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The Effects of Mindfulness Practice with Music Listening on Working Memory

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THE EFFECTS OF MINDFULNESS PRACTICE WITH MUSIC LISTENING ON WORKING MEMORY

by

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DEDICATION

This thesis is dedicated to my parents Theresa and Garry Messick for their unconditional support and instilling in me a lifelong love of music and learning.

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The Effects of Mindfulness Practice with Music Listening on Working Memory

Abstract

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The purpose of this experimental study was to investigate mindfulness strategies and their influence on working memory. The potential role of music in facilitating mindfulness practice is explored. Various listening exercises were investigated along with their influence on working memory (i.e. attention control). Thirty-four individuals were randomly assigned to participate in one of four listening groups: 1) mindfulness with music, 2) mindfulness without music, 3) music only, and 4) silence. Thirty-four participants engaged in a computerized digit-span task before and after the listening exercise to assess pre- and post-test working memory performance. Thirty participants were included in data-analysis due to technical errors in data collection. Differences between listening exercises were explored and comparisons were made between mindfulness, non-mindfulness, music, and non-music based exercises. Two-tailed independent samples *t*-tests found no significant differences in working memory when comparing mindfulness versus non-mindfulness and music versus non-music based exercises. An Analysis of Variance (ANOVA) indicated no significant differences in working memory for any of the listening conditions. Results call for further examination of control variables and methodology to explore the role of music listening in mindfulness practice. Implications for further research and contributions to music therapy and music education are considered.

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Chapter 1: Introduction

Many individuals today struggle with mental health problems which can severely inhibit their ability to lead healthy and productive lives. As reported in the 2017 National Survey on Drug Use and Health (NSDUH), it was estimated that 11.2 million adults (4.5%) in the United States had a serious mental illness within the past year (Substance Abuse and Mental Health Services Administration, 2018). This survey defined a serious mental illness as being characterized as a mental, behavioral, or emotional disorder, diagnosable in the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* resulting in substantial impairment in carrying out life activities as defined by Global Assessment of Functioning scores of 50 or less (Center for Behavioral Health Statistics and Quality, 2018). When including less severe mental disorders i.e., those not involving serious functional impairment, the NSDUH survey found that 46.6 million (18.9%) adults 18 or older in the U.S. lived with any mental illness.

In an effort to address this growing problem The Grand Challenges in Global Mental Health Initiative (Collins et al., 2011), an advisory board of 594 scientists and researchers across 60 countries, identified challenges and priorities in mental health research and treatment. The authors presented several themes, including an emphasis on a "life-course" approach, recognizing that mental illness can develop early in life. The authors state, "efforts to build mental capital — the cognitive and emotional resources that influence how well an individual is able to contribute to society and experience a high quality of life — could also mitigate the risk of disorders such as depression, substance-use disorders, bipolar disorder and dementia" (p. 28). Broadening treatment focus beyond patients to their community and families along with developing evidenced-based interventions were also suggested by the findings of the board. It would seem important to increase efforts in research and clinical practice to address these

challenges and priorities, as well as examine the underlying factors of common mental health problems.

Major depression is one of the most common mental illnesses, while 17.3 million (7.1%) of adults in the U.S. aged 18 or older had at least one major depressive episode in the past year as reported in the 2017 NSDUH (Substance Abuse and Mental Health Services Administration, 2018). Major depression is a serious mood disorder that negatively effects functioning in social/occupational areas and overall quality of life. Common symptoms of depression include feelings of worthlessness, hopelessness and guilt, loss of interest in hobbies and activities, difficulty concentrating, decreased energy or fatigue, difficulty sleeping, appetite or weight changes, and thoughts of death or suicide (National Institute of Mental Health, 2018). Anxiety disorders are also highly common mental illnesses that significantly impact a person's ability to function and enjoy life. In 2005, 18.1% of the U.S. population had any anxiety disorder (e.g. generalized anxiety disorder, post-traumatic stress disorder, panic disorders, etc.) in the past twelve months, while 22.8% of these cases were considered severe (Kessler, Chiu, Demler, & Walters, 2005). Common characteristics of generalized anxiety disorder include difficulty controlling feelings of worry, restlessness, difficulty concentrating, muscle tension, fatigue, irritability, and sleep problems (National Institute of Mental Health, 2018). There has been growing interest in the significance of repetitive negative thinking patterns in mental health and their influence on the severity of anxiety and depression symptoms.

Repetitive Negative Thinking

Repetitive negative thinking, such as rumination and worry, is considered a strong contributor to the development and severity of various mental illnesses. Rumination is generally

defined as a repetitive thought process focused on negative affect and the self (Smith & Alloy, 2009) and may involve thoughts about the causes, consequences, circumstances, and symptoms of negative affect (Nolen-Hoeksema, 1991) or sadness (Conway, Csank, Holm, & Blake, 2000). Similarly, worry is characterized as repetitive thought activity focused on negative things, often in fear or anticipation of negative events that may happen in the future (Borkovec, Ray, & Stöber, 1998). These repetitive negative thinking processes may become pervasive and uncontrollable, leading to enhanced and prolonged symptoms of mental illness. Of these processes, rumination is considered an important cognitive feature of Major Depressive Disorder; chronic and uncontrollable worry is acknowledged as a main feature of Generalized Anxiety Disorder (Yilmaz, 2015). While rumination is often investigated as related to depression and worry associated with anxiety, recent research has recognized the strong relationship between the two as they are both forms of repetitive and intrusive thought patterns.

Research suggests that both worry and rumination are types of repetitive negative thinking and have similar underlying processes with the difference being that worry generally involves thoughts about the future and rumination tends to involve the past (McEvoy, Watson, Watkins, & Nathan, 2013; Watkins, 2008). Research suggests that repetitive negative thinking, including both rumination and worry, is present in anxiety and depression (McEvoy et al., 2013; Yilmaz, 2015). McEvoy and colleagues (2013) conducted a study which investigated measures of worry and rumination across a large clinical sample of individuals with various forms of anxiety and depression including comorbid diagnoses (i.e. diagnosed with both anxiety and depression). There were no significant differences between the various anxiety and depression diagnoses with regard to measures of worry and rumination; higher repetitive negative thinking was also related to comorbid diagnoses. Another study conducted by Yilmaz (2015) found that

both worry and rumination were related to anxiety and depression symptoms among a sample of college students. Similarly, results from a longitudinal study found that increased stress, worry, and rumination predicted both anxiety and depressive symptoms among young adolescents (Young & Dietrich, 2015). These recent findings may suggest that repetitive negative thinking patterns, including worry and rumination, should be examined and addressed based on their common processes regardless of diagnosis.

Mindfulness-Based Psychotherapy Approaches

In recent decades, mindfulness practice has become widely implemented and investigated within various psychotherapy approaches (Hoffman, Sawyer, Witt, & Oh, 2010; Kabat-Zinn, 2003; Linehan, 2015; Segal, Williams, & Teasdale, 2013). Originating from traditional Buddhist meditative practices, mindfulness-based interventions have been adapted for contemporary mental health treatment (Ivey, 2015). Bishop et al. (2004) describe mindfulness as "a form of mental training to reduce cognitive vulnerability to reactive modes of mind that might otherwise heighten stress and emotional distress or that may otherwise perpetuate psychopathology" (p. 231). Along with acceptance-based and emotion regulation therapies, mindfulness is part of a recent wave of cognitive behavioral treatment approaches that emphasize the relationship between thoughts and emotions. Gu, Strauss, Bond, and Cavanagh (2015) conducted a meta-analysis which found strong evidence that cognitive and emotional reactivity are among the main mechanisms and effects of mindfulness-based interventions. This study also found moderate and consistent evidence that mindfulness, rumination, and worry are important mechanisms of mindfulness-based interventions. The connection to cognitive/emotional reactivity and repetitive negative thinking patterns seems important when considering the benefits of mindfulness practice.

Mindfulness-based therapy and mindfulness interventions have been found to have significant effects in improving mental health symptoms. A meta-analysis conducted by Hoffman et al. (2010) explored the effects of mindfulness-based therapy (MBT) on anxiety and depression symptoms. Most studies which met the criteria for inclusion involved an 8-week mindfulness intervention, such as Mindfulness-Based Stress Reduction (Kabat-Zinn, 2003) or Mindfulness-Based Cognitive Therapy (Segal et al., 2013), with all interventions delivered in person. All studies used clinical samples with participants diagnosed with a variety of psychological or physical/medical disorders; anxiety and mood symptoms were measured from pre- to post-intervention in all studies (Hoffman et al., 2010). Results showed that MBT was moderately effective in decreasing anxiety and reducing mood symptoms in the overall sample from pre- to post-intervention. For participants specifically diagnosed with anxiety and/or depression, MBT was very effective in improving symptoms. Individuals who were not diagnosed with an anxiety or depressive disorder, but demonstrated anxiety or mood symptoms along with a physical or medical condition, MBT was moderately effective in reducing symptoms. This meta-analysis demonstrates the overall impact of mindfulness-based therapies in the management of anxiety and depressive symptoms. Specialized therapies have been developed to target various symptoms and diagnoses including Mindfulness-Based Stress Reduction, Mindfulness-Based Cognitive Therapy, and Dialectical Behavior Therapy.

Mindfulness-Based Stress Reduction

One of the most well-known psychotherapy approaches that utilizes mindfulness meditation is Mindfulness-Based Stress Reduction (MBSR) developed in 1979 by Jon Kabat-Zinn (Kabat-Zinn, 2003). MBSR is rooted in ancient Buddhist meditation philosophy emphasizing compassion, insight, and open-mindedness. MBSR was originally developed to

serve as a complementary treatment approach for medical patients to facilitate more adaptive and less reactive responses to distressful experiences. Founded by Kabat-Zinn and colleagues, the Stress Reduction Clinic at The University of Massachusetts was created to provide medical patients with training in meditation and mindfulness practice to further manage symptoms in addition to medical treatment. The program involves 8 weeks of mindfulness education and guided practice to gain control and awareness of the connection between mind and body, ultimately to relieve physical and mental suffering. Recent research has explored the effectiveness of MBSR in improving symptoms among various clinical populations.

A randomized controlled study conducted by Reich et al. (2017) examined the effects of MBSR in the reduction of co-occurring mental health symptoms or "symptom clusters" among breast cancer survivors. When compared to usual care without MBSR, individuals who participated in the MBSR for breast cancer program experienced reduced severity of psychological (i.e. anxiety, depression, stress, and emotional well-being) and fatigue (i.e. fatigue, sleep quality, drowsiness) symptom clusters with medium effect sizes. These improvements were sustained for 12-weeks following completion of the program. In another randomized controlled trial Vollestad, Siversten, and Nielsen (2011) investigated the effects of MBSR among patients with heterogeneous anxiety disorders, including panic disorder, social anxiety disorder, and generalized anxiety disorder. Compared to a wait list control condition, the MBSR group demonstrated significant improvements in anxiety measures with a medium to large effect size and an improvement in depression symptoms with a large effect size. Results also showed that improvements in the MBSR group were maintained at six months following treatment. MBSR has also been shown to improve anxiety and depression symptoms among adults with autism spectrum disorder (Sizoo & Kuiper, 2017) and enhance emotion regulation for individuals with

social anxiety disorder (Goldin & Gross, 2010). Across diagnoses, there appears to be strong support for MBSR in managing mental health symptoms such as stress, anxiety, and depression.

Mindfulness-Based Cognitive Therapy

Mindfulness-Based Cognitive Therapy (MBCT) has been shown to be an effective therapeutic intervention for preventing relapse among individuals with chronic or recurrent depression (Piet & Hougaard, 2011; Kuyken et al., 2008; Kuyken et al., 2016). MBCT is a systematic training combining mindfulness techniques with theoretical concepts behind cognitive therapy, originally developed to target cognitive mechanisms relating to depressive relapse (Segal et al., 2013). MBCT was adapted out of Mindfulness-Based Stress Reduction (Kabat-Zinn, 2003) to address symptoms of depression and factors leading to relapse. The model is meant to address the cognitive vulnerability of individuals who experience multiple episodes of depression (Segal et al., 2013). Over an 8-week period, MBCT teaches mindfulness exercises and strategies to gain control over automatic thoughts and disengage from repetitive rumination which tend to preserve depressive mood.

Meta-analytic research has explored the effectiveness of MBCT in the treatment and relapse prevention of chronic depression. A meta-analysis conducted by Piet and Hougaard (2011) explored the effectiveness of MBCT in preventing depressive relapse by analyzing six randomized controlled trials including 592 participants total. Results showed that that MBCT was significantly effective in preventing relapse among individuals with Major Depressive Disorder. The authors suggest that MBCT is a cost-effective intervention for recurrent depression as it may reduce the need for medication. A more recent meta-analysis by Kuyken and colleagues (2016) analyzed individual patient data (n = 1258) across nine different randomized controlled trials to explore rates of depressive relapse 60 weeks after MBCT

treatment. Results found a significant effect for MBCT in preventing depressive relapse, especially among individuals with severe symptoms who experience recurring episodes of depression. By combining strategies of mindfulness and cognitive therapy, MBCT is an effective non-pharmacological intervention for preventing depressive relapse and may play an integral role in the therapeutic intervention of severe mood disorders.

Dialectical Behavior Therapy

Originally developed to treat individuals with borderline personality disorder and chronic suicidality, Dialectical Behavior Therapy (DBT) has widely expanded in research and clinical use over the past few decades (Linehan, 2015). The creator Marsha M. Linehan describes DBT in her skills training manual as "based on a dialectical and biosocial theory of psychological disorder that emphasizes the role of difficulties in regulating emotions, both under and over control, and behavior" (p. 3) with a goal of changing problematic patterns of emotion, thought, behavior, and interpersonal interaction. Standard DBT involves engagement in a combination of group skills training, telephone coaching, individual therapy, and a therapist consultation team. Various themes and skills are taught within DBT including distress tolerance, emotion regulation, interpersonal effectiveness, and mindfulness skills. Research supports training in DBT mindfulness skills with a variety of populations, both in standard DBT and when incorporated in other treatment settings.

A study by Soler et al. (2012) explored the effects of DBT mindfulness training among individuals with borderline personality disorder as compared to general psychiatric management alone. Results showed significant improvements in measures of impulsivity for those in the DBT-mindfulness training, while those in general psychiatric management alone worsened in

measures of inattention and impulsivity. The results of a meta-analysis by Cook and Gorraiz (2016) showed positive effects of DBT on reducing non-suicidal self-injurious behavior and depression among adolescents. Other research has found DBT skills training to be effective for symptom management among in individuals with bipolar disorder (Eisner et al., 2017) and children with disruptive mood regulation disorder (Perepletchikova et al., 2017). Additionally, a randomized controlled trial investigated the effects of DBT skills training among individuals with transdiagnostic emotion dysregulation, including those with depression and/or anxiety and without borderline personality disorder (Neacsiu, Eberle, Kramer, Wiesmann, & Linehan, 2014). Results after 16 weeks of DBT skills training, when compared to an activities-based support group, showed significant effects of decreased anxiety, increased skills use, and increased emotion regulation. Significant evidence supports DBT, in which mindfulness plays an important role, for the treatment and symptom management of a variety of diagnoses.

Mindfulness and Attention Control

It seems that mindfulness practice may be an effective way to regulate emotional and cognitive stress that could predict or sustain symptoms of mental illness, such as repetitive negative thinking patterns within anxiety and depression. While the practice is frequently utilized across a variety of clinical practices and investigated in a number of research studies, Bishop et al. (2004) addressed the lack of a specific operational definition of mindfulness. They emphasize the importance of coming to a consensus about an operational definition of mindfulness to identify the components of the practice which may be measurable predictors of effectiveness. The investigators held a series of meetings to discuss common factors across various approaches and develop a potential theoretical definition of mindfulness practice. Bishop and colleagues propose a two-component model of mindfulness which emphasizes: (1)

self-regulation of attention and (2) orientation to the present moment with curiosity, openness, and acceptance.

Bishop et al. (2004) explain that the first step in reaching a state of mindfulness is the ability to sustain attention as well as shift attention back to the object of focus, often one's breath, whenever the mind wanders to other thoughts or feelings. It is suggested that improvements in sustained attention and attention shifting may be objectively measured with standard tests of attention; this would allow for assumptions regarding the effectiveness of mindfulness practice. This self-regulation of attention helps support the second component of mindfulness which is an awareness to present thoughts, feelings, and sensations without elaboration or judgment. Rather than dwelling on other thoughts or feelings and allowing them to become a distraction, these thoughts and feelings are simply acknowledged and accepted while attention is shifted back to the current focus. The investigators suggest that practicing non-judgmental awareness of thoughts and feelings can improve cognitive inhibition and diminish "secondary elaborative processing" (p. 233). It is proposed that tasks that require inhibition of semantic processing, such as the Stroop task (1935), could possibly be used to measure the regulation of awareness required in mindfulness practice. This operational definition of mindfulness, emphasizing self-regulation of attention and a non-judgmental awareness, has been generally accepted and explored by many clinicians and researchers (Kabat-Zinn, 2003; Bishop et al., 2004; Hoffman et al., 2010; Khoury, Lecomte, Gaudiano, & Paquin, 2013). It would seem an appropriate approach to emphasize attention and non-judgmental awareness when investigating effects of mindfulness practice.

The Role of Perception and Music-Based Interventions

In recent years, research has explored the role of music in mindfulness for mental health (Eckhart & Dinsmore, 2012; Graham, 2009; Graham, 2010), while mindfulness interventions and approaches have been adapted for use in music therapy practice (Chwalek & McKinney, 2015; Lesiuk, 2016; Medcalf, 2017). Through active and receptive music-based interventions, music therapy may target a range of clinical needs including relieving stress/anxiety and managing depression symptoms (Aalbers et al., 2017; Ghetti, 2013; Goldbeck & Ellerkamp, 2012). Many clinicians and researchers are demonstrating interest in combining music and mindfulness, both within and outside of music therapy practice. When exploring the combined use of music and mindfulness practice, it would seem important to consider the unique influences of music perception on human behavior and psychological functioning.

Theories of music perception and aesthetic arousal consider the neuropsychological effects of music, as well as its influence on attention and cognitive functioning. According to Thaut (2005), "music exploits stimulus properties that facilitate perception by effectively controlling exploration, attention, motivation, and reinforcement," (pp. 9). Thaut discusses Berlyne's (1971) theory of arousal, affect, and reward when processing aesthetic stimuli. Music listening activates the limbic system in the brain, in which arousal and pleasure are activated and processed. Music listening and music experiences are considered rewarding due to the pleasurable experiences that come from arousal changes when the limbic system is activated. Behaviors related to the limbic system are also influenced when processing music stimuli such as motivation, alertness, and mood (Thaut, 2005; Berlyne, 1971). Music stimuli may encourage selective attention and abstraction by inhibiting the processing of outside stimuli (Thaut, 2005). Thaut also suggests that the grouping patterns in musical structure, including rhythmic and

melodic patterns, may assist in learning and retention. The influence of music perception on arousal and alertness is of significance in music therapy and may suggest the potential for combining music and mindfulness practice.

Research Purposes

Given the increased interest in mindfulness within psychotherapy to enhance cognitive flexibility and reduce repetitive negative thinking, as well as the influence of music on arousal and alertness, it would seem important to explore the potential role of music in facilitating mindfulness practice. Based on the definition of mindfulness proposed by Bishop et al. (2004) which emphasizes self-regulation of attention to the present moment, attention control is examined by measuring working memory. This experimental study is aimed at investigating the following research questions:

1. Does participation in mindfulness-based versus non-mindfulness based exercises impact working memory as evidenced by performance on a computerized auditory digit span test?

2. Does participation in music-based versus non-music based exercises impact working memory as evidenced by performance on a computerized auditory digit span test?

3. Are there differences in working memory as evidenced by performance on a computerized auditory digit span test among those engaged in various listening exercises?

Chapter 2: Review of the Literature

Mindfulness Factors

The mental health benefits of mindfulness practice have been widely recognized, especially within common psychotherapy approaches. Recent research has emphasized the investigation of specific factors which contribute to the benefits of mindfulness practice. As previously discussed, Bishop et al. (2004) describe mindfulness as sustained attention control with non-judgmental awareness. A theoretical model of mindfulness involving similar factors is presented by Shapiro, Carlson, Astin, and Freedman (2006). A three-axiom model of mindfulness is proposed which illustrates the role of 1) intention, 2) attention, and 3) attitude, stating "at the core of mindfulness, is the practice of paying attention" (p. 376). Shapiro and colleagues suggest that intention of mindfulness may range from self-regulation, to self-exploration, to self-liberation as individuals continue their practice, while outcomes will reflect these intentions. Attention is proposed as an important component of mindfulness which includes sustained attention (i.e. attending for a prolonged period), attention switching (i.e. shifting focus between objects), and cognitive inhibition (i.e. avoiding elaborative processing of thoughts, feelings, and sensations). Lastly, the authors suggest having an attitude of acceptance, kindness, and openness as another important factor of mindfulness, described as bringing "heart" qualities to the practice (p. 377). It is suggested that intention, attention, and attitude all play a role in mindfulness practice in which one may ultimately learn to "reperceive" experiences in a more objective and detached manner (p. 378). Other models of mindfulness (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Brown & Ryan, 2003; Vago & Silberswieg, 2012) involve related factors such as self-awareness, intention and motivation, and non-reactivity to inner experiences with consistent emphasis on attentional factors.

A literature review by Wolkin (2015) suggests that mindfulness practice engages attention aspects which contribute to reduced rumination and improved psychological well-being. By reviewing research on mindfulness and its mechanisms, Wolkin suggests that mindfulness engages multiple aspects of attention including alerting (i.e. sustaining and maintaining attention focus), orienting (i.e. selecting attention focus within a high-volume sensory experience), and executive attention (i.e. shifting attention within competing cognitive demands). It is suggested that although the relationship between these three attention aspects is unclear, all demonstrate engagement and improvement through mindfulness practice. Wolkin also discusses the difference between focused attention and receptive attention in mindfulness practice, explaining that one may practice focused attention to an object (e.g. one's breath) or expand to receptive attention involving a broad awareness of multiple present-moment experiences. It is suggested that focused attention on one object is a starting point for practicing mindfulness and with further practice one may engage in receptive attention of broader experiences. However, it is also noted that these levels of attention interplay and may fluctuate between focused and receptive even for those with extensive mindfulness experience.

Wolkin (2015) proposes a two-part model of mindfulness involving 1) distraction (i.e. maintaining focus on the present moment) and 2) decentering (i.e. shifting to non-judgmental acceptance of thoughts and experiences). By practicing focused attention, self-regulation processes may be enhanced; one may develop adaptive control over where to place attention and distract from ruminative thoughts. Receptive attention in mindfulness practice supports broader awareness to resist elaboration of ruminative thoughts, leading to decentering and non-judgmental acceptance of thoughts as "fleeting 'mental' events" (p. 177). Wolkin's review demonstrates the significance of attention factors in mindfulness research. Additionally, it

illustrates the variability in operations and interventions, making it a challenge to define mindfulness and clarify its mechanisms.

In an effort to contribute to the empirical research on effects and mechanisms of mindfulness, Josefsson, Lindwall, and Broberg (2014) conducted a randomized controlled trial comparing a short-term mindfulness-based intervention with an active control group (i.e. relaxation) and an inactive waitlist group. The authors suggest a need for further exploration into short-term mindfulness interventions, as compared to the standard 8-week programs such as MBSR, to increase accessibility especially for individuals with active and busy lives. Both the mindfulness and relaxation groups involved engagement in two 45 minute classes per week for four weeks. The mindfulness class was taught in-person by a psychologist specializing in mindfulness practice in clinical settings; the relaxation group was taught by an experienced relaxation skills trainer. The mindfulness-based intervention taught standard sitting mindfulness practices such as attention to breath, thoughts, emotions, and body sensations while practicing non-judgmental awareness and acceptance. Pre- and post-test scores were collected among 126 working adults to measure self-reported mindfulness and decentering, psychological well-being, anxiety, depression, and coping style; executive attention was also measured using a computerized version of *The Stroop Task* (1935).

Results showed that the mindfulness group scored significantly higher on self-reported mindfulness and psychological well-being than the inactive waitlist group (Josefsson et al., 2014). However, no significant differences were found between groups for decentering, anxiety, depression, executive attention, or coping style. It is suggested that the relaxation intervention involved similar exercises such as awareness of body sensations, which may account for the lack of significant differences between the mindfulness and relaxation groups. The authors discuss

how long-term mindfulness interventions (e.g. MBSR) may allow for more insight-based practices to increase decentering and reduce anxiety and depression. Since no differences were found in executive attention, it is suggested that *The Stroop Task* (i.e. quick responses to external objects) may not be related to the internal awareness and "refined attentional ability" (p. 30) involved in mindfulness practice. The authors propose the need for further investigation into ways to measure attention regulation in mindfulness practice.

Recent research has begun to explore the immediate effects of mindfulness practice, as opposed to studies involving multiple sessions over several days or weeks. A randomized controlled study by Johnson, Gur, David, and Currier (2015) explored the effects of a single 25-minute mindfulness session on mindfulness, mood, and attention measures. Ninety-two university students were randomly assigned to participate in a mindfulness meditation, sham meditation, or book listening group. The mindfulness meditation group engaged in an audio recorded guided mindfulness exercise and involved instructions to focus on breathing and acceptance. The sham meditation group involved lesser detail in breathing instructions, as well as longer periods of silence between instructions; the sham meditation was intended to investigate if outcomes were due to participant expectations of the effects of meditation. Participants in the book listening control group were instructed to listen to a book on CD for the same amount of time as the other meditation groups. Post-tests were conducted immediately after engaging in the listening exercises to measure repetitive thoughts, state mindfulness, anxiety, and mood states; to measure attention and working memory cognitive tests were conducted including a forward/backward digit span, visual tracking, and attentional set shifting tasks.

Johnson and colleagues (2015) found significant improvement on state mindfulness and several mood states for both the mindfulness meditation and sham meditation groups. However, no significant effects were found on the attention and working memory tasks for the mindfulness and sham meditation groups as compared to the control group. It is discussed that the mindfulness meditation and sham meditation exercises may not have differed enough to yield significant effects. The authors also suggest that one session of mindfulness practice may not have been enough to effect performance on the types of complex cognitive tasks used to measure attention factors. It is suggested that the tasks used to measure attention factors (i.e. working memory, visual tracking, word retrieval, and concentration) were demanding and complex, requiring sustained attention, which may not have shown significant effects after one session of mindfulness practice. The authors suggest that cognitive tasks which measure attentional lapses (e.g. Sustained Attention to Response Task, attentional blink, Stroop tasks, etc.) may be more appropriate in assessing effects of one-session mindfulness practice.

Working Memory Capacity

Research suggests that working memory capacity (WMC) is a predictive factor in performance on tasks requiring a high level of concentration and attention control. In a laboratory study examining the relationship between WMC and mind wandering Kane et al. (2007) asked participants to complete three complex-span tasks. WMC scores were then compared with participants' self-reported thoughts and experiences at spontaneous times throughout their regular daily routine. Using experience-sampling methodology, participants were digitally probed at random times in the day to complete a short questionnaire reflecting whether they were focused on the current task or if their mind was wandering to unrelated thoughts. Participants also reported other aspects of their experience, such as enjoyment,

anxiety, or level of difficulty regarding the task. Results showed that participants who demonstrated lower-WMC in the laboratory were more likely to report mind-wandering during daily tasks that were more cognitively demanding. Furthermore, results showed that WMC did not predict the amount of self-reported mind-wandering during tasks that were considered boring or unpleasant. Kane and colleagues emphasize the role that WMC appears to play in the ability to avoid mind-wandering during challenging tasks that require focused concentration.

Mrazek, Franklin, Phillips, Baird, and Schooler (2013) conducted a randomized experimental study examining the effects of a 2-week mindfulness training on working memory capacity, GRE performance, and mind-wandering . A group of 48 undergraduate students were randomly assigned to either a mindfulness class or a nutrition class. Classes met four times a week for two weeks, with each class being 45 minutes in length. The mindfulness class was strongly influenced by MBSR techniques, with each class involving 10-20 minutes of mindfulness meditation on sensory experiences followed by class discussion for further understanding of concepts. The class was also required to engage in 10 minutes of daily mindfulness practice outside of class. Before and after the two weeks of classes, participants in each class completed the operation span task (OSPAN) to measure working memory and a section of the Graduate Record Examination (GRE) which assessed reading comprehension. Mind-wandering during these tests was measured using retrospective measures, thought sampling, and self-report. Participants in the nutrition class demonstrated no change in WMC, GRE performance, and mind wandering. Those in the mindfulness group demonstrated a significant improvement on all measures from before to after the two weeks of classes. Mrazek and colleagues extoll the positive influence of mindfulness training, along with daily mindfulness practice, on working memory and attention factors.

Jha, Stanley, Kiyonaga, Wong, and Gelfand (2010) explored the effects of mindfulness training (MT) among a military cohort in a high stress pre-deployment stage, as compared with a civilian control group who also participated in MT and a military control group who did not engage in MT. Specifically, this study aimed to explore whether MT is an effective preventative intervention for individuals experiencing a time of high stress and who are at risk of developing psychological distress. Participants in the military control group (n = 17) were in the pre-deployment stage and did not receive MT. The civilian control group (n = 12) involved teachers who received MT in a separate study. Participants in the MT military group (n = 29) engaged in 8-weeks of Mindfulness-Based Mind Fitness Training (MMFT), a mindfulness program based on MBSR and developed to support the specific needs of individuals in the military. Participants in the MMFT program were also asked to log their amount of out of class mindfulness practice.

Using the Operation Span Task (OSPAN), working memory capacity (WMC) was measured before and after the 8-week long intervention (Jha et al., 2010). The OSPAN involves solving a math problem while simultaneously remembering a sequence of letters. Results showed that within the civilian control group WMC remained stable over time, while WMC decreased for individuals in the military control group. Within the military MMFT group, results demonstrated that WMC decreased over time for those who logged low MT practice and increased over time for those with higher MT practice. Those with high MT practice also demonstrated lower negative affect and higher positive affect. The authors recognize several limitations of the study including small sample size and lack of randomization into the experimental groups. However, this study may be a starting point for further exploration into the influence of sufficient mindfulness practice on WMC and psychological distress during periods of high stress.

Music and Attention

The connection between music and attention has been a significant area of research such as within the fields of music perception, music education, and music therapy. Janata, Tillman, and Bharucha (2002) studied the effect of polyphonic music listening on working memory circuits using experimental neuroimaging. Using a magnetic resonance imaging (MRI) scanner to map changes in neural activity in the brain, event related potentials (ERPs) were monitored during music listening. ERPs are considered small timed voltages in brain structures in response to motor, sensory, or cognitive stimuli (Sur & Sinha, 2009). In one group, participants were prompted to practice selective attention to polyphonic music by following one instrument and to notice any deviants in the music (Janata et al., 2002). In another group, participants were prompted to listen to the music globally, without focusing attention to one instrument or musical element alone.

From examining ERP results, participants were more likely to hear deviants in the music when engaging in selective attention exercises than when listening to the music globally (Janata et al., 2002). As compared to resting without music listening, increases in neural activity were detected when participants were listening to music both selectively (i.e. to one instrument) and globally (i.e. across several instruments). While significant differences were found in neural activity between the selective listeners and global listeners, the authors express they are unable to make meaningful conclusions about the contrasts in cognitive networks being employed. Overall, the Janata and colleagues conclude that attentive listening to polyphonic music stimulates neural circuits including those related to working memory and attention.

In another study, Koeslch, Schroger, & Gunter (2002) used neuroimaging to explore the influence of music listening “preattentively” or when not focusing attention directly on the music

(p. 38). Based on their previous research, Koelsch and colleagues emphasized the ERP activity related to hearing "harmonically unrelated chords" in music (p. 38). The authors discuss that due to the unexpected and surprising nature of an unrelated chord within an established key in the music, unique neural responses are activated. The current study sought to investigate whether these neural responses to an unexpected chord were detected even when listeners were ignoring and not actively attending to the music.

Koelsch et al. (2002) used recordings of a keyboard playing a chord progression that established a stable key, with Neapolitan sixth chords included as the harmonically unrelated chords (e.g. a D-flat major chord in the key of C major). A group of non-musicians were divided into two listening groups; one group was instructed to ignore the music while reading a book, while the other group was prompted to attempt to detect the Neapolitan sixth chords. Results demonstrated that the ERP responses related to the unexpected Neapolitan sixth chords were present within the group who were not directly attending to the music. Koelsch and colleagues emphasize the significance of these results in illustrating the automatic and implicit processing of music even among non-musicians.

In a small experimental study, Graham, Robinson, and Mulhull (2009) explored the influence of music listening on attentional focus within an emotional Stroop task. The emotional Stroop task is an adaptation of the original Stroop task, prompting the individual to name font colors while including words that elicit an emotional response, such as "murder" (p. 486). The authors discuss the significance of the emotional Stroop task in examining "attentional bias for threat" or one's tendency to focus on worrisome or threatening environmental factors, which is related to hypervigilance within anxiety disorders (p. 486). This study compared participants' performance on an emotional Stroop task between silent conditions and when listening to music.

Using headphones, each participant completed four conditions of the emotional Stroop task in randomized order, 1) threatening words with music, 2) neutral words with music, 3) threatening words in silence, and 4) neutral words in silence.

Graham et al. (2009) found a significant difference in response latency between the music and silent conditions. When music was present, the expected latency for emotional/threatening words was significantly decreased. The authors suggest that similar to how music may alleviate stress in medical settings among individuals with chronic pain or undergoing procedures, music may be effective in reducing attentional focus on threatening environmental factors. Potential explanations for how music influences attentional focus are discussed, including how music may be useful in developing a broad and diffused attentional state which can assist in processing cognitive tasks. The authors also discuss the potential physiological effects of music listening (e.g. changes in respiratory and heart rate) and how these effects may have an influence on performance on the emotional Stroop task. Additionally, the effect of music on mood/affect and how that may influence attentional factors and cognitive performance is discussed.

Diaz (2015) conducted an experimental study to further explore the relationship of varying music listening strategies on attention, emotion, and affective experiences. Diaz discusses the role of attention in music listening and the relevance in music education to encourage meaningful listening experiences for students. Based on previous research, Diaz argued that attention during music listening is enhanced when listeners are given some sort of guidance or task. This study explored whether attention and emotion responses varied by the type of listening strategy or style of music. The study utilized a sample population of trained musicians due to previous research often using non-musicians and because musicians may better relate and articulate influences of musical elements. Participants were divided into three groups

and listened to four music excerpts of varying styles, each group employing differing listening strategies: 1) making a mark on which musical element the participant was attending to when their attention shifted within the music, 2) making a mark when their attention shifted away from the music, and 3) listening without any specific guidance or instruction.

Questionnaires were used to measure the participant's perceived level of attentiveness and quality of emotional responses to the music (Diaz, 2015). Results demonstrated that connections between attention and emotional responses were significant, regardless of the type of listening strategy or style of music. Diaz noted that even in the unguided listening group, the participants may have experienced heightened attention and emotional response due to expecting a potential goal for their music listening. This study suggests the influence of establishing some type of goal within music listening in enhancing attention and emotional responses, regardless of style of music or listening strategy.

Mindfulness in Music Therapy

Common practices and experiences of using mindfulness techniques in music therapy seem a relevant area of interest in research and clinical practice. A qualitative phenomenological study conducted by Medcalf (2017) explored four music therapists' experiences who identified as using mindfulness-informed techniques in their music therapy practice. All participants were Registered Music Therapists (RMTs; Australia) and represented a variety of clinical populations in their work including palliative care, mental health and substance abuse, children with intellectual disabilities, self-care for helping professionals, and young people in current or post cancer treatment. Each participant engaged in an in-depth interview with the researcher regarding their experiences and perceptions of the influence of mindfulness-informed techniques

in their practice. Through "Phenomenological Microanalysis" (p. 53), Medcalf contemplated meaning from the participants' interviews to identify common themes.

Medcalf (2017) illustrated a common theme that music appeared to be an effective means to support engagement and motivation in mindfulness practice, while mindfulness skills and present moment awareness can be practiced through active music making. Another overall theme involved the idea that mindfulness skills may encourage a client to be objective and enhance positive change in therapy. It is also emphasized that music therapists may benefit from personal mindfulness practice, while knowledge of the benefits of mindfulness can strengthen the client-therapist relationship. Finally, it is suggested that mindfulness techniques may not be appropriate in every situation and music therapists should be aware of individual client abilities to adapt their approach. This study provides insight into the benefits and experiences of using mindfulness techniques within music therapy clinical practice.

A quantitative clinical study conducted by Lesiuk (2015), a Board-Certified Music Therapist (MT-BC), explored the effects of mindfulness-based music therapy (MBMT) on attention and mood distress among women with breast cancer who are receiving adjuvant chemotherapy. Fifteen women with stage I-III breast cancer participated in individual MBMT sessions once per week for four weeks. The MBMT sessions were influenced by the author's involvement in a Mindfulness-Based Stress Reduction (MBSR) program and emphasized four main mindfulness themes: 1) *"non-judging,"* or the absence of evaluating or reacting habitually, 2) *"beginner's mind,"* or perceiving newness in a familiar environment, 3) *"suspending judgment,"* or being willing to try new experiences without criticism, and 4) *"accepting and letting go,"* or viewing one's current state without fighting or wanting to change the moment (Lesiuk, 2016, p. 3). Different music experiences were utilized to emphasize the main themes of

mindfulness and provide a focus of attention and promote decentering. Music experiences included "music listening and writing, exploring new instruments, singing, imitating rhythms and playing instruments in an ensemble, and music-assisted relaxation" (p. 3). Participants were also given daily homework assignments to practice music listening and write reflections.

Attention was measured using the Conners' Continuous Performance Test II (CPT-II) at two points during the study, before and after the four weeks of MBMT sessions (Lesiuk, 2015). The CPT-II is a computerized assessment of attention, 14 minutes in length, prompting the participant to press the keyboard spacebar each time a letter of the alphabet is displayed except on the letter "X". Lesiuk explains that this test may "help to identify potential problems in executive functioning in clinical populations" (p. 278). Mood variables were measured before and after each individual session of MBMT using the Profile of Mood States-Brief Form (POMS-BF). The POMS-BF includes 30 Likert-type scale items ranging from 0 (not at all) to 4 (extremely), prompting the participant to rate their mood within six subscales (i.e. confusion-bewilderment, anger-hostility, depression-dejection, tension-anxiety, fatigue-inertia, and vigor-activity).

Results showed a significant improvement in attention from before to after the four weeks of MBMT treatment. Additionally, all mood states improved from beginning to end of each MBMT session, with fatigue decreasing significantly more than the other mood states. Lesiuk emphasizes that music may provide a point of focus to assist in mindfulness practice and address common symptoms among women receiving breast cancer treatment including decreased focus, attention, short term memory, and mood distress. It should be noted that the test used to measure attention (CPT-II) is a visual attention task; since the mindfulness-based music interventions were auditory in nature, it would seem appropriate to have used an auditory task to

measure attention. Overall, this study provides insight into how mindfulness techniques may be incorporated into music therapy clinical practice, as well as supports further empirical investigation into the effects of mindfulness-based music therapy on attention and working memory.

Summary

Recent research has sought to uncover underlying factors and components of mindfulness practice. An overall theme across mindfulness research emphasizes the significance of attention factors including distraction and decentering. Experimental studies have explored the effects of mindfulness on attention and working memory and yielded varied results. Some studies found an increase in working memory and attention factors following weeks of a mindfulness intervention along with additional practice. It seems that working memory plays a role in reducing mind wandering, while mindfulness practice may help increase working memory and reduce distress. However, the research seems to call for further investigation into other measurements and varied interventions.

Research exploring music and attention, including experimental neuroimaging studies, suggests the implicit processing of music may stimulate neuro-activity related to attention and working memory. Some studies suggest that music listening may enhance performance on attention tests, while attention may increase when given a strategy or goal during music listening. The influence of music on attention is of significance when considering the role of mindfulness techniques in music therapy practice. Qualitative and quantitative experimental research suggests how music may help facilitate mindfulness practice, while mindfulness approaches within music therapy may help improve attention and mood. It seems the literature surrounding

mindfulness in music therapy is minimal and calls for further experimental investigation into the effects and interactions of music and mindfulness.

Chapter 3: Methodology

Method and Design

Participants

Participants for this study were required to meet the following inclusion criteria: (a) participants must be at least 18 years or older; (b) participants' primary language must be English; and (c) participants must not have severe hearing impairments due to the auditory nature of the testing and listening procedures. Potential participants were recruited through verbal announcements in classrooms, emails, and flyers posted on campus and in local businesses. The researcher was notified that some university instructors offered extra credit for students who completed participation in the study. Individuals interested in participating were asked to email, text, or call the researcher who then emailed participants the informed consent form, as well as potential dates and times at which to complete the study procedures. At the scheduled date and time, the researcher further explained the purpose of the study, risks, and procedures involved to each participant. Each participant was then asked to sign the informed consent form before engaging in the testing and listening procedures.

Design

Based on previous studies (Diaz, 2015; Johnson et al., 2015; Joseffson et al., 2014), this randomized experimental study adopted a pre-test/post-test design involving four listening conditions: 1) mindfulness with music, 2) mindfulness without music, 3) music only, and 4) silence. Thirty individuals participated in the study with each group consisting of 7-8 participants. Participants were randomly assigned to a listening group using a block randomization procedure (Suresh, 2011). To achieve an approximately equal number of

participants for each group, the researcher made a list using blocks of four; each block was randomized across the four listening conditions prior to meeting with participants. The researcher used an online list randomizer from *Random.org* (Randomness and Integrity Services Ltd., 2017) to randomize the four listening conditions in each block. As recruitment continued over a period of several months, the participants were assigned to the next listening condition on the list when they met with the researcher. Each participant attended an individual session with the researcher to complete testing and listening procedures.

Instrumentation

Inquisit Web from Millisecond Software (2015) is a web-based application which provides online collection of psychological data. Inquisit Web offers a library of computerized neuropsychological tests for online experimental research and data collection. With the Inquisit Web 4 license, the researcher gained access to the Digit Span (Auditory) script which allowed for administration of the auditory digit span test through a web link. According to the Inquisit Auditory Digit Span user manual (Borchert, 2017), this digit span test is administered and measured as described by Woods et al. (2011).

Testing Procedure

The Inquisit 4 (2015) Auditory Digit Span test measures recall of forward and backward digit sequences. During the test, auditory digit sequences are presented while the participant is expected to recall the sequence, either forward or backward, by typing the digits on the computer number pad. Forward digit sequences are presented first, starting at three digits and increasing or decreasing in list length depending on the accuracy of participant responses. If the participant correctly recalls a single digit sequence, the list increases by one digit in the next sequence. An

incorrect response results in the same digit length for the following sequence. Two consecutive incorrect responses at the same list length results in a decrease in list length by one digit in the next sequence. Woods et al. (2011) describe this method as a "1:2 staircase" (i.e. one correct response results in an increase in list length; two incorrect responses results in a decrease in list length) (p. 103). This pattern continues until the participant has completed 14 trials at the forward digit span. The application then provides instructions and a practice trial which explain the backward digit span. For this task, auditory digit sequences are aurally presented and the participant is asked to recall the sequence in reverse order by typing on the keypad. Depending on the accuracy of participant responses, the backward digit sequences increase and decrease in the same "1:2 staircase" as the forward digit span with a total of 14 trials.

Measurement Characteristics

The Auditory Digit Span application measures responses in four ways, labeled as: 1) two-error maximal length, 2) two-error total trials, 3) maximum length, and 4) mean span (Woods et al., 2011). The two-error maximal length represents the longest list length recalled before two consecutive incorrect responses at the same length. The two-error total trials represents the total number of trials, correct or incorrect, before two consecutive incorrect responses at the same list length. The maximal length represents the longest list length correctly recalled across all 14 trials. Finally, the mean span represents the list length where 50% of sequences would be correctly recalled. Woods et al. explain that the mean span is based on an "estimation using psychophysical procedures" (p. 103). This estimation is described by Killion, Niquette, Gudmundsen, Revit, and Banjeree (2004) in their quick speech-in-noise test which measures signal-to-noise ratio loss. Woods et al. (2011) note that as compared to traditional digit span measurements, the mean span demonstrated higher test-retest reliability, reduced variance, and

correlated with results from other similar neurological tests. Forward and backward digit span are some of the most common measures of short-term verbal memory (Richardson, 2007; Woods et al, 2011). Within this experimental study, the forward and backward digit spans are dependent measures, measuring working memory which is considered the dependent variable.

Procedures

Through email, the researcher communicated with participants about available dates and times of meetings. The researcher informed participants that the testing and listening procedures required approximately 30 minutes to complete. The researcher communicated with each participant individually to determine a day and time to meet. To complete the digit span and listening procedures, participants met individually with the researcher in a small practice room in Faye Spanos Hall at the University of the Pacific.

Equipment Setup

Participants used the researcher's personal laptop (Lenovo Ideapad 100S) and noise cancellation headphones (Sony MDR-NC7) to complete the auditory testing and listening procedures. The computerized Inquisit 4 (2015) digit span application was downloaded and installed on the researcher's laptop before meeting with participants. Before each meeting, the researcher prepared equipment in the practice room for the participant to complete the digit span and listening procedures. The laptop was set up on a music stand which was positioned horizontally to serve as a desk. The noise cancellation headphones were plugged into the laptop with disposable headphone covers which were replaced between each meeting for sanitation. A chair was positioned in front of the stand for the participant. A blank sheet of paper and pen were placed on the stand next to the laptop. The researcher also prepared the Administration

Procedures (Appendix A), the informed consent document (Appendix B) on which she wrote a randomized four-digit number, and the background information questionnaire (Appendix C).

Informed Consent and Instructions

The participant was asked to sit in the chair when they arrived at the meeting in the practice room. The researcher asked the participant to complete the background information questionnaire (Appendix C). The researcher proceeded to explain the instructions and procedures by reading from the Administration Procedures (Appendix A). The researcher then provided the informed consent document (Appendix B) and explained that the four-digit number will be used instead of the participants' name when analyzing the data. After the researcher reviewed the informed consent form and risks of participation, the participant was invited to sign the form. The participant was then asked to use the pen and write down their name and the four-digit number on the blank sheet of paper. Providing all participants with a pen and paper allowed for consistency of instructions and procedures across groups. After clarifying any procedural questions from the participant, the investigator invited the participant to put on the headphones. The participant was informed that they may adjust the volume during the procedure so it is not too loud or too soft. The participant was then prompted to press start on the digit span and enter the four-digit number they wrote on the paper when prompted by the application. The researcher then stepped outside of the room for the duration of the procedures.

Pretest

Each participant in all groups completed a computerized digit span test through the Inquisit 4 web-based application (2015), taking approximately five minutes to complete depending on the participants' performance and length of correct responses. Upon opening the

Inquisit 4 application and before beginning the test, the participant entered the four-digit code assigned by the researcher. This code was used to log their responses to the digit-span on the application's web-based data log. Within the Inquisit 4 Auditory Digit Span script, there is an option to input a weblink to be automatically opened following completion of the test. The researcher input the Google Drive (2016) audio file link which corresponded to the appropriate listening group (i.e. mindfulness with music, mindfulness without music, music only, or silence) prior to meeting with each participant.

Listening Conditions

Immediately following the digit span pre-test, the Inqusit 4 application automatically redirected the computer browser to an audio file on Google Drive (2016) corresponding with the experimental listening condition. Depending on the listening condition to which the participant was randomly assigned, the application opened the appropriate webpage to stream either the mindfulness with music, mindfulness without music, music only, or silence audio files.

Mindfulness with music condition. Participants in the mindfulness with music listening group listened to an audio file which included instructions on how to listen to a piece of music. Based on previous research, polyphonic music was used to facilitate enhanced attention and working memory to assist in mindfulness practice (Janata et al., 2002). To enhance moment-to-moment awareness and attention control, the recording includes verbal instructions prompting participants to listen closely to the music and mark a tally on a piece of paper each time they hear an instrument enter the music. Only participants in the mindfulness with music listening group used the pen and paper to assist in the listening exercise. The recording also instructs participants to gently bring their attention back to the present task if they notice their mind

wandering to other thoughts (See Appendix D). The piece of music used for this listening exercise was *Good Intentions Paving Company* by Joanna Newsom (2010). This piece was familiar to the researcher and was chosen based on the layers of instruments which enter almost one at a time throughout the piece, while many instruments drop out and re-enter the music. The way the instruments gradually enter and drop out of the music seemed to provide an element to focus attention in the music and mindfulness group. The piece also includes harmonically unrelated chords as described by Koelsch et al. (2002). The mindfulness instructions were two minutes and five seconds long while the music portion of this audio file was seven minutes long.

Mindfulness without music condition. The mindfulness without music group practiced mindfulness by listening to an audio file with instructions aimed at focusing attention to present breath sensations. This exercise is based on common non-music based mindfulness practices (Johnson et al., 2015; Josefsson et al., 2014; Mrazek et al., 2013). This audio file also includes prompts to gently turn attention back to the present moment when participants notice their mind wandering to other thoughts. The mindfulness without music audio file involves seven minutes of silence that is punctuated by a total of two minutes of instructions to redirect attention.

Music only condition. The third group involved music listening only, without mindfulness instructions. This group listened to the same piece of music as the mindfulness with music group (i.e., *Good Intentions Paving Company* by Joanna Newsom, 2010). This audio recording only involved brief instructions (13 seconds) to sit and listen to the piece of music, without instructions to focus attention on any aspect of the music. The music portion of this audio recording was also seven minutes in length.

Silence control condition. The fourth listening group listened to an audio recording involving a brief instruction to sit in silence. This recording did not involve additional

instructions to guide or redirect attention throughout the duration of silence. Seven minutes of silence followed the brief prompt (thirteen seconds) at the beginning of the audio recording.

Posttest

At the end of all four audio recordings, a short verbal instruction directed the participants to click back to the Inquisit 4 application and complete the digit span posttest. Just as the pre-test, the final digit span task was approximately five minutes in length depending on participants' responses. After completion of each digit span test, the participants' scores were immediately uploaded to the researcher's account on the Inquisit website for further data analysis.

Data Analysis

Data was analyzed to examine for significant differences between groups in working memory scores from pre- to post-test. The data included in analysis was each participants' forward and backward mean span scores on the digit span pretest and posttests. Common statistical analyses were performed using the IBM Statistical Package for the Social Sciences version 21 (SPSS; International Business Machines, 2012). Data will be kept for at least three years and then permanently deleted from the researcher's private computer.

Demographic Characteristics

Descriptive statistics were used to analyze the demographic data by gender, ethnicity, music background, meditation background, and listening condition.

Analysis Approach for Research Questions 1 and 2

The first research question concerned whether there are differences in working memory performance between those in a mindful vs. non-mindful listening condition. A two-tailed t-test for independent samples was conducted on change scores (posttest score minus the pretest score)

for both digits forward and digits backward. Using Levene's test for homogeneity of variance, the equality of variance between the two groups was assessed.

The second research question concerned whether there are differences in working memory performance between those in a music-based versus non-music based listening condition. A two-tailed t-test for independent samples was conducted on change scores (posttest score minus the pretest score) for both digits forward and digits backward. Again, Levene's test of homogeneity of variance was used to assess the equality of variance between the two groups.

Analysis Approach for Research Question 3

The third research question addressed the extent to which working memory performance varied as a function of the type of listening condition. A one-way analysis of variance was conducted with the listening condition serving as the single independent variable with four levels: mindfulness with music, mindfulness without music, music only, and silence. As with the first two research questions, the dependent variables were working memory as measured by the change in digits forward and digits backward performance from pretest to posttest. Levene's test of homogeneity was used to assess the equality of variance between the conditions. Post Hoc tests were conducted to identify pairwise differences: The Gabriel was used if Levene's test was homogenous and the Games-Howell if Levene's was heterogeneous.

Chapter 4: Results

Participant Characteristics

Following the recruitment phase, 38 individuals communicated interest in participating; 4 did not successfully complete the study due to failure to schedule an appointment or failure to show at the appointment. A technical error occurred for 4 out of the 34 participants who completed the listening procedures in which the internet disconnected during the digit span exercise; as a result, the data for these participants were not successfully logged and therefore not used in the data analysis (See Figure 1).

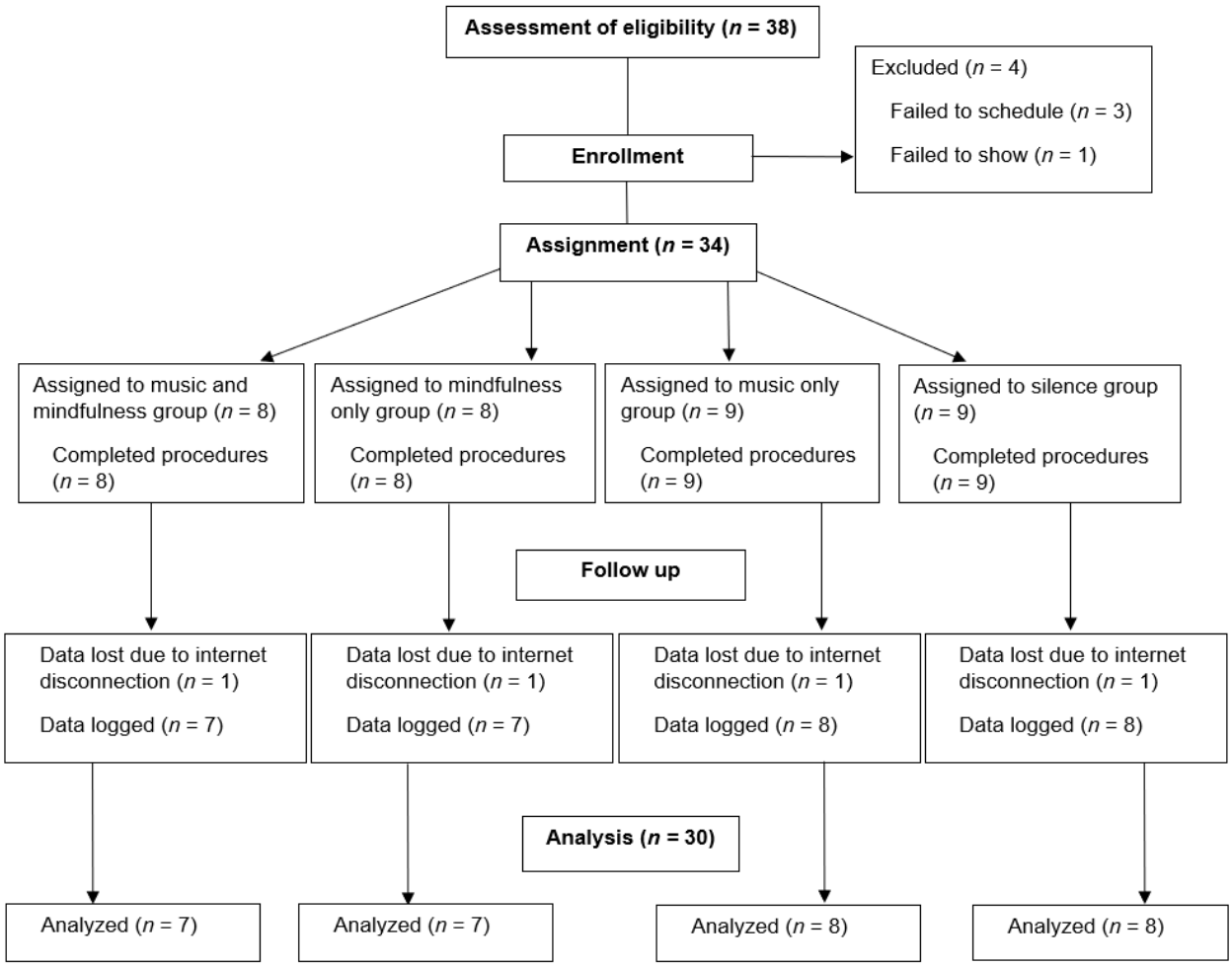

Figure 1. Flow of participants through each stage of the experiment. Assessment of eligibility (i.e. emails between researcher and participants), enrollment (i.e. scheduling and meeting with the researcher), assignment to listening group, follow up (digit span data log), and data analysis. This flowchart is an adaptation of the flowchart offered by CONSORT Group (Shultz, Altman, Moher, & the CONSORT Group, 2010).

Participants (n = 30) included 21 females and 7 males, ranging in age from 18 to 61 years (M = 24.9, SD = 1.62). Participants included individuals of Asian, African American, Latino, and White ethnicity. Most participants were students of the University of the Pacific, with 19 being students of the Conservatory of Music and 11 being either non-music students or members

of the community. Most participants (90%) reported that they did not practice meditation regularly (See Table 1).

Table 1
Participant Characteristics Between Listening Groups

Demographic	Music and mindfulness (*n* = 7)	Music only (*n* = 7)	Mindfulness only (*n* = 8)	Silence (*n* = 8)
Gender				
Female	5	6	6	6
Male	2	1	2	2
Ethnicity				
Asian	1	1	0	3
African American	1	0	1	0
Latino	0	2	2	1
White	5	4	5	4
Music background				
Conservatory student	4	4	5	6
Non-music/community	3	3	3	2
Meditation background				
Practices regularly	0	0	2	1
Does not practice regularly	7	7	6	7

Research Question 1: Working Memory and Mindfulness Condition

The first research question investigated whether participation in mindfulness-based versus non-mindfulness based listening exercises impacted working memory performance.

Change scores were calculated for the digits forward exercise by subtracting the pretest from the posttest scores. Secondly, the researcher calculated Levene's Test of Homogeneity to assess the equality of variances for digits forward change scores between the mindfulness and non-mindfulness conditions; the test was not significant ($F[1,28] = 0.796$, $p = .435$) and equality of variance was assumed. A two-tailed independent samples *t*-test was used to evaluate whether changes in working memory performance on the digits forward exercise were different in the mindfulness versus non-mindfulness based groups. Findings were not significant, $t(29) = 0.793$, $p = .435$, $d = 0.29$, with change among those in the mindfulness conditions ($M = 0.476$, $SD = 0.74$) not statistically different from change in the non-mindfulness conditions ($M = -0.145$, $SD = 0.59$). Therefore, there is insufficient evidence to suggest that change in digits forward performance differs between the two conditions and the null hypothesis was not rejected.

Change scores were also calculated for the digits backward exercise by subtracting the pretest from the posttest scores. Levene's Test was calculated to assess the equality of variances for digits backward change scores between the mindfulness and non-mindfulness conditions; the test was not significant ($F[1,28] = 0.018$, $p = .895$) and equality of variance was assumed. A two-tailed independent samples *t*-test was used to evaluate whether changes in working memory performance on the digits backward exercise were different in the mindfulness versus non-mindfulness based groups. The finding was not significant, $t(29) = 1.122$, $p = .271$, $d = 0.41$, with change among those in the mindfulness conditions ($M = .251$, $SD = 0.87$) not statistically different from change in the non-mindfulness conditions ($M = -.106$, $SD = 0.87$). Therefore, there is insufficient evidence to suggest that change in digits backward performance differs between mindfulness and non-mindfulness conditions and the null hypothesis was not rejected.

Research Question 2: Working Memory and Music Condition

The second research question addressed whether working memory performance differed between those who participated in music-based versus non-music based listening exercises. Changes in performance were calculated for the digits forward exercise of the digit span by subtracting pretest from posttest scores. The researcher calculated Levene's test to assess the equality of variances for digits forward change scores between the music and non-music based conditions; the test finding was not significant ($F[1,28] = 0.867$, $p = .36$) and equal variances were assumed. A two-tailed independent samples *t*-test was used to evaluate whether changes in working memory performance on the digits forward exercise were different in the music versus non-music based groups. The finding was not significant, $t(29) = -0.1978$, $p = .242$, $d = 0.43$, with change among those in music conditions ($M = -.198$, $SD = 0.72$) not statistically different from change in the non-music conditions ($M = .088$, $SD = 0.58$). Therefore, there is insufficient evidence to suggest that change in digits forward performance differs between music and non-music conditions and the null hypothesis was not rejected.

Changes were also calculated for the digits backward exercise of the digit span by subtracting pretest from posttest scores. The researcher calculated Levene's test to assess the equality of variances for digits backward change scores between the music and non-music based conditions; the test finding was not significant ($F[1,28] = 3.57$, $p = .069$) and equal variances were assumed. A two-tailed independent samples *t*-test was used to evaluate whether changes in working memory performance on the digits backward exercise were different in the music versus non-music based groups. Findings were not significant, $t(29) = .470$, $p = .642$, $d = 0.17$, with change among those in music conditions ($M = -.198$, $SD = 1.06$) not statistically different from change in the non-music conditions ($M = -.016$, $SD = 0.66$). Therefore, there is insufficient

evidence to suggest that change in digits backward performance differs between the music and non-music conditions and the null hypothesis was not rejected.

Research Question 3: Working Memory and Listening Condition

The last research question involved determining which group (i.e., music and mindfulness, mindfulness only, music only, and silence) showed a difference (from pre- to posttest) on the digits forward and digits backward exercises (see Table 2). The researcher first calculated change scores from pre- to post-test for the digits forward exercise. Levene's test was not significant ($F[3, 26] = 1.680$, $p = .196$) and equal variances were assumed. A one-way ANOVA was conducted to determine which of four listening conditions evidenced the greatest change in digits forward performance. Results were not significant, $F(3, 26) = 1.137$, $p = .353$, partial $\eta^2 = 0.16$. Thus, the null hypothesis, stating that there is no difference between any of the conditions, was not rejected.

Change scores were also calculated from pre- to post-test for the digits backward exercise. Levene's test was not significant ($F[3, 26] = 1.623$, $p = .208$) and equal variances were assumed. A one-way ANOVA was conducted to determine which of four listening conditions evidenced the greatest change in digits backward performance. Results were not significant, $F(3, 26) = .467$, $p = .708$, partial $\eta^2 = 0.05$. Thus, the null hypothesis, stating that there is no difference between any of the conditions, was not rejected.

Table 2
One-way ANOVA Descriptive Statistics

Listening group	*n*	*M*	*SD*	*SE*	95% CI
Digits forward					
Music and mindfulness	7	-.243	0.87	0.33	[-1.05, 0.56]
Mindfulness only	7	.338	0.48	0.18	[-0.11, 0.79]
Music only	8	-.158	0.62	0.22	[-0.68, 0.36]
Silence	8	-.131	0.59	0.12	[-0.63, 0.36]
Total	30	-.055	0.66	0.12	[-0.30, 0.19]
Digits backward					
Music and mindfulness	7	.343	1.02	0.39	[-0.60, 1.29]
Mindfulness only	7	.159	0.75	0.28	[-0.54, 0.86]
Music only	8	-.044	1.14	0.40	[-0.99, 0.91]
Silence	8	-.169	0.58	0.20	[-0.65, 0.31]
Total	30	.061	0.87	0.16	[-0.27, 0.39]

While the one-way ANOVA found no significant results for digits forward or digits backward, the descriptive statistics illustrate some notable differences between listening conditions (See Table 2). The only listening condition which demonstrated improved digit span performance for both digits forward (M = .338) and digits backward (M = .159) was the mindfulness only group. The music and mindfulness group demonstrated decreased digit span performance on digits forward (M = -.243), but improved performance on digits backward (M = .343). The music only group demonstrated decreased digit span performance on digits forward (M = -.158) and a small decrease, or almost no change, on digits backward (M = -.044). The

silence listening condition demonstrated decreased digit span performance on digits forward (*M* = -.131) and digits backward (*M* = -.169).

Chapter 5: Discussion

The purpose of this study was to examine the impact of mindfulness strategies on working memory. This randomized experimental study involved a pre-test/post-test design to investigate the effect of various listening exercises (i.e. music and mindfulness, mindfulness only, music only, and silence) on working memory performance. Change scores were calculated for digits forward and digits backward performance on a computerized digit span task. Using two-tailed independent samples *t*-tests, change scores were compared between mindfulness and non-mindfulness listening conditions, as well as between music and non-music listening conditions. Results demonstrated no significant difference between the mindfulness and non-mindfulness conditions for either digits forward or digits backward performance. In addition, results demonstrated no significant difference between the music and non-music conditions for either digits forward or digits backward performance. To identify any significant differences across all listening conditions, a one-way ANOVA was conducted for both digits forward and digits backward performance. No significant differences were found across all listening conditions for either the digits forward or digits backward exercises.

While no significant results were found, it cannot be said confidently that there is no effect on working memory based on the type of listening condition. Due to the low sample size ($N = 30$) for the analyses conducted, this study lacks the statistical power necessary to detect any effects on the dependent variable (i.e. working memory). Power analysis using G*Power, version 3.1.9.2 (Buchner, Erdfelder, Faul, & Lang, 2014) yielded a suggested sample size of $N = 176$ for *t*-test using the following statistical parameters: $f^2 = .30$ (medium to large effect size), $\beta = .05$, $\alpha = .95$. For ANOVA using the following statistical parameters: $f^2 = 0.25$ (medium to large effect size), $\beta = .05$, $\alpha = .95$, power analysis yielded a suggested sample size of $N = 280$.

Because of the low statistical power, it is possible that any effect on working memory was simply not detected.

It is important to consider the potential effect of the length of the listening interventions across groups. The length of the listening interventions, not including the instructions at the beginning and end of the audio files, were equal in length at 7 minutes. However, due to the simplicity of the music only and silent listening conditions, the total length of verbal instructions were shorter (13 seconds) than in the music and mindfulness and mindfulness only groups (2 minutes). The extraneous and systematic variance in time required to complete the listening procedures may have influenced results. This variance may have been accounted for using an Analysis of Covariance (ANCOVA) with the length of time as the covariate.

Relating to the pre- and post-test digit span exercises, there is also a maturation threat involving participants' potential fatigue throughout the research procedures. The forward and backward digit span exercises require concentration and focused attention, while the overall length of the exercise will be longer if a participant is successfully providing accurate responses. After completing the forward and backward digit span pre-test, participants were asked to engage in a 7-8 minute listening exercise. It is understandable if participants experienced mental fatigue which may have influenced performance on the digit span post-test. An ANCOVA with the length of the digit span exercises as the covariate may account for this variance. A post-test only design may also be considered in future studies to minimize fatigue related to completing digit span and listening procedures.

Future Research and Applications

Additional modifications of methods and procedures can be made in future studies to increase reliability and validity. Based on power analyses previously mentioned (Buchner et al., 2014) it is clear that a much larger sample size is necessary to increase statistical power with this experimental design. More weeks of recruitment, scheduling, and administration of procedures would be necessary to achieve an appropriate sample size. Administering procedures with each participant individually, as opposed to with other participants in a classroom, allows for increased internal validity as distractions and influences from other participants are minimized. However, it requires a significant amount of time and resources to administer procedures individually, with each meeting lasting approximately 30 minutes. Involving multiple researchers to meet with participants individually and administer the listening procedures may be an efficient use of time/resources to increase sample size. Additionally, it may be appropriate to explore any differences between listening groups using two single factorial ANOVAs, one for digits forward and one for digits backward (as opposed to multiple *t*-tests). The advantage would be limiting the number of statistical hypothesis tests thereby reducing the chance of making a Type I error.

In future studies, it would be important to minimize errors occurring during data collection of the digit span responses. Data on digit span performance was lost for 4 out of 34 participants due to disconnection in wireless internet connection. It would be important in future studies to complete multiple trial digit span exercises to detect potential problems with data collection and avoid technical errors. Completing digit span and listening procedures using a direct internet connection is a potential solution to avoid issues with wireless connection.

Research has supported the implicit influence of music in engaging attention factors even among non-musicians (Koelsch et al., 2002). It is also important to consider research which explores trends in cognitive functioning among trained musicians and non-musicians. Several studies found enhanced executive function, selective attention, and auditory working memory in musicians as compared to individuals without music training (Clayton et al., 2016; Grassi, Meneghetti, Toffalini, & Borella, 2018; Patson, Hogg, & Tippett, 2007). The majority of participants in the current study were students of the Conservatory of Music (63%), while it is possible that other participants not affiliated with the conservatory may have had music training experience. It seems that if trained musicians often demonstrate enhanced selective attention and auditory working memory, many participants in this study may have preexisting skill in the digit span task. However, it is also necessary to consider research which found no differences in cognitive areas such as central executive functioning (Strait, Kraus, Parbery-Clark, & Ashley, 2010) and alerting and orienting (Medina & Barraza, 2019) between those with and without music training. In future studies, it would be important to explore differences in attention/working memory between trained musicians and non-musicians when engaging in mindfulness exercises.

It is also recognized that participants' familiarity or liking of the music used in the music-based listening groups may have influenced thoughts and level of focus during the exercises. Some research has found that listening to pleasant music utilizes high levels of attention (Nemati, Akrami, Salehi, Esteky, & Moghimi, 2019). Additionally, research in music and stress reduction has found that degree of liking for music was a strong indicator for stress reduction, and not level of familiarity (Jiang, Rickson, & Jiang, 2016). While it is understood that the goal of mindfulness practice is not always to reduce stress, identifying the role of familiarity and

liking of music in mindfulness practice seems important. The music chosen for this study is of a particular alternative style of music and may not have been used if not for the researchers' preference and familiarity of the piece. The piece involves instruments gradually entering in layers which provided an element to focus attention in the music and mindfulness group. Additionally, other musical elements such as vocal style, melody, instrumentation, or accompaniment may have influenced participant reactions or openness to the exercise. While there was no formal collection of participants' responses to the music, the researcher did not recall any participant commenting that they were familiar with the music used in the music-based groups. In future studies, it would seem useful to collect information on the participants' familiarity and liking of the music such as through a brief questionnaire.

The current study investigated digit span results before and after one 7-minute listening exercise. Consistent with previous research (Johnson et al., 2015), it can be understood that one-session of mindfulness practice may not make a significant impact on attention and working memory. Further studies that employ a one-time mindfulness session may consider using a different measure of working memory, such as the operation span task (OSPAN) or Stroop Task, perhaps to more accurately capture the effects of various mindfulness and listening exercises. However, research in mindfulness practice often emphasizes the benefits of multiple sessions, daily practice, skill building, and understanding broader concepts such as non-judgmental awareness (Bishop et al., 2004; Jha et al., 2010; Kabat-Zinn, 2003; Linehan, 2015; Mrazek, 2013; Segal et al., 2013). Future studies may take a more expansive approach, exploring the effects of multiple sessions of mindfulness and music listening, possibly incorporating personal practice and discussion of mindfulness concepts.

Exploring the effects of mindfulness and music listening may illustrate potential benefits in music education. Diaz (2015) discusses the consistent efforts of music educators to support their students in having attentive and meaningful experiences during music listening. The author also emphasizes that increasing attention can enhance emotional and peak affective experiences during music listening. Developing a mindfulness-based music listening exercise which engages working memory and attention may allow for enhanced awareness, emotion, and meaning when listening to music. Understanding the positive effects of mindfulness practice may also be helpful in music education to support self-care for students. It is common among music students in higher education to struggle with fatigue, anxiety, stress, and depression, often related to the pressures of practice and performance (Hildebrandt, Nubling, & Candia, 2012). Supporting students in developing healthy ways of managing mental health and self-care is of importance within music education. Encouraging music students to practice mindfulness, such as mindfulness and music listening exercises, may help to alleviate common areas of distress.

Recognizing and addressing the influence of attention control and working memory is indicated in the treatment of anxiety and depression. Recent research appears to demonstrate the influence of repetitive negative thinking patterns on the severity of symptoms in anxiety and depression. Mindfulness interventions which enhance attention and working memory may contribute to increased cognitive flexibility and control over repetitive negative thinking. Results of future related studies may further expand understanding of ways music and mindfulness may be combined to enhance working memory and attention. Research in music perception, music education, and music therapy supports the influence of music in engaging attention and working memory factors (Diaz, 2015; Janata et al., 2002; Koelsch et al., 2002;

Thaut, 2005). Understanding whether music listening may enhance mindfulness practice would be beneficial in evolving music therapy practice and mental health treatment.

Developing a mindfulness practice through music listening may be an approachable and motivating intervention for use in music therapy. Practicing mindfulness through recorded music listening may be an accessible coping exercise to be used outside of direct music therapy sessions. Incorporating mindfulness techniques and concepts into music therapy practice has been a popular area of interest in research and clinical practice. Many music therapists may already utilize mindfulness concepts and interventions within their practice (Chwalek & McKinney, 2015; Lesiuk, 2016; Medcalf, 2017). Further understanding and articulating how music may support mindfulness practice would enhance justification and advocacy for music therapy practice as a whole. Experimental research into the operations and effects of mindfulness combined with music listening would contribute to the continued effort to identify effective ways of enhancing working memory, managing repetitive negative thinking patterns, and improving quality of life.

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APPENDIX A: ADMINISTRATION PROCEDURES

1) Mindfulness with music condition. Participants in the mindfulness with music listening group will listen to an audio file with mindfulness instructions prompting participants to listen closely to a piece of music and mark a tally on a sheet of paper every time they hear an instrument enter. Based on previous research, polyphonic music will be used in order to facilitate enhanced attention and working memory to assist in mindfulness practice. The mindfulness instructions are about two minutes long while the music portion of this audio file is seven minutes long.

Set-Up

The researcher will have the headphones and laptop prepared with the Inquisit 4 application open before the participant arrives. A pen and blank sheet of paper will be placed next to the laptop. Once the participant arrives, the researcher will greet the participant and ask them to sit in the chair. The researcher will ask the participant to complete the Background Information Questionnaire.

Explanation of Procedure

The researcher will provide an explanation of the testing and listening procedures by reading the following script:

- ***You will first complete a computerized attention task called "Digit-Span"***
- ***You will wear these headphones and use this laptop.***
- ***"Digit-Span" involves listening to a stream of numbers and typing back the numbers as best you can from memory.***
- ***One part asks you to type the numbers in the same order and another asks you to type the numbers in reverse order.***
- ***The program will provide detailed instructions and will start with a "practice"***

round.

- ***This should take about 3 - 5 minutes.***
- ***After completion, the program will automatically open a webpage with an audio file.***
- ***Once this page is opened, you may press play. This audio file will include instructions to guide you through a meditation exercise.***
- ***This exercise will take about 9 minutes.***
- ***At the end of the exercise, you will hear an instruction to click back to the "Digit-Span" tab and press start to complete it again.***
- ***After you have completed the "Digit Span" a second time, you are finished. You may place the headphones on the stand and step outside of the room where I will be waiting.***
- ***If you are unsure what to do or have any questions during the procedure, just wave to me outside the room or open the door and I will come assist you.***
- ***You are free to stop the Digit Span or meditation exercise at any time for any reason.***
- ***Do you have any questions?***

The researcher will answer any questions from the participant for clarification. Once the participant fully understands the procedures, the researcher will ask the participant to sign the Informed Consent Form.

- ***Please review this Informed Consent form.***

A pre-determined four-digit number will be written on the participant's signed form.

- ***This number will be used as your identification number; I'll be using this***

number instead of your name when analyzing the data. Your name will not be directly associated with your performance.

- ***If you have no further questions and would like to participate, please sign the form.***
- ***Now, please use this pen to write your name and this number on the blank paper.*** *(Point to number on Informed Consent form)*
- ***Before we get started, please make sure your phone and other electronic devices are turned completely off. You may get distracted by any vibration or sound alerts.***
- ***Remember, I'll be waiting outside of the room, wave to me or come get me if you need any help.***
- ***When you are finished with the digit span for a second time, you may set the headphones down and come outside.***
- ***Alright, once you are ready, you may press start. It will ask you to enter a four-digit number, please enter the number that you wrote on the paper.***
- ***Are you ready to begin?*** *(Wait for response)*
- ***You may begin by pressing start.***

The researcher will step outside of the room and wait for the participant to finish the digit span and listening procedures. Once the participant exits the room, the researcher will explain that she will follow up through email about the purpose and results of the study after data collection is complete.

2) Mindfulness without music condition. The mindfulness without music group will practice mindfulness by listening to an audio file with instructions aimed at focusing attention to present

breath sensations. This exercise is based on common non-music based mindfulness practices (Johnson et al., 2013; Josefsson et al., 2012; Mrazek et al., 2013;). The mindfulness without music audio file involves two minutes of instructions and seven minutes of silence in order to focus on breath.

Set-Up

The researcher will have the headphones and laptop prepared with the Inquisit 4 application open before the participant arrives. A pen and blank sheet of paper will be placed next to the laptop. Once the participant arrives, the researcher will greet the participant and ask them to sit in the chair. The researcher will ask the participant to complete the Background Information Questionnaire.

Explanation of Procedure

The researcher will provide an explanation of the testing and listening procedures by reading the following script:

- ***You will first complete a computerized attention task called "Digit-Span"***
- ***You will wear these headphones and use this laptop.***
- ***"Digit-Span" involves listening to a stream of numbers and typing back the numbers as best you can from memory.***
- ***One part asks you to type the numbers in the same order and another asks you to type the numbers in reverse order.***
- ***The program will provide detailed instructions and will start with a "practice" round.***
- ***This should take about 3 - 5 minutes.***
- ***After completion, the program will automatically open a webpage with an audio***

file.

- ***Once this page is opened, you may press play. This audio file will include instructions to guide you through a meditation exercise.***
- ***This exercise will take about 9 minutes.***
- ***At the end of the exercise, you will hear an instruction to click back to the "Digit-Span" tab and press start to complete it again.***
- ***After you have completed the "Digit Span" a second time, you are finished. You may place the headphones on the stand and step outside of the room where I will be waiting.***
- ***If you are unsure what to do or have any questions during the procedure, just wave to me outside the room or open the door and I will come assist you.***
- ***You are free to stop the Digit Span or meditation exercise at any time for any reason.***
- ***Do you have any questions?***

The researcher will answer any questions from the participant for clarification. Once the participant fully understands the procedures, the researcher will ask the participant to sign the Informed Consent Form.

- ***Please review this Informed Consent form.***

A pre-determined four-digit number will be written on the participant's signed form.

- ***This number will be used as your identification number; I'll be using this number instead of your name when analyzing the data. Your name will not be directly associated with your performance.***
- ***If you have no further questions and would like to participate, please sign the***

form.

- ***Now, please use this pen to write your name and this number on the blank paper.*** *(Point to number on Informed Consent form)*
- ***Before we get started, please make sure your phone and other electronic devices are turned completely off. You may get distracted by any vibration or sound alerts.***
- ***Remember, I'll be waiting outside of the room, wave to me or come get me if you need any help.***
- ***When you are finished with the digit span for a second time, you may set the headphones down and come outside.***
- ***Alright, once you are ready, you may press start. It will ask you to enter a four-digit number, please enter the number that you wrote on the paper.***
- ***Are you ready to begin?*** *(Wait for response)*
- ***You may begin by pressing start.***

3) Music listening only condition. The third group will involve music listening without mindfulness instructions. This group will listen to the same piece of music as the first group involving music and mindfulness. This audio recording will only involve a very brief prompt to sit and listen to the piece of music, without any instructions to focus attention on any aspect of the music. This audio recording will also be seven minutes in length.

Set-Up

The researcher will have the headphones and laptop prepared with the Inquisit 4 application open before the participant arrives. A pen and blank sheet of paper will be placed next to the laptop. Once the participant arrives, the researcher will greet the participant and ask them to sit in

the chair. The researcher will ask the participant to complete the Background Information Questionnaire.

Explanation of Procedure

The researcher will provide an explanation of the testing and listening procedures by reading the following script:

- ***You will first complete a computerized attention task called "Digit-Span"***
- ***You will wear these headphones and use this laptop.***
- ***"Digit-Span" involves listening to a stream of numbers and typing back the numbers as best you can from memory.***
- ***One part asks you to type the numbers in the same order and another asks you to type the numbers in reverse order.***
- ***The program will provide detailed instructions and will start with a "practice" round.***
- ***This should take about 3 - 5 minutes.***
- ***After completion, the program will automatically open a webpage with an audio file.***
- ***Once this page is opened, you may press play. This audio file will include instructions to guide you through a meditation exercise.***
- ***This exercise will take about 9 minutes.***
- ***At the end of the exercise, you will hear an instruction to click back to the "Digit-Span" tab and press start to complete it again.***
- ***After you have completed the "Digit Span" a second time, you are finished. You may place the headphones on the stand and step outside of the room where I***

will be waiting.

- ***If you are unsure what to do or have any questions during the procedure, just wave to me outside the room or open the door and I will come assist you.***
- ***You are free to stop the Digit Span or meditation exercise at any time for any reason.***
- ***Do you have any questions?***

The researcher will answer any questions from the participant for clarification. Once the participant fully understands the procedures, the researcher will ask the participant to sign the Informed Consent Form.

- ***Please review this Informed Consent form.***

A pre-determined four-digit number will be written on the participant's signed form.

- ***This number will be used as your identification number; I'll be using this number instead of your name when analyzing the data. Your name will not be directly associated with your performance.***
- ***If you have no further questions and would like to participate, please sign the form.***
- ***Now, please use this pen to write your name and this number on the blank paper.*** *(Point to number on Informed Consent form)*
- ***Before we get started, please make sure your phone and other electronic devices are turned completely off. You may get distracted by any vibration or sound alerts.***
- ***Remember, I'll be waiting outside of the room, wave to me or come get me if you need any help.***

- ***When you are finished with the digit span for a second time, you may set the headphones down and come outside.***
- ***Alright, once you are ready, you may press start. It will ask you to enter a four-digit number, please enter the number that you wrote on the paper.***
- ***Are you ready to begin?*** *(Wait for response)*
- ***You may begin by pressing start.***

4) Silence control condition. The fourth listening group will listen to an audio recording only involving a brief instruction to sit in silence. This recording will not involve additional instructions to guide or redirect attention throughout the duration of silence. The recording will include seven minutes of silence.

Set-Up

The researcher will have the headphones and laptop prepared with the Inquisit 4 application open before the participant arrives. A pen and blank sheet of paper will be placed next to the laptop. Once the participant arrives, the researcher will greet the participant and ask them to sit in the chair. The researcher will ask the participant to complete the Background Information Questionnaire.

Explanation of Procedure

The researcher will provide an explanation of the testing and listening procedures by reading the following script:

- ***You will first complete a computerized attention task called "Digit-Span"***
- ***You will wear these headphones and use this laptop.***
- ***"Digit-Span" involves listening to a stream of numbers and typing back the numbers as best you can from memory.***

- ***One part asks you to type the numbers in the same order and another asks you to type the numbers in reverse order.***
- ***The program will provide detailed instructions and will start with a "practice" round.***
- ***This should take about 3 - 5 minutes.***
- ***After completion, the program will automatically open a webpage with an audio file.***
- ***Once this page is opened, you may press play. This audio file will include instructions to guide you through a meditation exercise.***
- ***This exercise will take about 9 minutes.***
- ***At the end of the exercise, you will hear an instruction to click back to the "Digit-Span" tab and press start to complete it again.***
- ***After you have completed the "Digit Span" a second time, you are finished. You may place the headphones on the stand and step outside of the room where I will be waiting.***
- ***If you are unsure what to do or have any questions during the procedure, just wave to me outside the room or open the door and I will come assist you.***
- ***You are free to stop the Digit Span or meditation exercise at any time for any reason.***
- ***Do you have any questions?***

The researcher will answer any questions from the participant for clarification. Once the participant fully understands the procedures, the researcher will ask the participant to sign the Informed Consent Form.

- ***Please review this Informed Consent form.***

A pre-determined four-digit number will be written on the participant's signed form.

- ***This number will be used as your identification number; I'll be using this number instead of your name when analyzing the data. Your name will not be directly associated with your performance.***
- ***If you have no further questions and would like to participate, please sign the form.***
- ***Now, please use this pen to write your name and this number on the blank paper.*** *(Point to number on Informed Consent form)*
- ***Before we get started, please make sure your phone and other electronic devices are turned completely off. You may get distracted by any vibration or sound alerts.***
- ***Remember, I'll be waiting outside of the room, wave to me or come get me if you need any help.***
- ***When you are finished with the digit span for a second time, you may set the headphones down and come outside.***
- ***Alright, once you are ready, you may press start. It will ask you to enter a four-digit number, please enter the number that you wrote on the paper.***
- ***Are you ready to begin?*** *(Wait for response)*
- ***You may begin by pressing start.***

APPENDIX B: INFORMED CONSENT

Music and mindfulness: The effects of mindfulness practice combined with music listening on working memory

You are invited to participate in a research study which will involve using listening and meditation strategies to improve mental focus and overall well-being.

My name is Emily Messick, and I am a music therapy graduate student at the University of the Pacific, Conservatory of Music. You were selected as a possible participant in this study because you are over the age of eighteen.

The purpose of this research is to explore listening and meditation practices for enhancing mental focus and overall wellbeing. If you decide to participate, you will be asked to meet individually with the researcher in a private room in Faye Spanos Hall on campus. You will engage in an auditory meditation practice (9 minutes), as well as complete a short computerized test of mental focus (3-5 minutes) before and after the listening exercise. Your participation in this study will last about 30 minutes total.

There are some possible risks involved for participants. These are the potential loss of confidentiality, as well as physical and psychological distress. The risk of loss of confidentiality is minimal since the informed consent forms will be stored in a locked and safe cabinet by the researcher. Data collected during this study will also have no link to a participant's name or identity, since the web-based computer application will assign number codes to the data.

Because you will be using individual headphones when completing listening procedures, there is also a potential risk of physical harm to the ears if the volume is too loud. However, you will have the ability to monitor and adjust the volume yourself to maintain a safe volume. When completing the brief mental focus assessment, you may experience feelings of anxiety. However this assessment is brief and nondemanding. It is also emphasized that participation in these procedures is voluntary, while you may stop and withdrawal from the study at anytime. There are some benefits to this research, particularly that you may gain insight into listening and meditation practices in order to improve overall well being.

If you have any questions about the research at any time, please call me at (***) ***-****, or Dr. Waldon at (***) ***-****. If you have any questions about your rights as a participant in a research project please call the Research & Graduate Studies Office, University of the Pacific (209) 946-7716. In the event of a research-related injury, please contact your

regular medical provider and bill through your normal insurance carrier, then contact the Office of Research & Graduate Studies.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Measures to insure your confidentiality are storing informed consent forms in a locked and safe cabinet and using non-identifiable codes within data collection. The data obtained will be maintained in a safe, locked location and will be destroyed after a period of three years after the study is completed.

Your participation is entirely voluntary and 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 with out penalty or loss of benefits to which you are otherwise entitled.

Your signature below indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time 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. You will be offered a copy of this signed form to keep.

Signature _____ Date _____

APPENDIX C: BACKGROUND INFORMATION QUESTIONNAIRE

Questionnaire

Age: _____

Sex: Female ☐ Male ☐ Other ☐

Ethnicity: _____

Are you a student of The Conservatory of Music at University of the Pacific?
Yes ☐ No ☐

Do you practice meditation regularly? Yes ☐ No ☐

APPENDIX D: LISTENING EXERCISE SCRIPTS

Music and Mindfulness Audio Script

0:01 In this exercise, you will practice focusing your full attention to one thing in the moment. This means, you will try to focus your attention on the music, specifically one aspect of the music rather than splitting your attention to multiple places.

When listening to the music, your task is to pay close attention to the instrumentation, and try to notice any time a new instrument enters. When listening, hold your pen or pencil, and every time you hear an instrument enter the song, simply make a tally or check mark on your paper. To clarify, whether an instrument is entering a song for the first time, or if it came in, went away for a bit, and entered at a later time, you can make a tally.

The goal of this exercise is not to get the correct number of tallies, but rather practice being in control of your attention and to one thing in the moment. Now, this will not be an easy task. The human mind is a busy place and your attention may naturally wander to other things such as, other aspects of the music or events outside of this moment.

Try to be aware of how your attention fluctuates. If your mind begins to wander toward something that happened earlier today or how much work you have to do tonight, that is okay. Simply notice these thoughts and gently turn your attention back toward the current task.

Again, your task is to listen to the music and make a tally or check mark every time you hear an instrument enter. Alright, go ahead and get your pen ready, take a nice deep breath, and let's get started."

2:10 Music begins.

9:10 Music ends. "You've completed this exercise. Please click back to the digit span tab at the top left of the screen, then press start to complete the task one more time."

Mindfulness Only Audio Script

0:01 "In this exercise, you will practice focusing your full attention on one thing in the moment. This means you will try to gain moment-to-moment awareness of your present experience, specifically focusing on your breath. To start, let yourself find a comfortable sitting position. Now, take a really deep breath, hold it in for a few seconds, and let it out slowly. Let's do this for a couple of minutes in silence. Breathe in through your nose, hold it for a couple of seconds, and blow out slowly.

0:43 Silence

3:02 "Now, bring your full attention to your breathing sensations at the tip of your nose. Mentally note this tingling sensation. Maybe it's a little cold, and when you breathe out, it's smooth and warm. See if you can bring your full awareness to each moment of your breath at the tip of your nose, and we will practice this in silence for the next couple of minutes.

3:33 Silence

5:55 "You may have noticed, your mind is very busy and it may wander off away from the present moment. You may find yourself thinking about something that happened earlier today or how much work you have to do tonight, and that is okay. Simply notice these thoughts and gently turn your attention back toward your breath in the present moment. Let's start over. Take a deep breath, and turn your full attention to your breath as it moves in and out at the tip of your nose.

6:32 Silence

8:55 "You've completed this exercise. Please click back to the digit span tab at the top left of the screen, then press start to complete the task one more time."

Music Only Audio Script

0:03 "In this exercise, you will listen to a piece of music for 7 minutes. Please follow the instructions that you hear at the end of the exercise."

0:15 Music begins.

7:12 Music ends. "You've completed this exercise. Please click back to the digit span tab at the top left of the screen, then press start to complete the task one more time."

Silence Audio Script

0:03 "In this exercise, you will sit in silence for 7 minutes. Please follow the instructions that you hear at the end of the exercise."

0:14 Silence

7:17 "You've completed this exercise. Please click back to the digit span tab at the top left of the screen, then press start to complete the task one more time."