RESEARCH
Feasibility and Effectiveness of Self-Administered Mood Vectoring Playlists in the Treatment of Anxiety Symptoms

Lead Researcher: Kate Bautch, MT-BC
Faculty Advisor: Eric Waldon, Ph.D., MT-BC

Your consent is being sought to participate in a research study, and your participation is entirely voluntary.

A. Purpose of Research. You are invited to participate in a research study which will look at the effectiveness of a self-administered music intervention. My name is Kate Bautch, and I am a graduate student in Music Therapy at University of the Pacific. The purpose of this study is to examine the effectiveness of music playlists to treat anxiety. While research shows that music therapy is effective, there is no research about people using their personalized playlists. If effective, this would extend the benefits of music therapy and allow interventions to be used when most needed by the client.

B. Duration of Participation. Your participation in this study will involve two in person meetings lasting no more than 1 hour 30 minutes, and over the course of 3 weeks you will take part in the treatment protocol for up to 20 minutes each day. The in-person meetings will include creation of the playlist, questionnaires, and a concluding interview.

C. Research Procedures. If you decide to participate, you will be asked to participate in two in-person meetings, lasting no more than 1 hour and 30 minutes in total. With your approval, the concluding interview in the final in-person meeting will be audio recorded. The initial meeting will include a pretest questionnaire, how to complete the protocol, and the creation of the playlist. After the initial meeting, you will complete the treatment protocol lasting no more than 20 minutes every day for 3 weeks. At the conclusion of the study, there will be a final 1 hour 30-minute meeting, during which you will take the posttest questionnaire, and there will be a final interview during which you have the opportunity to share your experiences and any barriers that you may have experienced.

D. Foreseeable Risks. There are some possible, minimal risks involved for participants. They include **Psychological**- You may feel more anxiety because you're being asked to think about it more. If any particular song in your playlist seems to increase your anxiety, you are free to skip that song. **Sociological**- You may feel a sense of embarrassment if you do not follow the directions exactly, or you may not feel sure whether you are following it correctly. During the initial meeting, you will be reassured that I, as the researcher, will remain non-judgmental and supportive. **Loss of confidentiality**- There is a possibility that your participation in this study will become known. Any information that is obtained in connection with this study and that can

be connected to you will remain confidential and be disclosed only with your permission. Additionally, your name will not be used and your identity will not be connected with any of your responses or results.

E. Benefits. There are some benefits to this research. Potential benefits are that participants may experience a reduction in anxiety symptoms and/or gain tools with which to better regulate their emotions. Additionally, you may become better aware of the effects music has on your emotions.

I. CONFIDENTIALITY

We will take reasonable steps to keep confidential any information that is obtained in connection with this research study and that can be identified with you. Measures to protect your confidentiality are: All digital data (e.g., audio recordings, typed transcription of final interview, and online treatment logs) will be kept on my password-protected external hard drive, which will be kept in a locked cabinet in my office. All signed consent forms (which have your signed name on it) will be kept in a safe, locked location, and destroyed after three years following the study.

II. PARTICIPATION

You were selected as a possible participant in this study because you contacted me, and you are an adult (18 years or older), and report experiencing symptoms of anxiety. We expect to have up to 50 participants take part in this study. Please feel free to ask any questions you may have.

Your decision whether or not to participate will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to participate, you are free to discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

III. EXPERIMENTAL PROCEDURES

The implementation of the treatment protocol is an experimental procedure, as it involves examining the effectiveness of an intervention in the management of anxiety.

IV. COLLECTION OF INFORMATION OR BIOSPECIMENS

Information (in the form of audio recordings, transcriptions of interviews, treatment logs, emails, and questionnaire responses) will be de-identified and will be destroyed after 3 years.

V. UNIVERSITY CONTACT INFORMATION

I am the lead researcher in this study and I am a graduate student at the University of the Pacific, Conservatory of Music. This research study is part of my thesis for my Master of Arts in Music Therapy.

If you have any questions about the research at any time, please contact me at (209) 661-5885 or by email at k_bautch@u.pacific.edu, or my advisor, Dr. Eric Waldon, at (209) 946-2419 or by email at ewaldon@pacific.edu.

If you have any questions about your rights as a participant in a research project or wish to speak with an independent contact, please contact the Office of Research & Sponsored Programs, University of the Pacific at (209) 946-3903 or by email at IRB@pacific.edu.

VI. NO COMPENSATION & NO COMMERCIAL PROFIT

No compensation is being offered for participating in this study. Your information will not be used for commercial profit.

VII. ACKNOWLEDGEMENT AND SIGNATURE

I hereby consent: (Indicate ***Yes*** or ***No***)

- To be audio recorded during this study.
  ___Yes ___No

You will be offered a copy of this form to keep.

Your signature below indicates that you have read and understand the information provided above, that you have been afforded the opportunity to ask, and have answered, any questions that you may have, that your participation is completely voluntary, that you understand that you may withdraw your consent and discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled, that you will receive a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Signed: _____ Date:_____

Research Study Participant (Print Name): _____

Participant's Legally Authorized Representative (Print Name):
_____

Description of Representative's Authority:
_____

Researcher Who Obtained Consent (Print Name): _____

APPENDIX G: STAI RESULTS BY PARTICIPANT

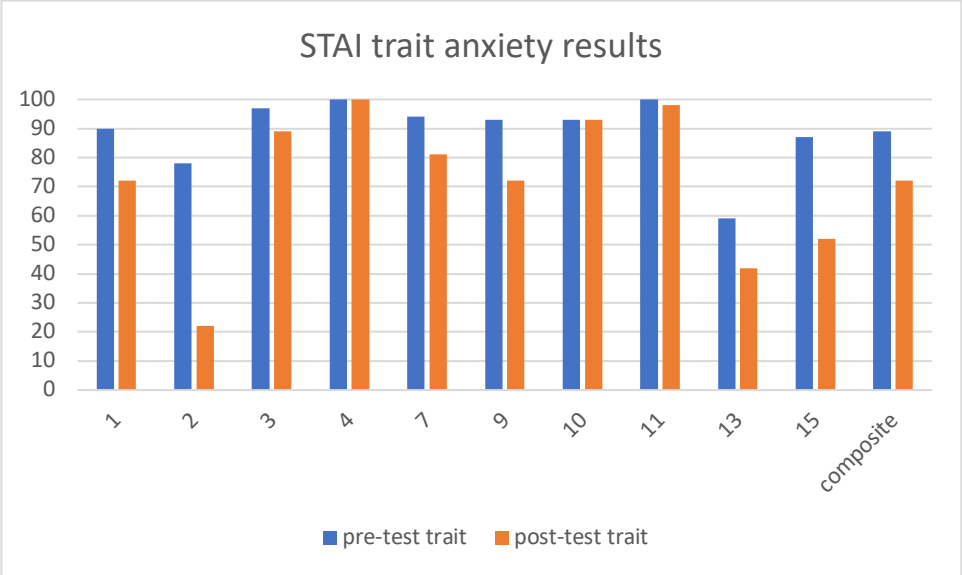


Figure 15. STAI trait results by participant

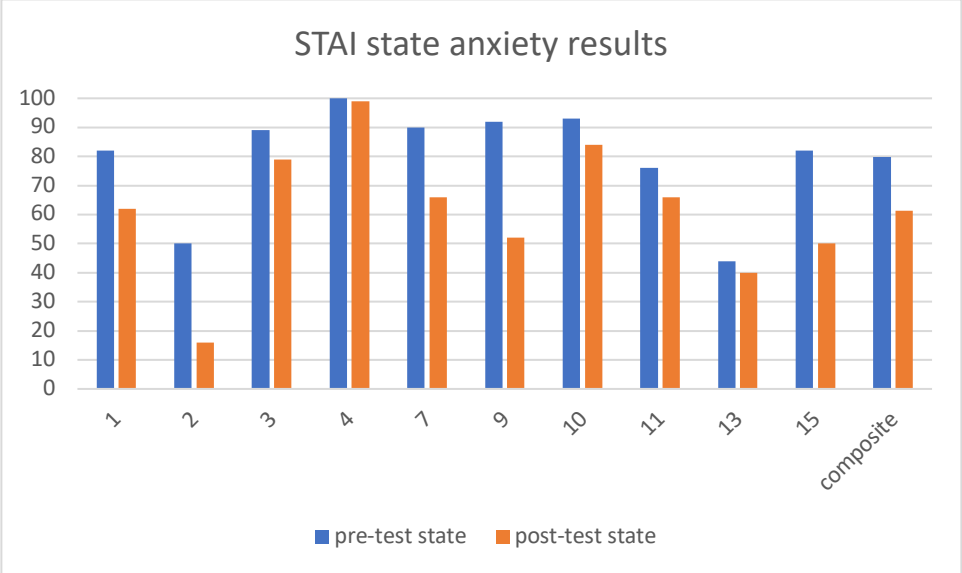


Figure 16. STAI state results by participant

APPENDIX H: DIFFERENCE BETWEEN PRE TO POST LISTENING MEANS, AND PRE TO POST LISTENING MEANS

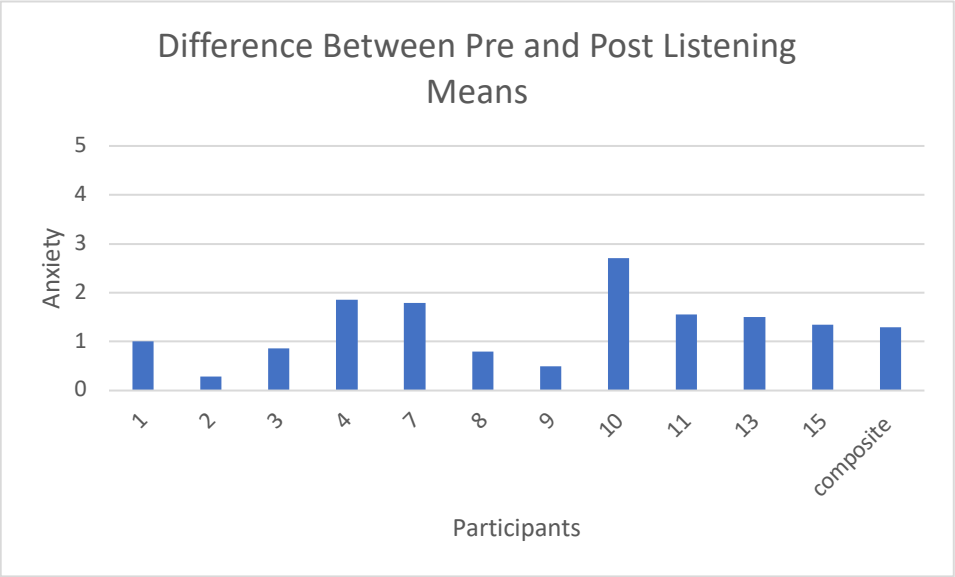


Figure 17. Difference between pre and post listening means

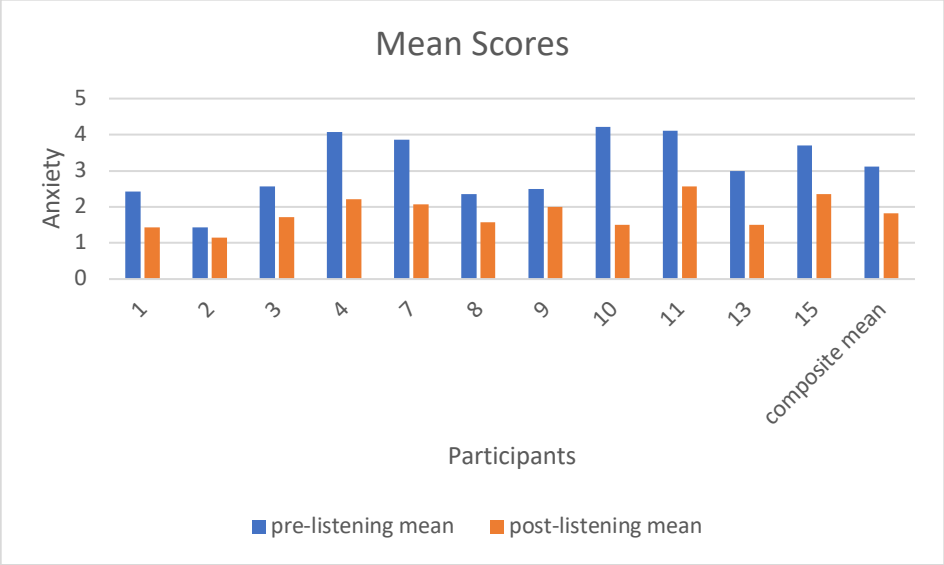


Figure 18. Mean pre and post listening mean scores

APPENDIX I: ACTIVITIES CHOSEN BY PARTICIPANT

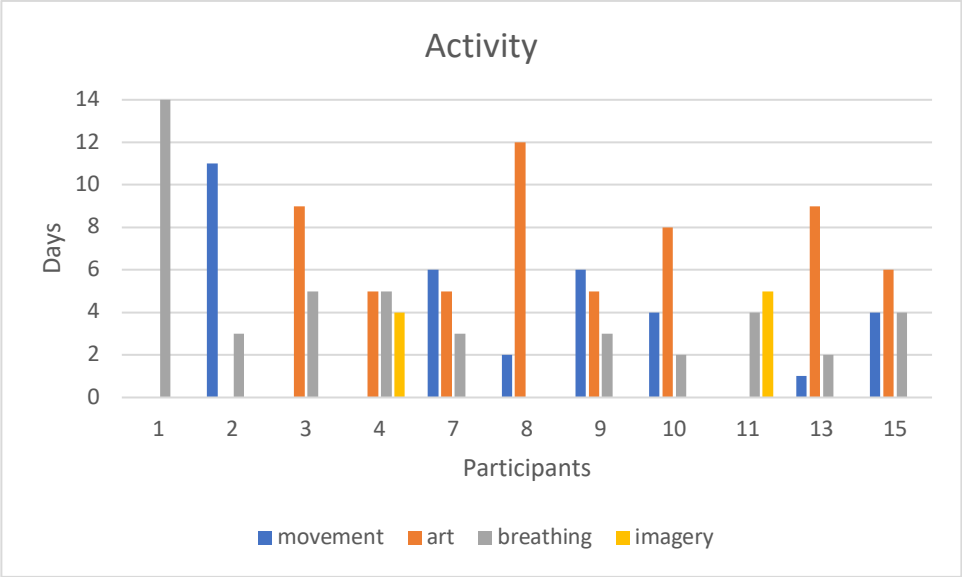


Figure 19. Activities by participant