LEARN TO MEDITATE: BREATHE IN CALM, BREATHE OUT STRESS

Honors Thesis

Presented in Partial Fulfillment of the Requirements
For the Bachelor of Science Degree in Psychology

In the School of Arts and Sciences
at Salem State University

By

Renee Ouellette

Dr. Darlene E. Crone-Todd
Faculty Advisor
Department of Psychology

***

Commonwealth Honors Program
Salem State University
2017

Table of Contents

Acknowledgements----------3
Abstract----------4
Introduction----------5
Stress in America: College Students----------5
Beneficial Outcomes of Meditation----------8
Meditation over Medication----------13
Operationally Defining Meditation----------16
A Behavior Analysis & Behavior Modification Primer----------17
Respondent Conditioning----------19
Operant Conditioning----------20
Respondent and Operant Conditioning Combined----------23
Fidgeting ----------25
A Behavior Analysis of Meditation----------26
Stimulus Control----------26
Fading----------27
Research Questions, Goals, and Hypotheses----------29

Method
Participants----------31
Materials and Instruments----------32
Procedure----------34

Results----------37

Discussion----------64

References----------71

Appendix A:
Day One Questionnaire----------74
Pre-Session Questionnaire----------78
After Session Questionnaire----------79
Follow-up Questionnaire----------80

Appendix B
Recording Sheet----------82

Acknowledgements

There are several people whom I would like to thank for making this thesis possible. First, I would like to thank Vicki Stearns, Taylor Faieta, and Natalia Rodriguez for donating their time to help me with the observation portion of the study. I would also like to thank my adviser, Dr. Darlene Crone-Todd for pushing me to make this thesis something that I could be proud of. I could not have completed this thesis without the help of my professor and committee member, Dr. Ben Miller who helped me navigate the difficulties that this project entailed. I would also like to thank visiting instructor Ryan Snyder, another committee member who offered his deep understanding of behavior analysis to help construct certain aspects of my procedure. Finally, I would like to express my gratitude to my mother and father who have fully supported me and pushed me through this project. Thank you to everyone who has made this thesis possible. All your hard work, advice, and guidance is deeply appreciated.

Abstract

The high stress and anxiety levels reported by college students are a concern for many students pursuing a degree. Meditation is a research-supported method of reducing stress and anxiety. While many students would like to learn how to meditate, it is difficult to do so without some form of instruction. The present study uses behavioral fading procedures to gradually diminish the use of verbal and audio prompts in a guided meditation program to eventually transfer stimulus control from the prompts to the participants themselves to meditate successfully on their own. The goals of the present study were to increase the probability of maintaining a frequent practice of meditation, and to increase the participants' success in meditating. Success in meditating was defined by the participants' decrease in heart rate, along with the number of fidgeting behaviors they emitted in each session. The participants (n=6) were introduced to the fading procedures at different times, using a multiple baselines across participants (MBAP) design. Physically recorded measures indicate that the program decreased participants' overall resting heart rate as well as their heart rate within sessions, fidgeting behaviors during meditation, and their self-reported anxiety levels. Further, some of the participants persisted with their meditation practice after the study was terminated. However, overall stress levels appeared to remain the same across the program. These results imply that a MBAP design that uses fading procedures for this limited amount of time is effective in decreasing heart rate and anxiety levels, but not stress levels.

Introduction

Stress is something that everyone encounters in daily life, but at certain times in our lives we encounter more or less stress. In college, many people encounter high levels of stress. Today's college students are often non-traditional, have many demands on their time, and are worried about their future career prospects. While there are many ways to reduce stress, the focus of the present thesis will be to investigate the beneficial effects of meditation in this population of both traditional and non-traditional undergraduate students. A second focus will be on using behavioral methods to fade out guided meditation such that students can learn to meditate on their own. As a result of this study, it is expected that students' heart rates and fidgeting during meditation sessions will decrease, as well as self-report measures related to stress and anxiety.

The literature review is organized into the following sections: (a) how stress affects college students in the United States of America; (b) beneficial effects of meditation, including its use versus medication; (c) operationally defining meditation; (d) a behavior analytic interpretation of meditation that includes both operant and respondent components; and (e) an overview of the procedures used in the study, such as stimulus control and fading. The rest of the thesis is organized into the research questions and goals, methods, results, and discussion.

Stress in America: College Students

In addition to taking several courses, college students often struggle to balance a social life, family responsibilities, and sometimes even a job. In high school, students often have their priorities arranged in a manner that is very different than what is required in a college environment. For example, in high school, a top priority might be getting

asked to the prom. In college, priorities change such that things like that seem trivial, and the student's focus often shifts toward academic goals. A major concern that is introduced to many college students for the first time is the uncertainty of finding employment in the competitive job market that exists today.

College students are often overwhelmed by the need to be perfect, and to produce perfect work, which causes significant levels of stress (Chang, 2006). To stand out, some students work for a 4.0 GPA, which requires them to get straight A's. Others who may not be straight "A" students might experience high levels of stress due to trying to pass their classes. Some students might not care about their grades at all, making this a stressor that does not affect them. However, most students do wish to pass their classes and others strive for good grades, which can be mentally, emotionally, and physically taxing. This strain that college students face each semester can be rather intense and takes a toll on their overall well-being and health. As Baghurst and Kelly put it:

> *Thus, as they [college students] grapple with increased academic, personal, social, and moral pressures in their lives, these stressors may lead to increased anxiety, loneliness, depression, hopelessness, headaches, sleep disturbances, colds, and sometimes suicidal ideations (Baghurst & Kelley, 2014, p, 438).*

The current job market competitiveness is often frightening to students nearing graduation. The present-day college student is likely to not be of traditional college age (18-22). Non-traditional students may include first-generation students, minority students, and students who do not fit in to the traditional college age for the corresponding class year that they are in. For example, a traditional college freshman might be 18-19 years old, a non-traditional freshman might be 20 or older. According to

Dill and Henley (1998), non-traditional students were students who held various roles (such as being a mother, someone with a job, as well as a student) and had at least one year off between high school and enrolling in college. These researchers found that non-traditional students faced many of the same stressors as traditional college students, but they tended to experience several stressors that traditional students did not. Non-traditional students often have to adjust from being in the workforce or at home with a family to juggling these obligations while becoming a student again. Many students, both traditional and non-traditional, hold a job while completing their degree, which means they must complete their professional duties while also completing their academic assignments in a high quality and comprehensive fashion.

Dill and Henley (1998) compared the stressors of the traditional student to those of the non-traditional student. They found that traditional students felt more pressure to do well academically, often because their parents might be paying for their education. Often, if this is the case, students feel pressured to do well in their classes to avoid disappointing their parents. Dill and Henley (1998) reported that non-traditional students claimed to be more negatively emotionally impacted by an awful professor than traditional students, and that they struggled to balance their other obligations with attending all their classes more often than traditional students. The researchers also found that non-traditional students rated doing homework, returning to an academic environment, and attending classes as being more desirable than traditional students had rated them.

With the constant reports of excess stress and anxiety on college campuses, one might wonder how they can help relieve themselves and fellow students of these

pressures. One way to help oneself is to meditate regularly. Studies have shown that doing so will aid in decreasing things like stress and anxiety levels, which is why the present study was designed to both initiate and look at the effects of a consistent meditation program in college students of both traditional and nontraditional backgrounds.

Beneficial Outcomes of Meditation

A regular meditation practice comes along with a plethora of health and wellness benefits. For example, meditation has been shown to help reduce stress and anxiety levels (Krisanaprakornkit, Sriraj, Piyavhatkul & Laopaiboon, 2006; Goyal et al., 2014). Sundquist et al. (2014) describe the benefits of mindfulness meditation as follows: "Mindfulness was…associated with less physical illness, improved well-being, increased self-control, decreased negative affect, better affect tolerance and improved concentration, focus attention and working memory. Among therapists, it was associated with increased empathy and better overall wellness" (p. 128). The potential list of benefits of meditation go on, which is the why the present study was designed to decrease stress and anxiety levels of college students through a meditation program.

In their meta-analysis and review of the literature, Goyal et. al (2014), found that those who practiced mindfulness-based meditation showed a modest reduction in symptoms of anxiety, depression, and stress, as well as in chronic pain. Further, they found a positive correlation between the total amount of time spent practicing meditation and symptom reduction. Goyal et al. also reported that there were no adverse side effects to meditation for most. However, they determined that those diagnosed with a condition of hypotension should not partake in the regular practice of meditation. Barnes, Treiber,

and Davis (2001) reported that meditation decreases one's blood pressure which supports that people diagnosed with hypotension should potentially not practice meditation because a decrease in their already low blood pressure is undesirable.

Meditation induces something termed the "relaxation response" by Benson in 1975. The relaxation response and how to induce it is described by Murphy and Donovan (1997):

> *The conditions necessary to evoke the relaxation response involve a quiet environment, repetition of a sound or phrase, a passive attitude, and relaxed watchful breathing. Meanwhile, in the medical literature he* [Benson] *had identified the relaxation response as a natural reflex mechanism which, when practiced twenty minutes a day, reduced stress and physiologically had the opposite effect of the fight-flight reflex" (pp. 9-10).*

The relaxation response is characterized by a series of physiological responses that are produced during relaxation, such as a decrease in heart rate and a change in EEG patterns (Lazar et al, 2000). A decrease in heart rate due to meditation was also observed by Bruning and Frew (1987) was one of the measures that the present study looked at to determine a decrease in stress levels. Further, meditation has been found to decrease the activity of the amygdala, which is the emotional response center and the part of the brain that initiates the eventual emission of a stress response ("Understanding the Stress Response", 2011).

Besides stress and anxiety, recent research indicates that meditation helps prevent several types of malignancies and is related to cardiovascular health. For example, there is evidence that meditation can increase melatonin levels with intensive practice.

Increased levels of melatonin is hypothesized to aid in the prevention of certain types of cancers through preserving patient's health and averting certain diseases such as breast and prostate cancer (Massion, Teas, Hebert, Wertheimer, & Kabat-Zinn, 1995). The American Heart Association suggests that meditating daily (specifically twice a day for twenty minutes) will decrease one's chances of developing cardiovascular disease, and also decrease blood pressure and heart rate ("Meditation and Heart Health", 2017).

Kabat-Zinn (1990) suggests that we are regularly distracted by all of the urgent thoughts about the tasks we must complete, the things we want to do, our tasks we must complete, responsibilities, and very busy schedules. One way to help acknowledge and accept these sometimes overwhelming obligations and thoughts is through meditation. The type of meditation that the present study focuses on is called mindfulness meditation. Mindfulness meditation requires that a person take a few minutes out of their busy day to sit peacefully while focusing on their inner and outer environments with complete awareness. Often, mindfulness meditation involves bringing one's attention to his or her breathing, and inevitably, the meditator may encounter an intrusive thought. In his book, *Full Catastrophe Living*, Kabat-Zinn described his concept of mindfulness meditation. He suggested that when one attempts mindfulness meditation, if intrusive thoughts become present in the meditator's mind, they may recognize that the thought is there, but instead of engaging in it, the meditator is to accept it, move along, and bring his or her attention back to the breath. In saying this, Kabat-Zinn means that mindfulness meditation is not about suppressing the thoughts that cross one's mind or attempting to not have any thoughts at all. Instead, he suggests that mindfulness meditation is about acknowledging and accepting one's thoughts, but then bringing their attention back to

one's breathing, being mindful of their inner environment.

In order for one to successfully meditate, one must commit to setting time aside to do so. The issue with this is that people often feel there is not enough time in the day to complete all of the tasks they have already been assigned, so adding yet another one to the mix is stressful in itself. Many people often do not have the time, space, or proper training to commit to a meditation regimen. Some people may not recognize spaces they already have readily available to them that could be used as meditation spaces, such as their desk at work. The lack of commitment to meditating is often what causes programs to be ineffective for many people. There is a daily commitment that must be made if a change is truly desired.

> *The problem with meditation, as with exercise, is that depression and anxiety can prevent you from trying them.... if you cannot sit still long enough to close your eyes and relax, you cannot meditate. If you cannot drag yourself out of the house to exercise, you do not do it. If you can, however, both work well when done on a regular basis -- that's the key, though, to their effectiveness (Morgan, 2005 was quoted in Krisanaprakornkit et al., 2006, p.9).*

In many self-control programs, some issues arise for many people who are attempting a behavior change (D. Crone-Todd, personal communication, May 3, 2017). Some of these issues include response cost, amount of effort needed to gain a response, small and unnoticeable immediate results, cumulatively significant results (delayed positive results), and initial discomfort with the program due to it usually being a condition which the individual finds aversive or uncomfortable due to not having

experienced it before (or enough) (Martin & Pear, 2015). These things may all discourage the individual from continuing to attempt the behavior change that they desire.

One technique to actively and efficiently deal with the everyday stressors that are encountered, and confront them with appropriate physiological and psychological responses, is the practice of daily meditation. Jon Kabat-Zinn (1990), the credited creator of mindfulness meditation, stated that "when your whole life is driven by doing, formal meditation practice can provide a refuge of sanity and stability that can be used to restore some balance and perspective" (p. 60). In an article about operationally defining mindfulness meditation, the authors described the general term of *meditation* in a way that demonstrates its intricacy and multiple facets. As Krisanaprakornkit et al. (2006) state, "Meditation is sometimes considered to be a form of relaxation therapy, however meditation not only creates a relaxation response but also produces an altered state of consciousness which facilitates the meta-cognitive mode of thinking which make [sic] possible the expectation of cognitive-behavioural benefits" (p.3). There are numerous benefits that meditation creates in those who regularly practice it. Certain types of meditation have shown evidence of increasing a type of thinking called divergent thinking. Divergent thinking is a type of thought process that helps the individual come up with several different solutions to a problem and aids in generating may different ideas (Hommel, Ozturk & Colzato 2012); Divergent thinking is correlated with an increase in creativity (Horan, 2009). This, meditation can be useful as a way to both lower stress and develop complex thinking skills

Meditation is an intervention that more people should consider when looking for a way to positively affect one's current state. In the Goyal et al. (2014) meta-analysis, a

continuous meditation practice over two to six months yielded similar efficacy results in the reduction of stress, anxiety and depression symptoms as prescription anti-depressant medications.

Meditation over Medication

Many side effects accompany medications that are used to treat the same problems meditation might also address. In consultation with a mental health professional, perhaps before, or while, seeking medicine to treat issues such as depression, generalized anxiety disorder, social anxiety disorder, as well as chronic pain, one should also attempt to practice meditation. If Goyal et al.'s (2014) suggestion is correct that meditation alone can successfully reduce the severity of some disorders, then an attempt at meditation might be made before seeking medication. This could be beneficial if it helps reduce the use of some kinds of prescription drugs that can be addictive and that may have adverse side effects. Of course, some medications are necessary to the health and well-being of many people, especially when it comes to treating many severe psychological and physiological issues. In these cases, meditation might be a useful addition to medication.

However, there is over-prescription and prominent abuse of drugs in the United States today. College students can get their hands on a variety of prescription drugs without their names actually on the prescription itself. McCabe and Boyd (2005) found that undergraduate students obtain prescription drugs illicitly most frequently through their peers. The abuse of medications, which is not to be confused with the prescription of medication to those who benefit from their effects for diagnosed reasons, is a cause for concern. Those who are prescribed these medications under medical supervision can have

a safe and efficient experience with the drugs, but unauthorized use of them can lead to complications. McCabe and Boyd suggest that clinicians limit the number of pills and refills prescribed to college students to prevent abuse.

Considering the levels of drug abuse in college students, their psychological and physiological stress levels should be a main concern for university communities. Kadison and DiGeronimo (2004) presented data from the 2002 American College Health Association (ACHA) Survey to which 29,230 college students nationwide responded. Over 90% of students reported feelings of exhaustion, being overwhelmed by their responsibilities, and having feelings of extreme sadness. Also, almost half of the respondents experienced difficulties in daily functioning (Kadison & DiGeronimo, 2004). In an updated version of the ACHA survey, the ACHA's National College Health Assessment II for the spring of 2015 expanded the survey to include over 92,000 students across the United States. This survey reported 30% of students having feelings of stress that ended up severely impacting their academics, and over 20% of students self-reported having feelings of anxiety that had also impacted their grades and success in the classroom (American College Health Association, 2015). It is, perhaps, not surprising given the levels of stress and anxiety reported, that students are seeking ways to alleviate these feelings.

Kadison and DiGeronimo (2004) stated that of all psychoactive medications prescribed for both college students and the general population, the most frequently used are antidepressants. Antidepressant use can trigger a manic episode when the real underlying cause of the depressive behaviors that the drugs were prescribed for is due to bipolar disorder and not just depression (Ghaemi et al., 2003). Another matter of concern

is that the use of antidepressants has shown to cause an increase in adolescent suicides in patients who were taking them (Kadison & DiGeronimo).

Antianxiety medications, some of which are referred to as benzodiazepines (e.g. benzodiazepines such as Xanax and Valium), are also a concern for misuse. People are attracted to these powerful drugs that are meant to treat clinical anxiety because they work so quickly and efficiently in reducing the symptoms they are experiencing. College students often experience symptoms of anxiety and stress, which explains the attraction to such powerful yet dangerous drugs. Kadison and DiGeronimo (2004) report that benzodiazepines can become highly addictive and after prolonged use, the user will build up a tolerance and require a higher dose to feel the same effects. They also explain that benzodiazepines can affect the user's cognitive functioning. Some of these effects on cognition include an impairment of sensory processing, psychomotor speed, nonverbal memory, the speed of processing information, problem-solving, attention and concentration, verbal memory, general intelligence, motor control and performance, working memory, as well as verbal reasoning (Barker et al., 2004). Another cause for concern with benzodiazepines is the severity of withdrawal from them, in which medical supervision is necessary for the individual. Meditation may not be the “cure-all” to eliminate student suicides and severe stress levels, but given its effectiveness in reducing symptoms of depression, anxiety, and pain as demonstrated by Goyal et al. (2014), it could provide college institutions with at least one alternative method to help their students enjoy a better college experience.

Operationally Defining Meditation

Meditation itself is a practice that consists of many different branches which include a number of techniques centering around relaxation of the mind, body, soul, or thought. Meditation usually involves deep breathing, tension release strategies, muscle relaxation, thought recognition and release, all in the context of being an individualized practice. Cardoso, de Souza and Leite (2004) state that a program can only be classified as a meditation practice if it meets certain requirements. If any of the requirements are not met, then the program is not a complete form of meditation. These requirements include: (a) The use of a clearly defined, specific technique; (b) some variation of a muscle relaxation technique; (c) a form of "logical relaxation;" (d) being a "self-induced state"; and (e) the use of a self-focus skill, or as the authors describe it, an "anchor." An example of an anchor would be reciting the phrase "ohm" or counting to 10 to oneself repeatedly. It is an "anchoring" strategy that keeps the individual focused on their practice, and can be different for everyone. In the present study, participants are instructed to use breath counting as an anchor. Breath counting in this case means silently counting to four on each inhale and each exhale.

As mentioned before, there are various forms of meditation practice, and to suggest only one single definition of meditation is misleading (Murphy & Donovan, 1997). One meditation technique that is widely used is guided meditation. Guided meditation can be found in the form of audio tracks online, or can be conducted in person by an instructor. The practice itself usually includes calming music or relaxing sounds and music, as well as the voice of a person reading from a script that allows the listener to be actively aware of their body and breathing patterns, creating distance between self and

the rest of the world. Guided meditation is usually the easiest form of meditation for beginners, because it gives constant verbal instruction on when to breathe, what to think, and sometimes how to feel. Another meditation condition that the present study will use involves listening to calming sounds and music audio tracks. The final meditation condition that the present study will focus on involves meditating in absolute silence. In this case, there are no audio tracks or verbal prompts to guide the individual in their practice. The participants will be using the breath counting silent anchor described previously to focus on their practice.

A Behavior Analysis & Behavior Modification Primer

As defined by Martin and Pear (2015), behavior analysis is "the study of the scientific principles that govern the behavior of individuals" (p. 316). Behavior analysis forms the basis upon which the general practice of behavior modification is based. The purpose of behavior modification is to enhance people's everyday lives by using learning principles and methods to evaluate problem behaviors and change them. Behaviors are defined as being either overt, meaning observable to others; or covert, meaning internal (Martin & Pear, 2015). In meditation, an overt behavior that might occur is the tensing of muscles throughout the body, facial expressions, or other physical movements because outsiders can observe the behavior occurring. An example of a covert behavior would involve counting to four when inhaling and then counting to four while exhaling silently to oneself (e.g. no facial or lip movements). This would be a covert behavior because an outside observer would not be able to detect this occurring; however, the behavior is observable to the person who is emitting the covert behavior.

There are seven dimensions that define applied behavior analysis (Baer, Wolf, & Risley, 1968): applied, behavioral, analytical, technological, conceptually systematic, effective and generality. The first dimension, applied, involves the behavior change being socially significant, and leading to increased reinforcement and an overall better life for the individual seeking help. The second dimension, behavioral, involves changing the individual's measurable behaviors to improve their functioning. An intervention is behavioral if it defines the problem and the solution in behavioral terms. The third dimension, analytical, involves a scientific demonstration being present in the procedure or intervention. The fourth defining characteristic of behavior modification is being technological, meaning describing the procedure in a way that allows anyone to be able to replicate it, due to the precise descriptions of procedures. The fifth characteristic involves the consistency of terminology within behavior analysis to explain phenomena; this is the conceptually systematic dimension of behavior analysis. The sixth characteristic stresses the importance of showing that a specific intervention produces socially or clinically significant effects, or the consumer satisfaction with the intervention. The last characteristic is known as generality, which means the success from the intervention can be transferred across people, places, or behaviors. The purpose of this study is to meet most of these dimensions. As discussed, learning the behaviors associated with modification should result in a socially significant change for participants. By clearly defining the problem and procedures in precise behavioral terminology, it is hoped that others could replicate the study. Further, by employing fading techniques in meditation to transfer control of behavior to the participants, generalization of clinically effective outcomes is more likely.

Respondent Conditioning

When a behavior is expressed due to genetic endowment based upon the survival of the species in the past, we call that kind of behavior phylogenic (Pierce & Epling, 1998). Phylogenetic behavior is naturally occurring, species specific, and aids in the species survival and chances of reproducing. With phylogenic behavior, the organism is provided with a "basic repertoire of responses that are evoked by environmental conditions" (Pierce & Epling, 1998, p. 54). Some of these phylogenetic behaviors include reflexes, which exist when an unconditioned stimulus (US) elicits an unconditioned response (UR).

A reflex itself is the relationship between the US and UR (Pierce & Epling, 1998). An unconditioned stimulus is an eliciting event that has not been previously taught to the organism, and an unconditioned response is a behavior elicited by the US automatically, without being taught. In other words, "Reflexive behavior is automatic in the sense that a physically healthy organism will always produce the unconditioned response when presented with an unconditioned stimulus" (Pierce & Epling, p. 56-57).

On the other hand, an organism also displays ontogenetic behavior which requires learning. It consists of behavior-environment relations with occurrences in the physical and social world. It builds on the phylogenetic behavior mentioned above to "determine when, where, and what kind of behavior will occur at a given moment" (Pierce & Epling, 1998, p. 59). For example, phylogenetic behavior would be salivating at the taste of food. Ontogenetic behavior would involve salivating when a McDonald's sign appears. The pairing of the sign (CS) with obtaining food (US) will cause you to salivate (CR). That is a behavior-environment interaction that had to be learned to elicit a certain response and

is an example of respondent conditioning. In respondent conditioning, the control of behavior is transferred from one stimulus to a different stimulus (Pierce & Epling, 1998). The idea is that initially, a US elicits a UR, but the control of the behavior is transferred to a new, unrelated stimulus that we call a neutral stimulus (NS). To do this, we present the NS, and then immediately after, we present the US. After several pairings of the US and NS, the NS begins to elicit a response similar to the original UR. When this occurs, the names and function of the stimuli and responses change. The NS is now a conditioned stimulus (CS) that elicits a conditioned response (CR). The CR is often called a respondent, hence the name respondent conditioning.

Respondent conditioning can be observed in meditation practice. Deep breathing (US) automatically elicits a decrease in heart rate (UR) without any prior training. This specific reaction is called a "relaxation response," which will be addressed later in another section. After enough pairings of deep breathing exercises (US) with the room in which one consistently meditates (NS), one's heart rate should begin to decrease (CR) after entering the room. Thus, the environment becomes a CS that controls this behavior. Another example related to the present study would involve pairing the deep breathing exercises (the US), which decreases heart rate (the UR), with calming music (the NS) to prompt the individual when to breathe in and out. After enough pairings, we would expect the sound of the calming music to become a CS and thus elicit a decrease in heart rate.

Operant Conditioning

Operant conditioning involves antecedent stimuli that set the stage for behavior to occur, behaviors that influence the environment (called operants), and consequences that

will either increase or decrease the likelihood of that behavior occurring again in the future. To be more specific, if a behavior happens in the presence of a specific stimulus, and that behavior is followed by a reinforcing consequence, that behavior will be more likely to occur again in the presence of that stimulus. Pierce and Epling (1998), amongst several others in the field of behavioral psychology, describe this stimulus that evokes the response as a discriminative stimulus (S^D), and sets the stage for the desired behavior to occur. They also explain that if the stimulus establishes the setting so that emission of the behavior would not be reinforced, this stimulus would be called an S-Delta (S^Δ). In the presence of an S^D, the probability that a certain response will occur may increase, but it is not guaranteed that the behavior will occur and in the presence of an S^Δ, the likelihood that a certain response will occur decreases. It is the behavior consequence (B-C) pairing that determines the probability that the behavior will increase (when the consequence is reinforcement), decrease (when the consequence is punishment or extinction), or stay the same (consequence has no effect on the behavior; Crone-Todd, D.E., personal communication, 12/15/16). For example, for meditation, an S^D might be a quiet room, because the meditator might be positively reinforced by the relaxation effects that might result from meditating successfully. On the other hand, an S^Δ for meditation not to occur might be at a heavy metal concert surrounded by jumping and screaming head-bangers. In this case, the likelihood of successfully meditating is low, since loud noises might increase your heart rate, therefore making it impossible to receive the positively reinforcing effects of the relaxation response.

Pierce and Epling (1998) describe operant conditioning as "an increase or decrease in operant behavior as a function of a contingency of reinforcement" (p. 100),

and a contingency of reinforcement as the “relationship between the events that set the occasion for behavior, the operant class, and the consequences that follow this behavior" (p. 93). An example of a contingency of reinforcement in meditation would involve a verbal prompt that tells the individual to "flex their muscles tightly and then release" (S^D), so they do so (R), which results in the release of tension in that area of the body (consequence). This leads to the individual practicing this method in the future whenever they feel the tension in their bodies. This specific behavior seems to be negatively reinforced, which means an aversive stimulus is taken away that will result in an increase in the probability of that behavior occurring in the future. This is one of the four main consequences in the three-term contingency in operant conditioning. The other three consequences are positive reinforcement, positive punishment and negative punishment.

Positive reinforcement involves administering a stimulus that influences the behavior that will increase the probability of that behavior occurring again in the future (Pierce & Epling, 1998). An example of this in meditation might involve the instructor giving positive feedback to how the individual is conducting their breathing, exclaiming "great job, keep up that pace of inhaling and exhaling," and the individual's steady breathing pattern increases. Positive punishment is the administration of a stimulus that, when following a certain behavior, will decrease the likelihood of that behavior occurring again in the future (Pierce & Epling). An example of this in Zen Meditation is if a monk falls asleep during meditating, the Zen master strikes him (lightly) with a stick called a jooki to prompt him to return to his practice (Bass, 2010). The strike is meant to startle the sleeping monk, and have him realize he has fallen asleep so that he will come

back to his meditation. In the future, the monk does not fall asleep during his meditation because the pairing of the behavior of sleeping (behavior/response) and the strike of the jooki (consequence/punishment) with the antecedent stimuli of being in the zendo (antecedent) causes the zendo to become an S^{Δ} for sleeping and an S^{D} for meditating. The final contingency of reinforcement is negative punishment. It is difficult to imagine an example of this contingency in meditation, but one might be not receiving a cup of tea if meditation does not persist for the time required.

Respondent and Operant Conditioning Combined

It is common to find that respondent and operant components of behavior interact and overlap. Covert behaviors, as previously explained, are private or internal, and overt behaviors are physical actions that are observable to others. Thoughts and feelings, both covert behaviors, can be elicited at different intensities when certain stimuli or reinforcers are introduced or removed. To explain this further, presenting reinforcers or pleasant stimuli can make an individual feel a range of emotions from being somewhat pleased to being filled with sheer excitement. Presenting aversive stimuli or removing reinforcers could elicit feelings of slight displeasure to deep anger or panic (Martin & Pear, 2015). Martin and Pear go further in explaining the connection between operant and respondent components in such situations:

> *"(a) the autonomic reaction that you feel during the experience of an emotion (typically accompanied by visible signs, such as frowns or smiles, which is influenced by respondent conditioning; (b) the way that you learn to express an emotion overtly (such as shouting, jumping up and down), which is influenced by operant conditioning; and (c) the way that you become aware of and describe*

your emotion, which is also influenced by operant conditioning" (Martin & Pear, 2015, p. 146).

Martin and Pear cite Skinner's theory that we learn to silently talk to ourselves covertly because when we think out loud we disturb those around us and encounter punishing consequences (Skinner, 1957 as cited in Martin & Pear, 2015). Talking silently to ourselves, therefore, is a covert operant behavior, because (a) it is a behavior that effects our internal environment and (b) we have learned that under certain circumstances (S^{Δ} = meditation) it is not considered appropriate to speak what we are thinking out loud. During meditation, it would not be deemed appropriate to say everything that crosses one's mind out loud especially if others are practicing their meditation in the same space. In this case, self-talk might involve thinking to oneself to inhale and exhale at the appropriate time to elicit the feelings of relaxation that one is trying to achieve (the respondent autonomic reaction). During meditation, one is practicing not engaging in thoughts, but merely observing them. This also means that no one is providing reinforcement for the off-task or verbal behavior the individual may emit, especially if they are new to meditating. This may cause the individual to undergo an extinction burst, or a portion of time during meditation where, since they are not used to being in a room with others without receiving social reinforcement of any kind, certain off task behaviors occur. Some of these behaviors might include opening their eyes to look around at the others in the room or fidgeting (Crone-Todd, D.E., personal communication 12/15/17).

Another example of how operant and respondent conditioning may begin to work together is as follows: The participants enter the classroom in which the meditation sessions take place (In operant terms, the room is an S^{D} for meditating; and in respondent

terms the room is initially a NS for heart rate). During the sessions, participants are taught to meditate via guided verbal prompting (Operant: R = meditation behaviors, such as breathing/respiration rate, sitting still, etc.), in which they breathe deeply (respondent US) which elicits the relaxation response of a decrease in heart rate (UR), which results in participants feeling relaxed and refreshed (operant reinforcer, or R^+) After pairing the room (NS, which also serves as an S^D) for the operant behavior (meditation responses, also the US) to occur, which is reinforced by feelings of relaxation (R^+) – with the US of the verbal prompting to breathe deeply, eventually, the room will become a CS for heart rate to decrease (CR) upon entering the room.

To make this example clearer, the diagram below represents the different components of the present meditation program used in this study in relation to both operant and respondent conditioning:

- Operant Conditioning:
  - S^D (Meditation Room) → R (Meditation Behaviors) → R^+ (Reinforced by feelings of relaxation)
- Respondent Conditioning:
  - US (Deep Breathing) → UR (Decreased Heart rate)
  - NS (Meditation Room) + US (Deep Breathing) → UR (Decreased Heart Rate)
  - CS (Meditation Room) → CR (Decreased Heart Rate)

Fidgeting

In the present study, we looked at fidgeting to attempt to measure the overt expression of covert anxiety behaviors during the meditation program. No published

literature was found on the topic of fidgeting, therefore we had to formulate our own operational definition of what would be considered a fidget. Fidgeting was operationally defined in this study as the participants displaying any of the following behaviors: opening eyes, looking around the room repetitive and irrelevant movement of fingers, feet, arms, legs, or head, touching one's arms /face/hair/ etc., tapping fingers or feet, unprompted facial tensing, unprompted movement of arms, head, or legs, shifting around in one's seat beyond a simple adjustment, as well as fiddling with an object. The purpose of studying fidgeting behaviors was to provide a measurable behavior that we could identify as increasing or decreasing over the course of the program. In the event of a decrease of fidgets over the course of the intervention, it is predicted that participants will also display a decrease in heart rate, suggesting overall success in the program. In the event of an increase of fidgets over the course of the intervention, it is predicted that the participant will also be unsuccessful in reducing their heart rate and therefore, be unsuccessful in the program.

A Behavior Analysis of Meditation

Stimulus Control

Stimulus Control is measured by the strength of the relationship between a stimulus and a response (Martin & Pear, 2015). If a stimulus exerts strong stimulus control, then that stimulus has a high probability of evoking a given response. If a stimulus has low stimulus control, then that stimulus has a low probability of evoking a given response. For example, Turner and Ascher (1979) showed that insomnia may be caused by the individual participating in other activities while in bed, such as studying, reading, texting, etc., which causes the bed to lose its ability to exert stimulus control for sleeping. They

suggest that if this is the case for an individual, they are advised only to use the bed for sleeping, and absolutely nothing else so that it becomes an effective discriminative stimulus once more for sleeping.

If the behavior occurs in a certain situation in the presence of a certain stimulus that is often present prior to the behavior and consequence pairing, then the stimulus or situation will eventually exert stimulus control over the behavior. If the behavior leads to punishment then the antecedent stimulus that was present when the behavior occurred would become an S^{Dp} or discriminative stimulus for punishment. If the behavior is followed by extinction of that behavior, then the antecedent stimulus would become an S^{Δ}. Finally, if the behavior is followed by a reinforcer (R^{+}), then that antecedent stimulus would become an S^{D}. So, the Antecedent-Behavior-Consequence (A-B-C) relationship is a result of the first pairing of the behavior and consequence, and if the antecedent stimulus is reliably present, then that stimulus will exert control over the behavior (Personal Communication, D. Crone-Todd, 12/15/16).

Once this relationship is established, the antecedent stimulus exerts strong control over a behavior when the presence of the stimulus evokes that behavior. Another common example of this would be the common traffic light. When a driver who is familiar with common traffic laws is in the presence of a green light (stimulus) at a traffic light, they press on the gas pedal to go (response). This is a stimulus that has a strong stimulus control on the response of proceeding through the traffic light (Pierce & Cheney, 2008).

Fading

Martin and Pear (2015) define the term fading as the "gradual change over successive trials of an antecedent stimulus that controls a response so that the response

eventually occurs to a partially changed or completely new antecedent stimulus" (p. 96). In other words, fading is the gradual transfer of stimulus control from one stimulus to another (Pierce & Epling, 1998). An example of fading would be teaching a two-year-old to point to your nose when you ask "Where's my nose?" by first saying "Where is my nose?" and then guiding their hand to point at it. Over many trials in a row, after strong response/reinforcement relationship is established, one would fade out the physical touch and move to pointing at your nose and ask “where is my nose?” Then after enough reinforcement, fade out pointing, and ask them "Where is my nose?" and the two-year-old points to your nose. A stimulus has several different characteristics or dimensions that can be measured on a continuum and can be faded along these dimensions, such as volume, pressure, physical environment, and stimulus clarity.

Prompts are additional antecedent stimuli presented to increase the chances of the desired behavior occurring (Martin & Pear, 2015). Prompts are also defined as additional stimuli "that are presented immediately before or after the stimuli that will eventually allow the learner to display the behavior of interest at the appropriate time or in the relevant circumstances," (Foxx, 1982 as cited in: MacDuff, Krantz, & McClannahan, 2001, pp. 38). There are four types of instructor behavior prompts: physical prompts, verbal prompts, gestural prompts, and modeling prompts. Most relevant to the present study, verbal prompts are stimuli that are introduced in the form of verbal instructions that will eventually lead the individual to perform the target behavior (MacDuff et al.).

There can also be environmental alterations that are used as prompts called environmental prompts. This type of prompting involves altering the environment in a way in which the behavior that is being targeted is evoked (Martin & Pear, 2015). These

instructor behaviors and environmental prompts can be divided into even more specific subgroups of prompts. There are extra-stimulus prompts and within stimulus prompts. Martin and Pear define extra-stimulus prompts as "something that is added to the environment to make a correct response more likely," (p. 98) and an example given in their text on this very topic involves parents attempting to teach their child where to place the fork, knife, and spoon while setting the table for dinner. They draw a fork, knife, and spoon on placemats around the table, which act as extra-stimulus prompts, with the intention of the child learning that the outlines of the utensils signal where the similarly shaped silverware would be placed. A within-stimulus prompt, as defined by Martin and Pear, is a variation of the features of the S^D that make the stimulus more prominent, making it easier for them to discriminate the appropriate response when that stimulus is present. The parents who want to train their child to set the table would include a fork and knife in their regular spots on the table, and then put a large silver spoon where the normal dinner spoon should go. The size and regularity of the spoon would be faded back to a regular spoon over several trials so eventually the child will place the dinner spoon in the correct place.

Fading relates to meditation as follows. An extra-stimulus prompt in a meditation program might include having a subtle chime sound every four seconds to cue when to inhale and exhale. This would be classified as an extra-stimulus prompt because it is a cue or stimulus that is added to the environment to increase the likelihood of the desired behavior, which in this case might be regulating the meditator’s rate of breathing. This prompt might be faded on the dimension of intensity. A within-stimulus prompt in a

meditation program relating to staying on pace with breathing might include beginning the program by counting the seconds one inhales and exhales.

Research Questions, Goals, and Hypotheses

In the present study, several questions pertaining to meditating and fading procedures are investigated. These questions are:

- Whether fading out verbal and audible prompts in a meditation program will be effective in decreasing participant's heart rates and frequencies of fidgeting behaviors from beginning to end;
- whether this meditation program will be effective in getting participants to continue meditating even after the intervention ceases;
- whether the prompt-fading meditation program will help participants successfully meditate on their own across several situations;
- whether the prompt-fading meditation program will create a reduction in participant’s stress and anxiety levels.

The goals of the proposed study were to provide students with a method to potentially decrease stress, to study a fading procedure to transfer self-control over meditation practice, and to study the effects of meditation and the fading process on heart rate and fidgeting as measures of relaxation.

Hypotheses regarding the research questions are:

(a) Fading out verbal and audible prompts in a meditation program will be effective in decreasing participant's heart rates and frequencies of fidgeting behaviors.

(b) The fading of prompts in meditation will be effective in getting participants to continue meditating even after the intervention ceases.

(c) The prompt-fading meditation program will help participants successfully meditate on their own across several situations.

(d) The prompt-fading meditation program will create a reduction in participants' stress and anxiety levels.

Method

Participants

Six participants were recruited from undergraduate psychology classes and at an information session held in the library at Salem State University. There were three men and three women who participated in the study, and their ages ranged from 19-61. Three were sophomores, two were juniors, and one was a senior (based on number of credits completed). Potential participants were provided with the author's email address for them to express their interest in participating in the study. Participant's email addresses were gathered on a contact sheet provided while recruiting in the undergraduate psychology classrooms and at the information session. The purpose of the information session was to answer any questions potential participants might have and to have them sign an informed consent form and fill out a baseline questionnaire about stress and anxiety levels. Participants had a choice to join one of two groups. Five joined group one, and one joined group two.

Before participating in the study, each participant was invited to sign the informed consent form which stated that under no circumstances were they obligated to take part in the study and that they could drop out at any time. It assured them that their data

would not have their names on it, but instead, the data would be kept under assigned alphanumerical identification numbers. To ensure confidentiality, the participants wore name tags with their identification number and a corresponding sticker on them during each session so data could be recorded properly, and identities would be kept private.

To ensure maximum participant turnout, a reminder email was sent out before each session to participants with the date, time, and place of each session along with an encouraging message such as "We hope to see you all tomorrow!" The message was used to hopefully evoke positive feelings toward the study and, encourage attendance.

Materials and Instruments

When signing up for the study, participants filled out an intake questionnaire that asked for stress and anxiety level ratings across several different stressor factors (the day one questionnaire can be found in Appendix A). Before and after each session, participants filled out another questionnaire, which can also be found in Appendix A. The pre-session questionnaire simply asks for overall stress and anxiety levels as well as for the individual's heart rate. The post-session questionnaire included the same items, as well as the participants' rating of enjoyment and easiness of the session. Participants were instructed to download a free app on their phones called HeartRateFree from the Apple App Store, or Instant Heart Rate from the Google Play Store for Android phones to record their heart rates before and after each session. To obtain one's heart rate by using the app, the participant would first open it, wait for the prompt that told them to put their index finger over their phone camera, and via the camera and the camera light that turns on automatically, the participant's heart rate would be measured. An accurate reading would only occur if one kept their finger over the camera lens and remained with their

finger there, unmoving. Participants documented their heart rates on the questionnaires given to them before and after each session. If a participant did not have a smartphone, they used my phone to collect this data. After each session, participants were invited to take a snack that was provided (Cheez-it®, peanut butter crackers, chocolate chip cookies, and clementines).

There were four volunteer observers in each session, except on Wednesdays and Fridays during group two's sessions during which there were only two observers. Each observer was trained in recording fidgets with the scoring sheets that can be found in Appendix B. The observers training consisted of all observers watching a video of my brother meditating while simultaneously watching a stopwatch to keep track of 30 second time intervals. While watching the video, observers were asked to use the recording sheets to record if they noticed any fidgeting behaviors that were defined on the first page. After the video was over, all observers discussed their results and it was determined that they had a clear understanding of what counted as a fidget.

The recording sheets were designed for an interval recording procedure, in which the intervals were 30 seconds. Before each session, the observers were given new observation sheets on which participants' identification numbers were written on them. Each participant was provided with an identification name tag that included their alphanumerical identification number as well as a colored sticker that corresponded with stickers that were placed next to the identification numbers on the recording sheets. The reason for having several observers was for the accuracy of recording the fidgeting data. If only one observer was recording data for all participants, while they were plotting data,

they might miss other participant's off-task behaviors. For this reason, each participant had their behavior monitored by two observers for the duration of the meditation.

iMovie was used to create slideshows in which pictures and titles with the corresponding time interval on them were displayed to keep all the observers on track with what interval they were supposed to record for. These slideshows were displayed on my personal laptop to the observers while the participants were meditating. The slideshows were voiced over in some sessions with the guided meditations recorded by the observer. Some of the slideshows were simply the thirty second interval titles – these were the videos used in the music only and silent conditions which will be explained later. These slideshows were only visible to the observers and served no other purpose than to keep everyone on the same interval without confusion. Behind the audio recordings, meditation music was played in the background from a public Spotify playlist, and looped throughout the entire session, if that session was not a silent one. The markers for intervals were added after the first session, in which markers were absent by oversight.

Procedure

Six participants were invited to partake in a four-week meditation program, consisting of twelve, ten-minute sessions. The fourth week was optional for participants to attend. The meditation sessions were held in a classroom building on Salem State University's campus. Sessions were held on Mondays, Wednesdays, and Fridays. The sessions were held at the following times:

Monday: Group 1: 11:30 am – 12:00 pm;

Group 2: 12:30 pm -1:00 pm

Wednesday: Group 1: 12:30 pm – 1:00 pm;

Group 2: 1:30 pm – 2:00 pm

Friday: Group 1: 12:30 pm – 1:00 pm;

Group 2: 1:30 pm – 2:00 pm

The classrooms had desk/chairs in which the participants sat during the sessions. Participants could sit wherever they pleased, however they tended to sit in the same seats each time they came in. The four observers sat in the front of the room facing the participants. The fidgeting score sheets for each participant was created as they entered the room, by writing the participant's identification number on the scoresheets along with a color coordinated sticker that corresponded with a sticker the participant was asked to wear during the session to make them identifiable to the observers. Observers were given the instructions provided on the front page of the recording sheets, which can be found in Appendix B.

On the first day of the program, upon arrival, participants who did not make it to the information session were asked to sign the informed consent sheet and fill out the intake questionnaire. After this, all participants were given the pre-session questionnaire and asked to fill it out. In this session, there were not any markers in the slideshow to show which interval was to be recorded for the fidgeting measure, so it was difficult to determine the accuracy of all observers' measures of fidgeting in this session. After this session, markers were added to slides to ensure proper recording, and to increase inter-observer reliability.

Table 1: Visual depiction of the conditions of each session over the course of four weeks for both Groups 1 and 2.

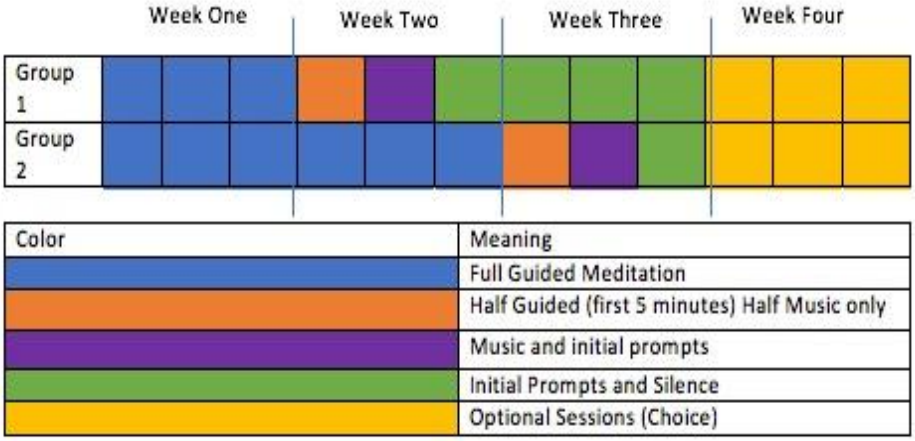


Table 1 shows the conditions participants experienced sequentially across the procedure. Group one underwent the fading procedures before group two, so their session schedule looked very different. The research design of the study was a multiple-baselines-across-participants design, meaning the intervention was introduced at different times to different participants. For group one, during the first three sessions the meditations were fully guided. To clarify, fully guided meditations consisted of constant instruction of exactly what participants were to do with their bodies, minds, and breathing patterns during the ten-to-twelve-minute meditation. In the fourth session, which introduced the fading procedure, guidance was provided for the first half, and music only for the second half. Session five was a music-only meditation. Session six began with music, which was faded out over the first three minutes, and was then a silence-only meditation. Sessions seven through nine were full silence-only meditations, and sessions ten through twelve were optional to attend. If participants attended the optional sessions, they were given the choice of which type of meditation they would experience.

Group two received full guided meditations for the first six sessions. Each of the full guided meditations began with the same instructions for the first five minutes. These instructions consisted of telling participants to get into a comfortable postured position, how to breathe in a way that relaxes their body, and to bring their attention back to their breath if their mind began to wander. Participants were encouraged to sit up straight with their legs crossed and hands on their thighs/knees, with their feet planted flat on the ground. The second half of the full guided meditations consisted of either a body scan or a meta-meditation. The body scan involved bringing one's attention to each part of the body, starting with the feet and ending with the head. The goal is to focus on the area and recognize if there is any tension in that area; if there is, the participant is instructed to release the tension on the next exhale. The body should begin to feel heavy and relaxed in doing this exercise. Meta meditation focuses on positive thoughts towards oneself and others. Session seven was the start of the fading procedures, where the one participant in group two completed the half-guided meditation, half music only session. Session eight was a music only session, and session nine was silent. Sessions ten through twelve, like group one, were optional, and if the participant attended, they would choose which type of meditation they preferred to experience.

After all sessions were completed, a follow-up survey was sent out one week later to gather information about participants' meditation practices after the intervention had terminated. This follow-up survey was emailed to all participants.

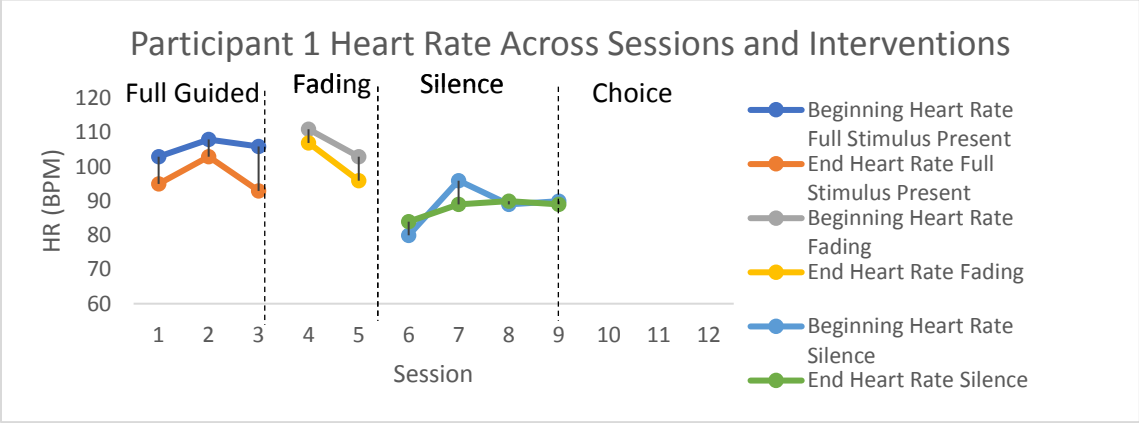
Results

Figure 1 displays the heart rate data of participants 1 and 2. The first graph, pertaining to Participant 1, shows an overall decrease in heart rate from the start of the

program to the final session. This participant had an initial pre-session heart rate of 103 beats per minute (bpm), and ended the program with a pre-session heart rate of 90 bpm. That is a 13 bpm decrease in resting heart rate, which appears to be quite a large change for just a few sessions. The two sessions in which an increase in heart rate was experienced for Participant 1 were in the silent sessions. The increase was only by a few bpm, however, the lowest overall heart rates for 1 were recorded in the silent condition. This participant was the only one who showed up to all mandatory nine sessions, which means their graph is the only one that shows the effect of the full program with the exception of the optional week. The data show the lowest records for heart rate in the silent meditation condition, which is the same condition in which this participant rated each session very highly in enjoyment both verbally to me and on the self-report questionnaire after each session.

Figure 1 also shows the data for Participant 2 which indicate an overall decrease in heart rate from the beginning of the program to the end of the program. She started the program with a resting heart rate of 117 bpm, and ended the program with a resting heart rate of 95 bpm. This was a 22 bpm decrease, which again is a large decrease in the expected direction. Only two increases in heart rate were experienced by Participant 2, and one was the first silent session, similar to Participant 1. The second was in the "optional" week where full guided meditations were reintroduced per request of the two participants who attended.

Figure 1: Pre and Post heart rate in beats per minute for participants 1 and 2 across full guided, fading, silence and choice sessions.



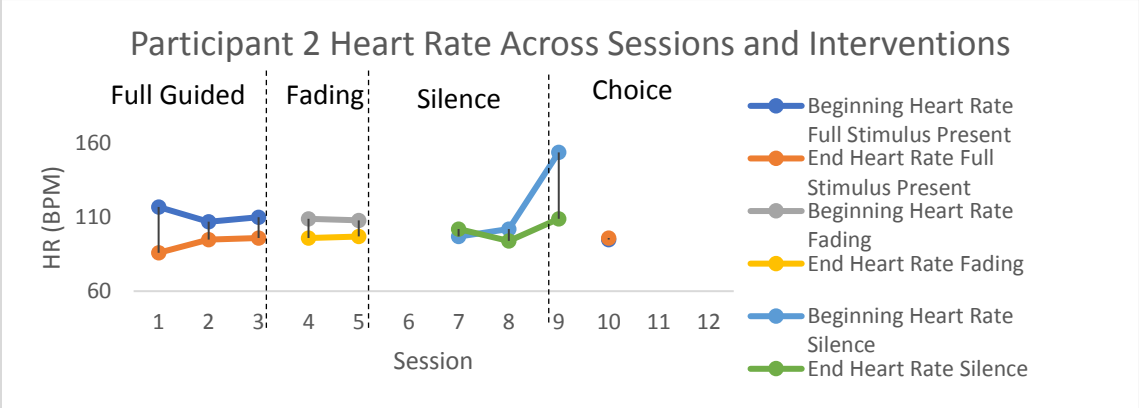
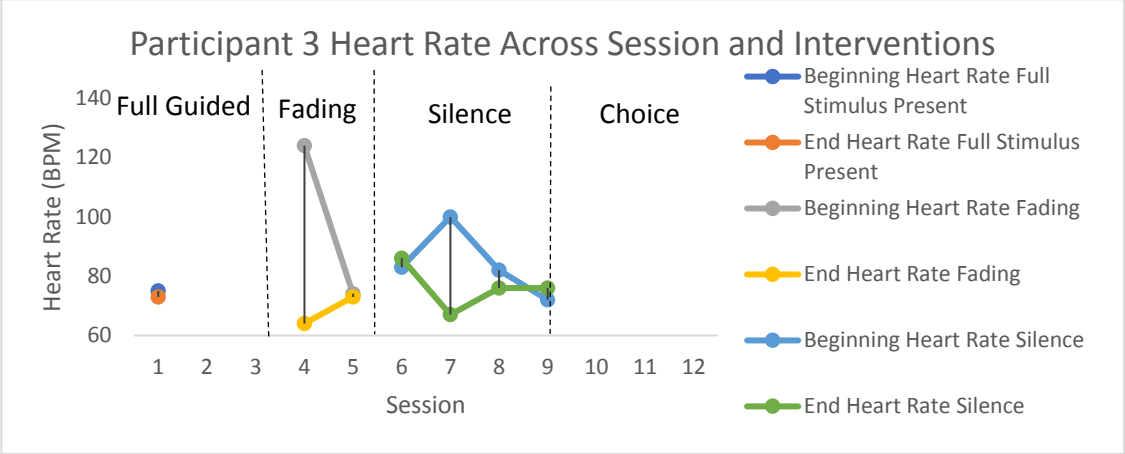


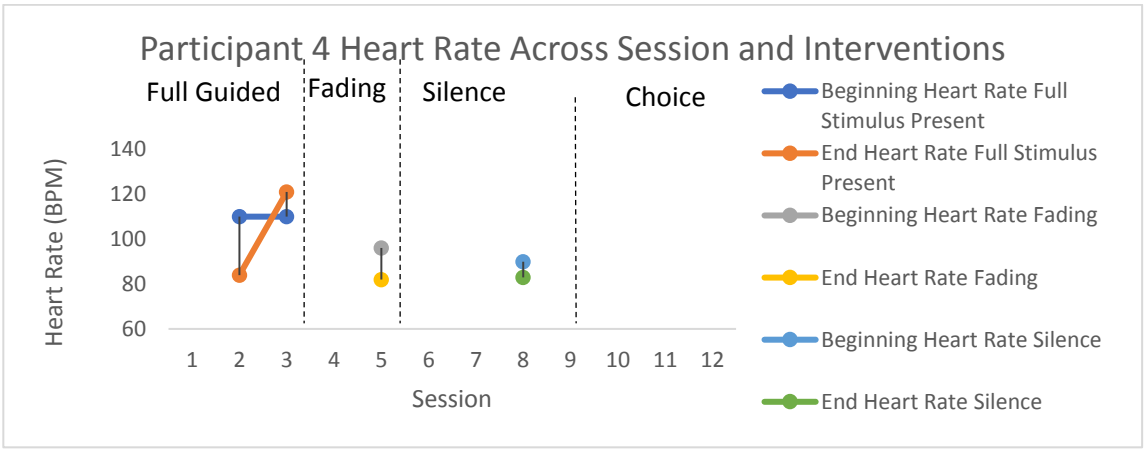
Figure 2 shows heart rate data for both Participant 3 and 4. The top graph indicates an overall decrease in resting heart rate, from 75 bpm to 72 bpm for Participant 3. However, this participant consistently had a resting heart rate above their initial recording in the sessions in between the first and the last meeting. Like the previously discussed participants, Participant 3 experienced two increases in heart rate, both in the silent conditions. In all other sessions, there seemed to be a relatively large decrease in heart rate from pre-session to post-session. This participant told me that she greatly disliked the silent condition, which was supported when observing her behavior while meditating during these sessions. In sessions 7 and 8 (the silent condition), the highest number (11) of fidgets were observed for Participant 3 and she looked uncomfortable

throughout the sessions themselves. Participant three's fidgeting results will be discussed later in more detail.

Participant 4 did not attend the majority of the sessions, but their data indicate a decrease in resting heart rate from the beginning of the program to the final session that they attended. This might be attributed to habituation to the meditation room described earlier. Their initial heart rate recorded was 110 bpm, and they finished with a resting heart rate of 90 bpm. During one of the four sessions Participant 4 attended, there was an increase in heart rate; this can be observed in the final fully guided meditation session.

Figure 2: Pre and Post heart rate in beats per minute for participants 3 and 4 across full guided, fading, silence and choice sessions.

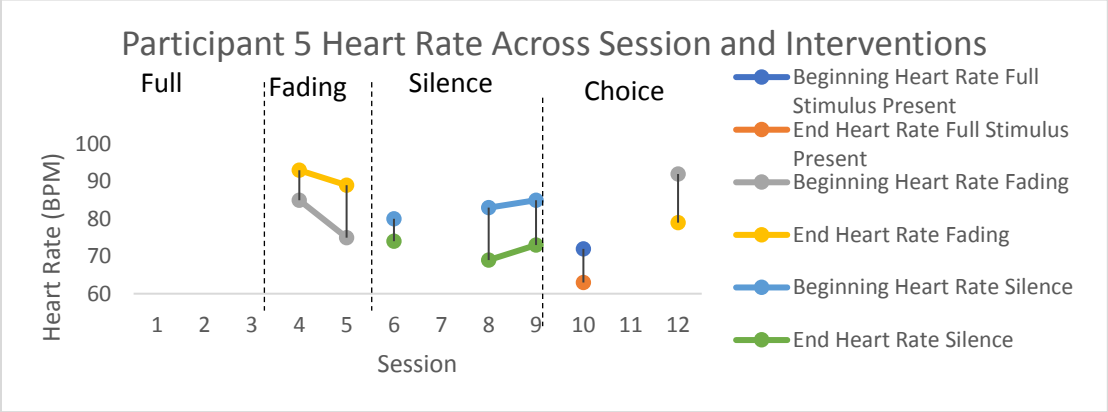


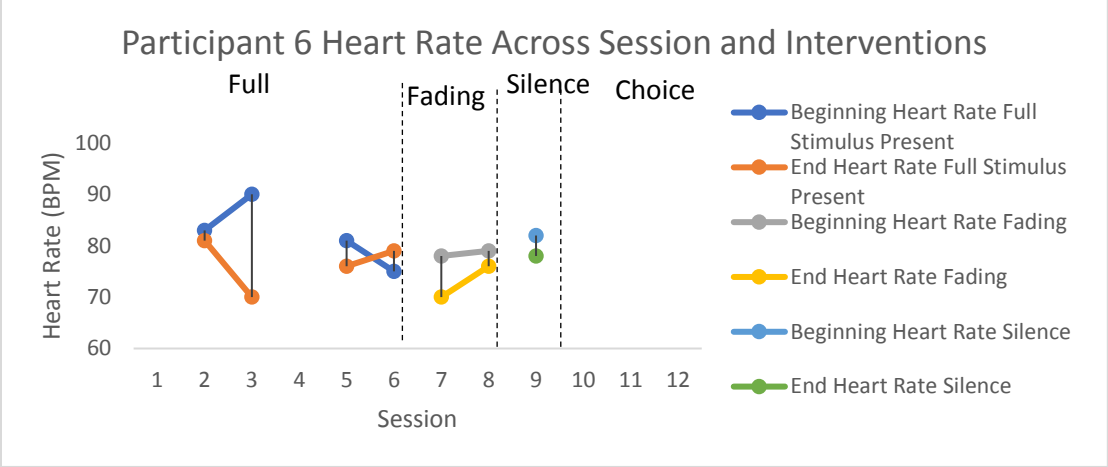


Participants 5 and 6 data (Figure 3), indicates an increase in heart rate from start (85 bpm) to finish (92 bpm), and a decrease in heart rate in the silence and guided meditation conditions. However, in the faded guided meditation session and the music only session, Participant 5 experienced an increase in their heart rate (initial: 75 bpm; post: 89 bpm). Participant 5 said that their favorite session was the music only condition, and chose to retry it as their final session in the optional fourth week. Before this session, Participant 5 showed an overall decrease in initial heart rate; however, due to rushing to get to the session, their heart rate had spiked. In this session, where the condition was music only, participant five's heart rate decreased from 92 bpm to 79 bpm, which showed improvement from the first session they completed in this same condition.

Participant 6 had one increase in heart rate, as seen in figure 3, in the final fully guided meditation condition. This participant received one more fully guided meditation session than those in Group 1 but was supposed to get three more such sessions than Group 1 participants. He did not come to two out of the six full guided meditations, so the comparison between the two groups is not impossible. Overall, Participant 6 decreased his resting heart rate by one beat per minute (83 bpm to 82 bpm).

Figure 3: Pre and Post heart rate in beats per minute for participants 5 and 6 across full guided, fading, silence and choice sessions.



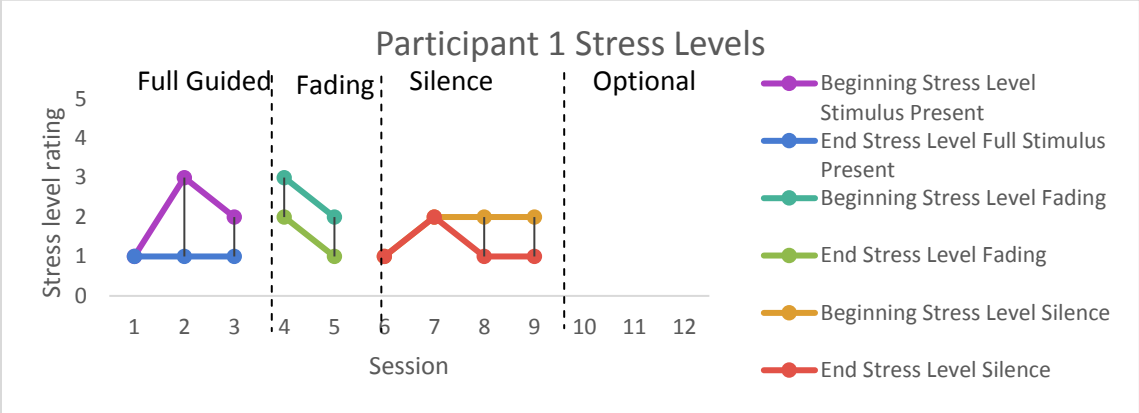


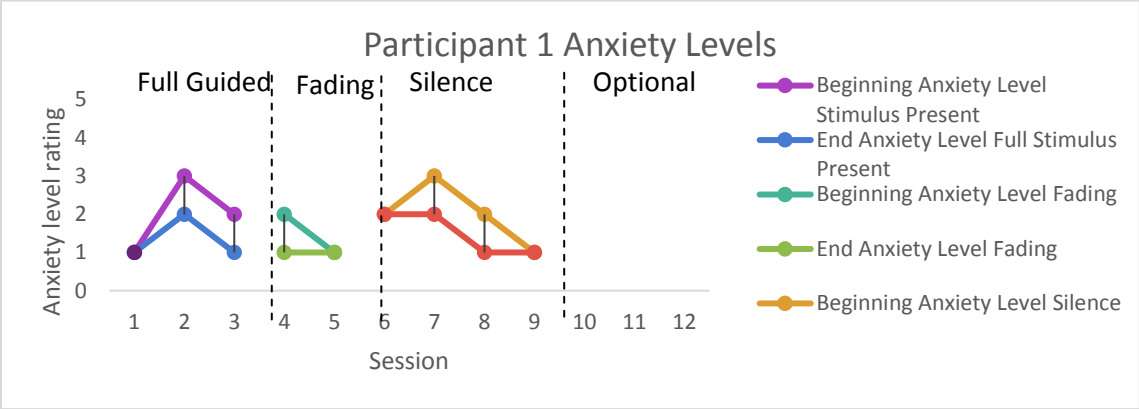
Stress/Anxiety Levels:

Participant 1 started the program with an initial stress level rated as "very low," but their stress level rating increased by the final session to "low." In figure 4, Participant one's stress level varied each day, suggesting that external events might be impacting their reported stress levels differently. However, if the reported stress levels did not stay the same across the session, the ratings then decreased instead. Participant one's reported anxiety levels (figure 4) remained the same (very low) from beginning to end, leaving no

room for improvement. Participant one's reported pre-session anxiety level fluctuated, and either decreased or remained the same from before the session to after the session.

Figure 4: Pre and Post stress levels for Participant 1 across full guided, fading, silence and choice sessions.





Participant 2 reported a decrease in stress levels from the start of the program, as shown in Figure 5. In session one, Participant 2 rated her stress level as "high," but in the final session she attended, she rated her pre-session stress level as "moderate." This seemed to be the most commonly reported rating for Participant 2, with "high" being the only other option reported. Decreases in stress level were only observed in the first and last full guided sessions, as well as in the faded guided session. Participant two's reported anxiety levels (figure 5), varied somewhat with the resting levels taken before the first

and last sessions both were reported as "moderate." In most of the sessions, a decrease in reported anxiety level was observed, or, the levels stayed the same.

Figure 5: Pre and Post stress levels for Participant 2 across full guided, fading, silence and choice sessions.

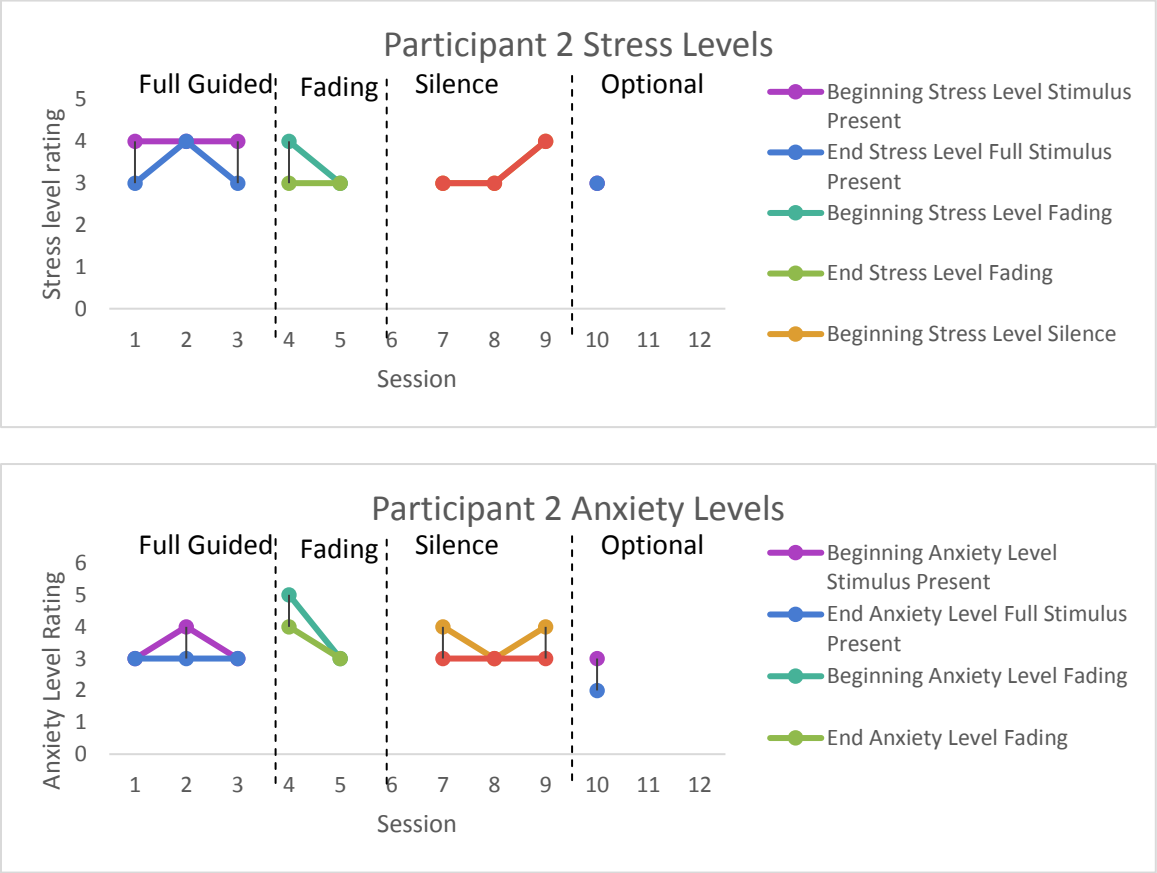
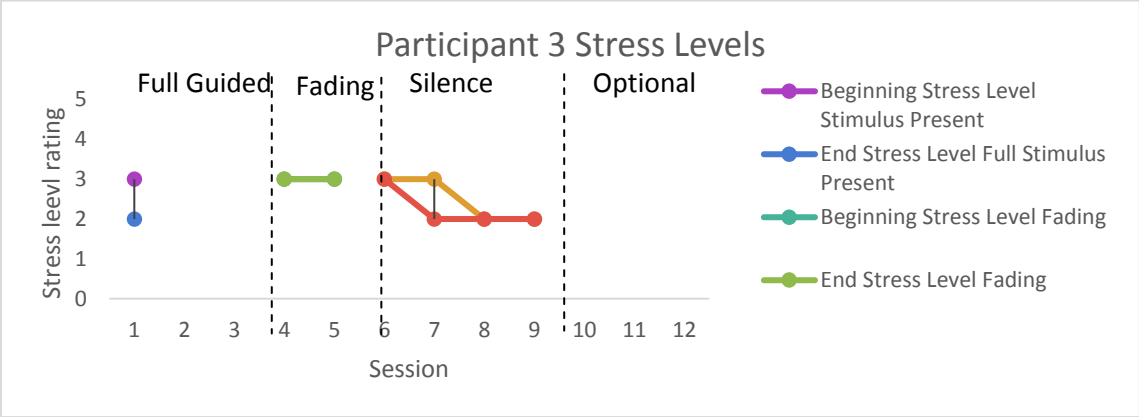


Figure 6 shows that participant three's reported stress levels decrease from session one to the final session she attended. She went from a consistent stress rating of "moderate" to a rating of "low" after completing the program. Only two of the seven sessions show a decrease in stress level, and these are in the full guided and silence conditions. All other sessions show no difference in participant three's reported stress levels. Similar results are shown for Participant 3, whose responses went from "moderate" to "low" after finishing the program. There was one decrease in reported

anxiety levels, in the full guided meditation condition; however, all other sessions had the same anxiety levels recorded both before and after the session had ended.

Figure 6: Pre and Post stress levels for Participant 3 across full guided, fading, silence and choice sessions.



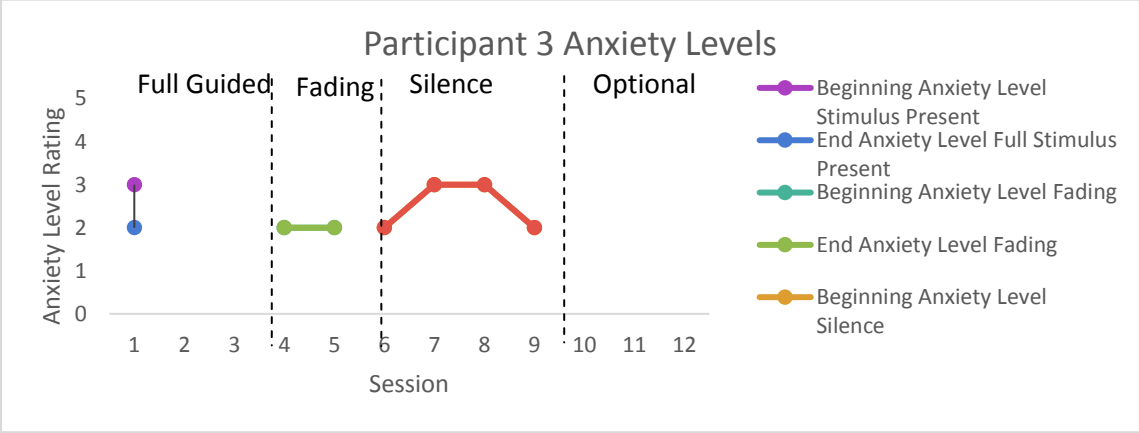
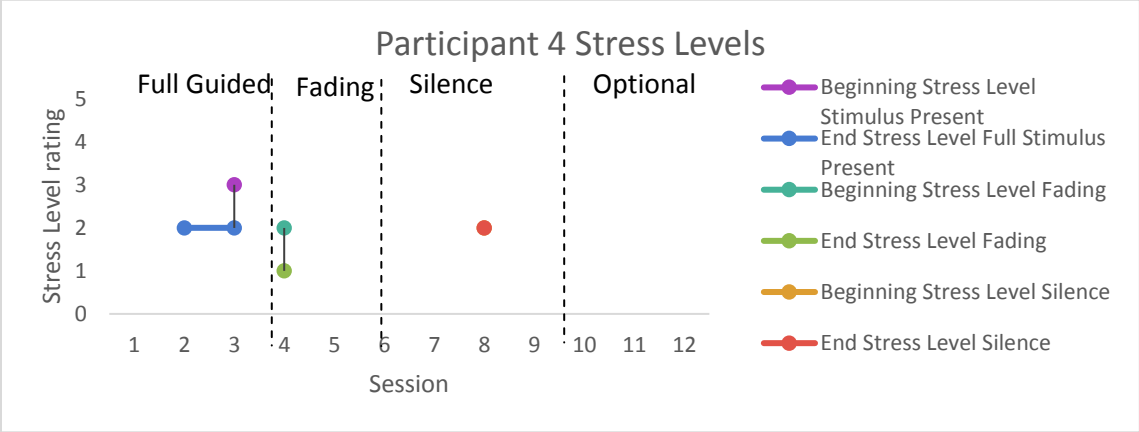


Figure 7 shows that Participant 4 reported low stress levels both before and after 50% of the sessions he attended, meaning that there was no change in reported stress levels in 2 out of the four sessions he attended. One of these no-change sessions was in the full guided condition and the other was in the silent condition. In the other two sessions, he reported decreases in his reported stress levels after completing the sessions. His reported anxiety levels also remained the same “low” rating for 75% of the sessions,

with only one session, the faded guided meditation, showing a decrease in anxiety level after it was completed.

Figure 7: Pre and Post stress levels for Participant 4 across full guided, fading, silence and choice sessions.



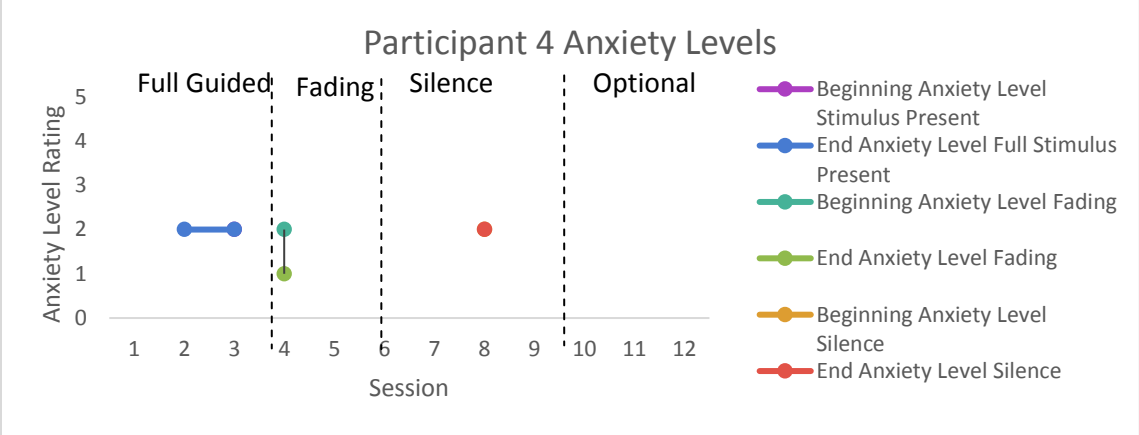


Figure 8 shows Participant 5 recorded the same pre-session stress level from her first session to her last (moderate), with fluctuations in starting stress levels in between. Each session completed resulted in a decrease in stress level, which shows that the sessions resulted in decreases in their reported stress levels momentarily. Also, participant five's reported anxiety levels show similar constant decreases in ratings, but ultimately recorded the same anxiety levels from before and after completing the program.

Figure 8: Pre and Post stress levels for Participant 5 across full guided, fading, silence and choice sessions.

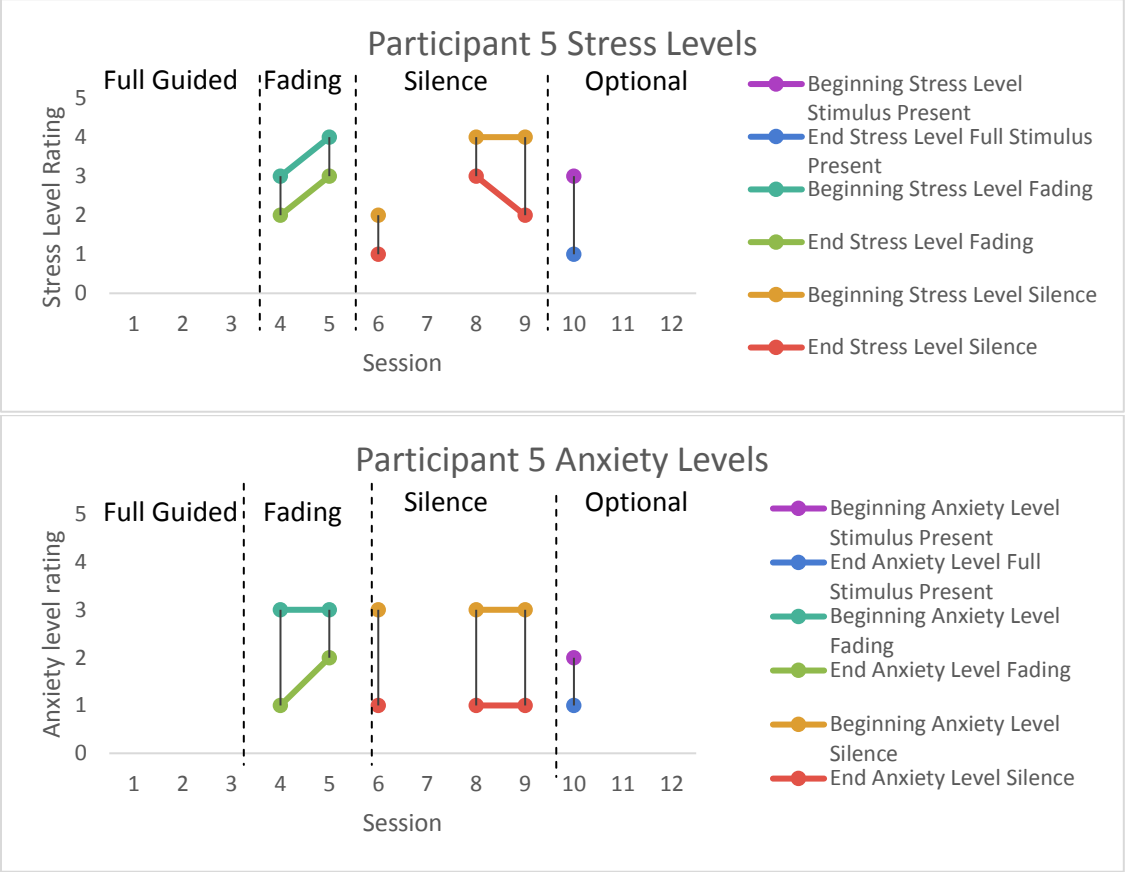
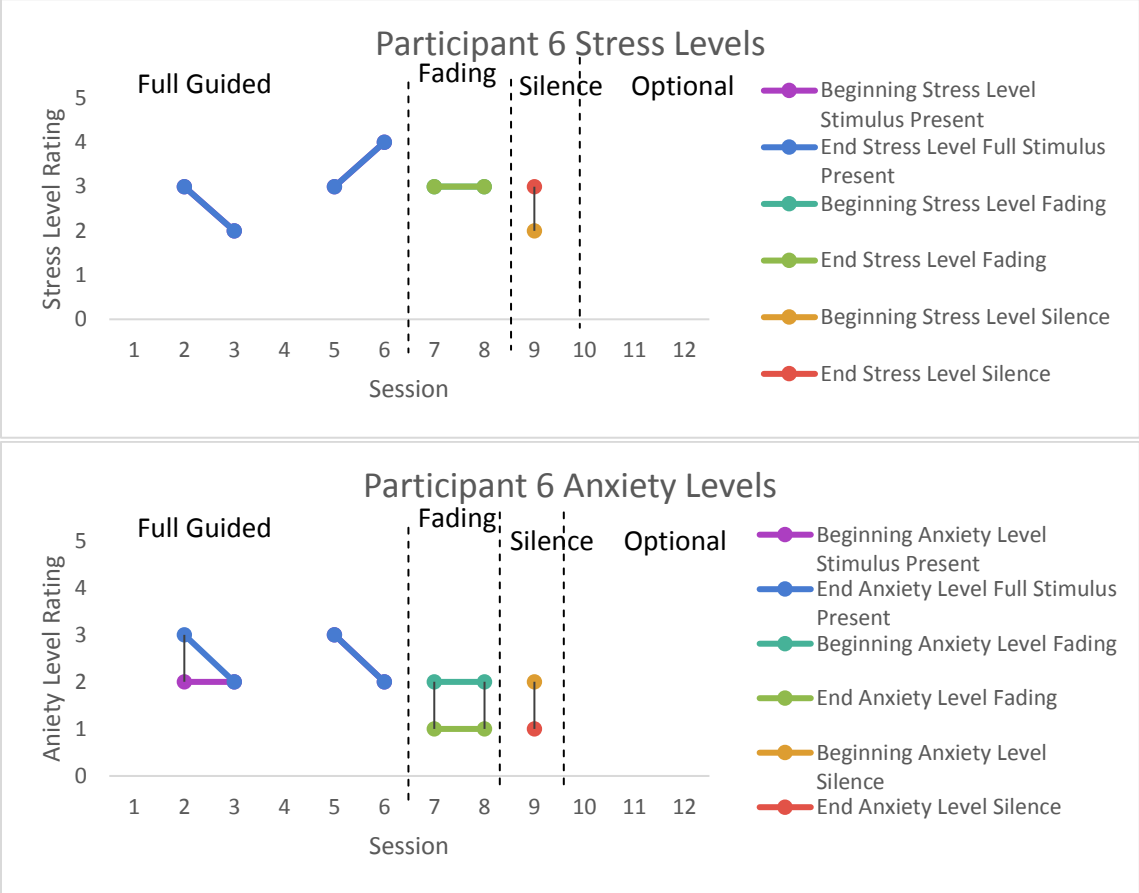


Figure 9 shows that the ratings of stress for Participant 6 remained the same across sessions and across the program, with one decrease in stress levels was recorded, during the silent condition. Participant 6 remained at a moderate stress level from start to finish. Also, the anxiety levels for Participant 6 showed four decreases in anxiety ratings, with the other two sessions remaining the same. Overall, the reported anxiety levels for Participant 6 decreased from the first session he attended to the last session that he attended.

Figure 9: Pre and Post stress levels for Participant 6 across full guided, fading, silence and choice sessions.



Fidgeting:

Figure 10 shows that Participant 1 displayed a varied pattern of fidgeting behaviors throughout the program. In the first full guided meditation session and the final silent session, Participant 1 did not fidget at all. There were four sessions in which Participant 1 did not fidget at all, however in two fully guided, one music only, and two silent sessions, Participant 1 displayed a low frequency of 1-3 fidgeting behaviors. The overall trend in fidgeting behaviors for Participant 1 were too irregular to determine; however, in both the first session and the last session this participant did not fidget.

The second graph in Figure 10 represents the number of fidgeting behaviors recorded, alongside the change in HR from before the session to after the session. In the full stimulus condition (full guided meditation) the change in heart rate decreased from start to finish each session; however, this was not reflected in the number of fidgeting behaviors that were observed. In the same condition the number of fidgeting behaviors increased each session. However, in the fading conditions (partial guided meditation and music only) this participant's heart rate decreased again from start to finish in both sessions. This time the number of fidgeting behaviors decreased from the full guided to partial guided conditions. Once all verbal prompts were faded out, fidgeting behaviors increased slightly. In the silent condition, Participant 1 displayed a few increases in heart rate from before to after the session. In the session in which the highest increase in HR was recorded, the highest number of fidgeting behaviors were also recorded.

Figure 10: Individual fidgeting data as well as change in heart rate compared to fidgeting data for Participant 1

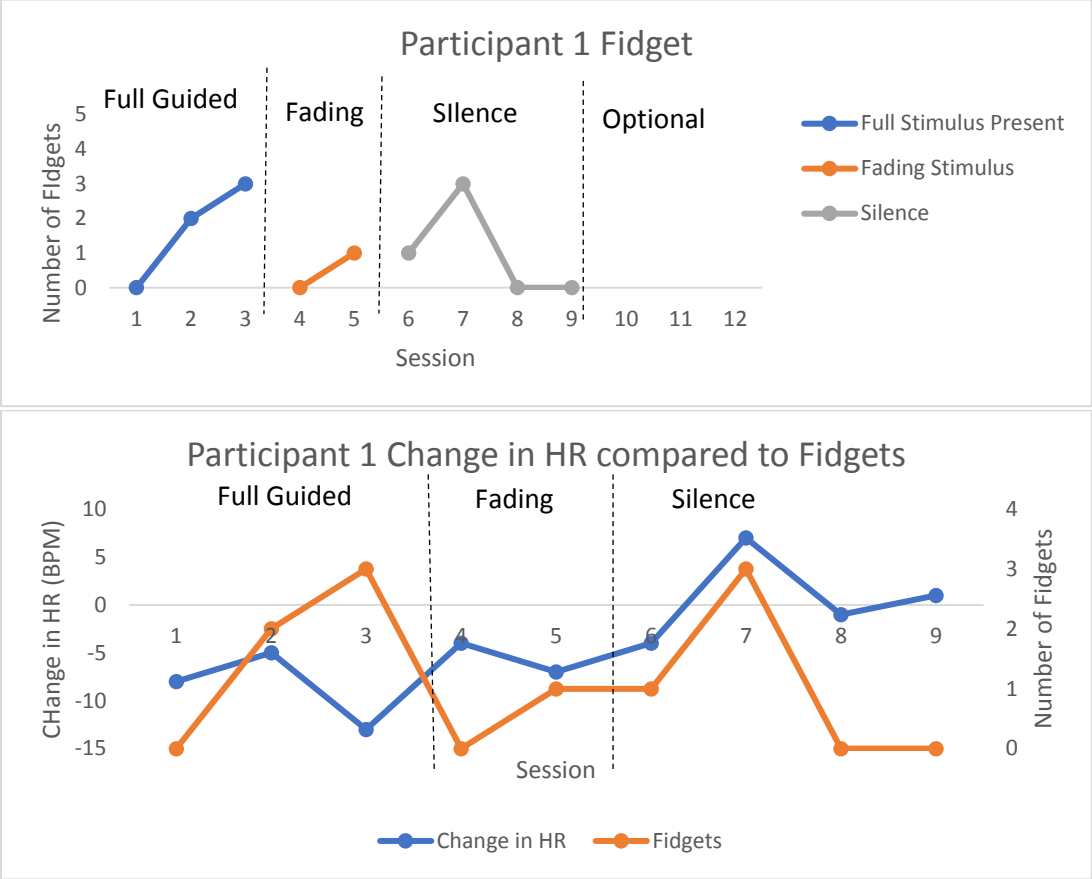


Figure 11 shows that Participant 2 decreased their fidgeting behaviors from the first session to their last. They started the first session with six fidgets, increased to ten fidgets in the second session, and continued to decrease for the most part across the remainder of the sessions. They ended the program with zero fidgets in two silent sessions, and in the final session they attended that was a full guided session. The overall trend in fidgeting behaviors for Participant 2 is a downward (decreasing) trend.

The bottom graph in figure 11 displays the number of fidgeting behaviors compared to the change in heart rate over the course of the session. In the full guided condition, 2 showed a decrease in HR in all of the sessions; however, they displayed their highest rates of fidgeting behaviors in the same condition. After the second session, in

which this high number of fidgeting behaviors occurred, the participant experienced an overall decrease in fidgets. In the fading condition, from start to finish in both sessions, Participant 2 demonstrated a small decrease in heart rate, however number of fidgets increased from the final full guided session to the first fading session, and then decreased in the music only condition. In the silent condition, this participant exhibited their most significant decrease in HR across the entire program, and also displayed the lowest number of fidgeting behaviors. In the choice condition, this participant chose to partake in a guided meditation. Compared to the results from the first few sessions of full guided meditation, there was an increase in heart rate (the only increase for this participant across the program) but the number of fidgeting behaviors decreased from their highest rates from the beginning to their lowest after completing the fading program

Figure 11: Individual fidgeting data as well as change in heart rate compared to fidgeting data for Participant 2

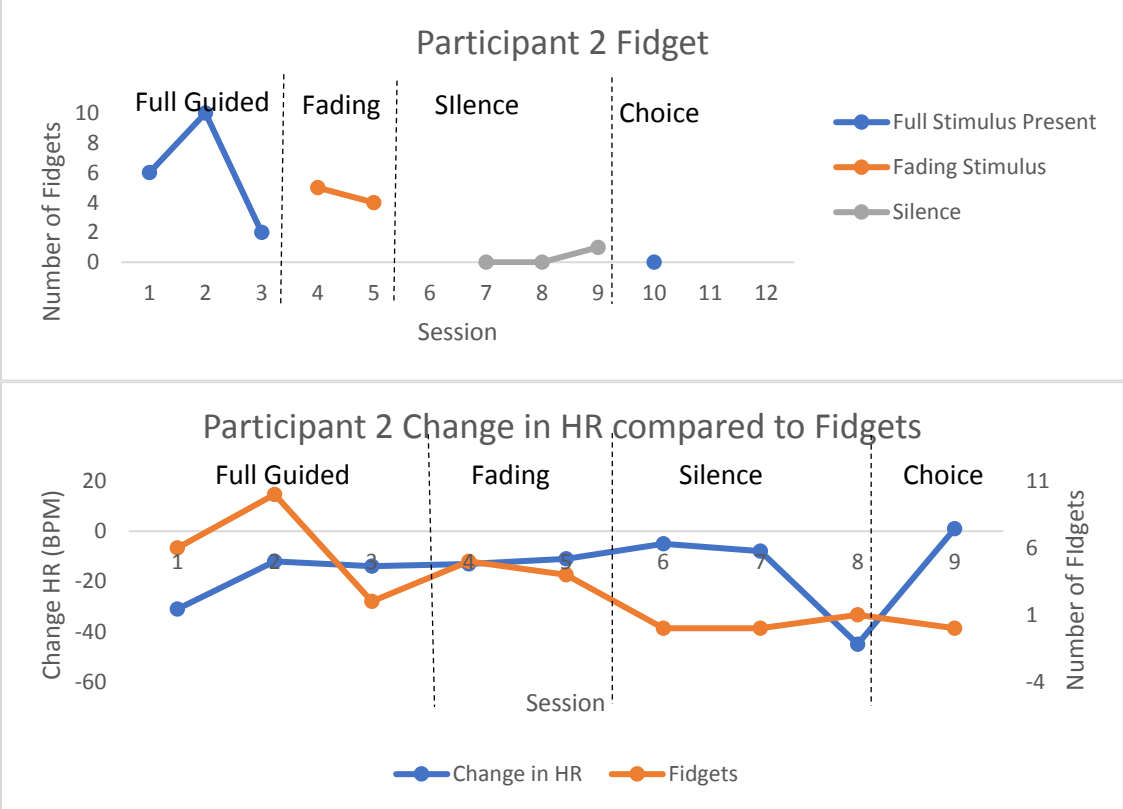


Figure 12 shows Participant 3 increased the number of fidgets the most during the first three silent sessions. The total number of fidgets from session one to the final session Participant 3 participated in decreased from six to five. The number of fidgeting behaviors trended upward for this participant from start to finish of the program, but did decrease in the final session.

Figure 12 shows the relationship between the change in heart rate and the number of fidgeting behaviors across sessions. In the fading condition, Participant 3 decreased their heart rate by about 60 bpm in the first fading session, and also exhibited their lowest rate of fidgeting behaviors during the entire program. This suggests that the combined evidence from the heart rate and fidgeting data suggest that the fading condition evoked the greatest physiological decrease in anxiety. In the silent condition, Participant 3's heart rate increased in 50% of the silent sessions but decreased the other 50%. The decreases in HR were greater than the increases. The number of fidgets were highest in the sessions in which the decreased heart rates were observed.

Figure 12: Individual fidgeting data as well as change in heart rate compared to fidgeting data for Participant 3

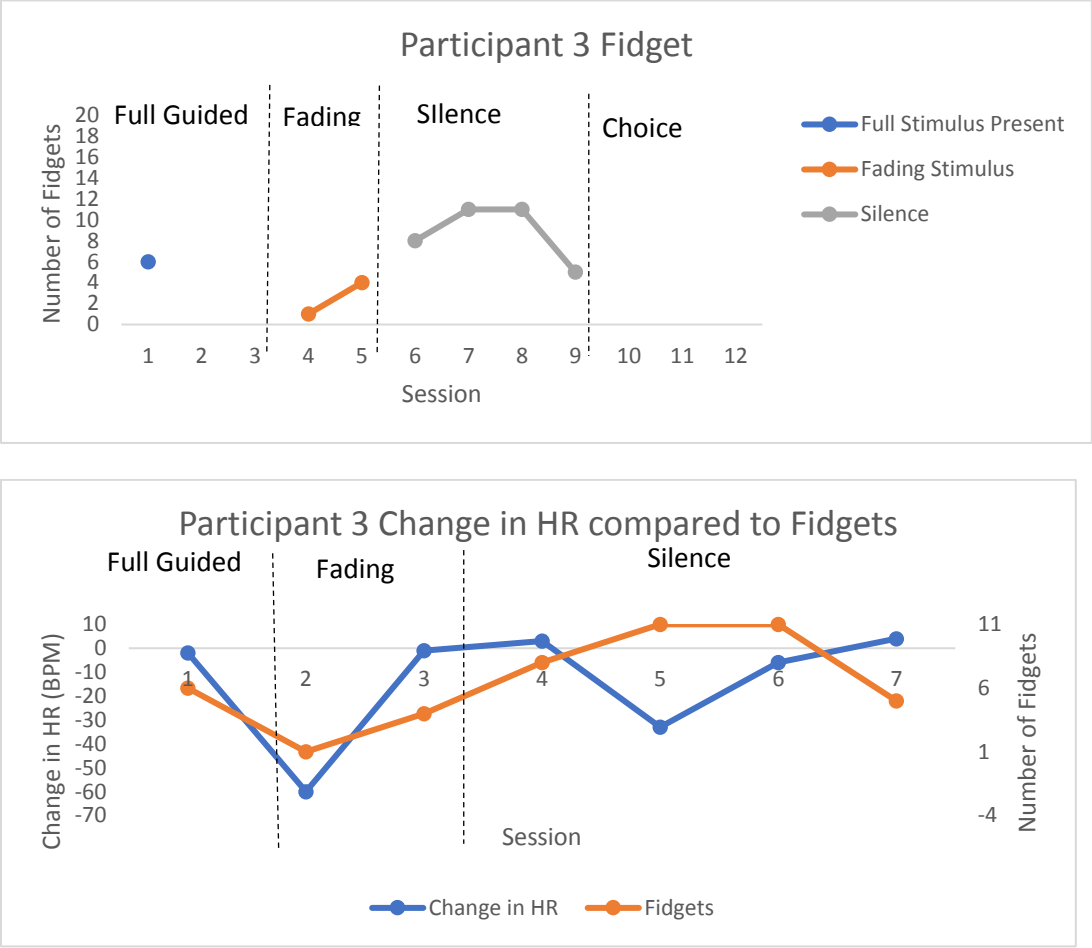


Figure 13 presents fidgeting data for Participant 4, which shows a gradual decrease in fidgets from session one to the last session attended. A total of three fidgets were recorded in the first session, and in the last, there were no fidgets recorded at all. There is a downward trend in fidgeting across the sessions Participant 4 attended.

This participant came to two sessions of the full guided meditation condition, in which a decrease in HR by 25 bpm and the highest number of fidgets, as well as an increase in HR with the second lowest number of fidgets were observed. In the fading condition, Participant 4 attended the music only session, in which their HR decreased but

their number of fidgets increased compared with the session before. In the silent session that this participant attended, their HR decreased and their number of fidgets reached its lowest rate across the program.

Figure 13: Individual fidgeting data as well as change in heart rate compared to fidgeting data for Participant 4

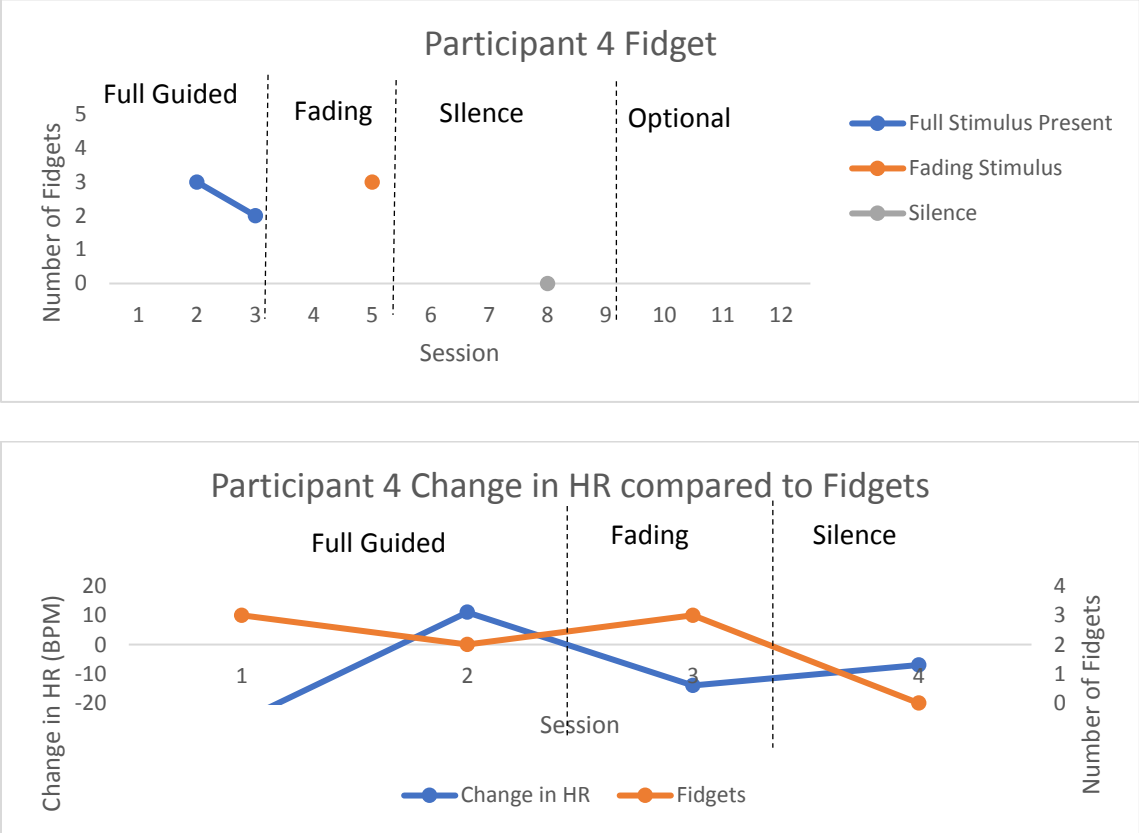


Figure 14 shows Participant 5 had a low, stable number of fidgets during all sessions. There were zero fidgets observed for both the first and final sessions for Participant 5, as well as for two other silent sessions. One fidget was recorded in the music only session as well as the first silent session, showing that the change in condition had little effect on heart rate and movements. Given that this participant did not display any fidgeting behaviors for the majority of the sessions, it can be determined that there was a steady trend in fidgeting behaviors at a rate of zero.

In the second graph in Figure 14, the comparison between change in HR and number of fidgeting behaviors are related as follows. When the change in heart rate increased from the first session to the second, the number of fidgeting behaviors also increased from the previous session. Heart rate decreased from beginning to end in all silent conditions, and the number of fidgets decreased from one in the first silent session to zero fidgets for the remainder of the sessions. During the optional fourth week in which participants chose which condition they would meditate in, Participant 5 chose to partake in a full guided meditation (in which they did not get to experience during the normal progressions of the program) and a session with music only. In both sessions Participant 5 exhibited a decrease in heart rates and zero fidgeting behaviors.

Figure 14: Individual fidgeting data as well as change in heart rate compared to fidgeting data for Participant 5

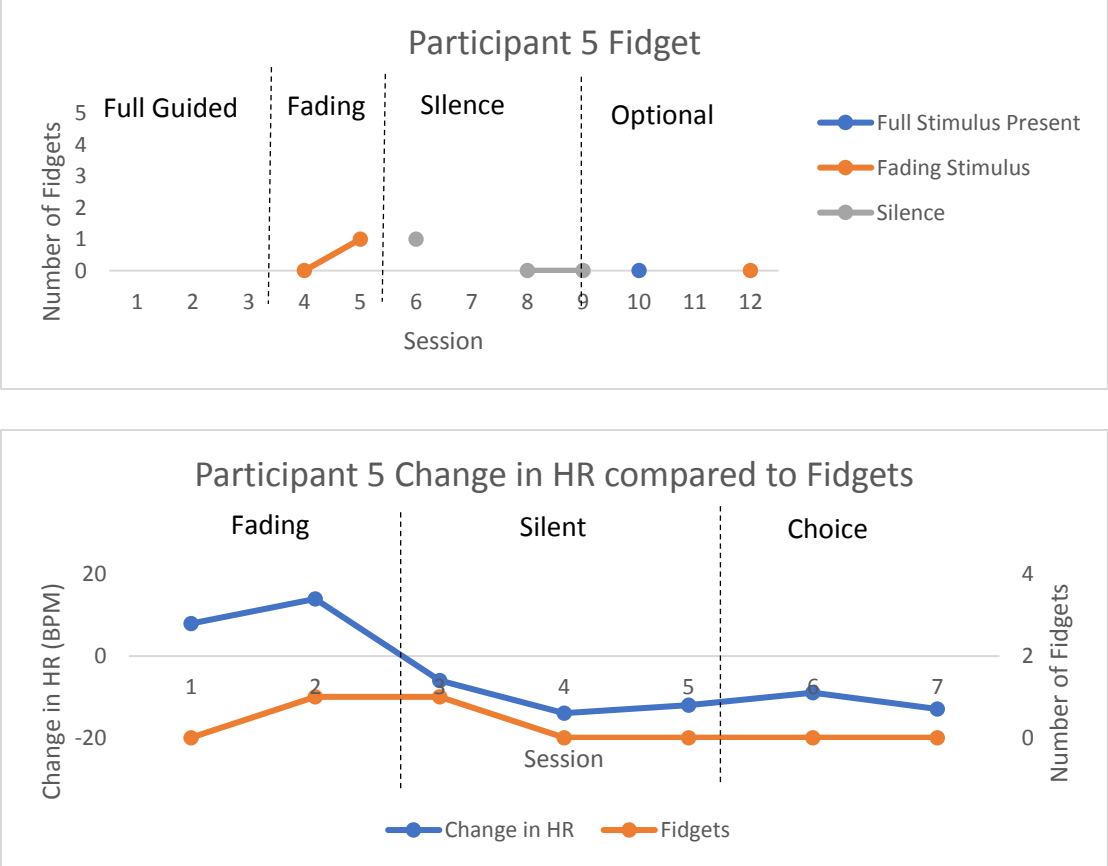
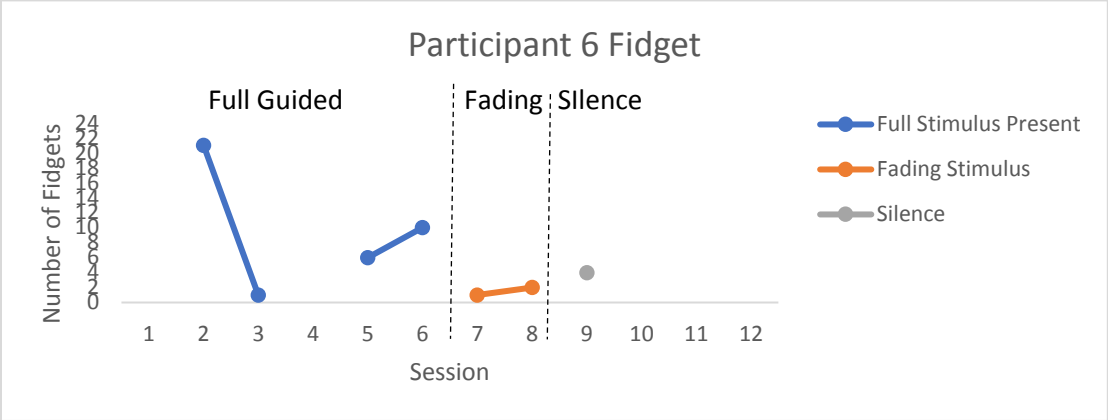
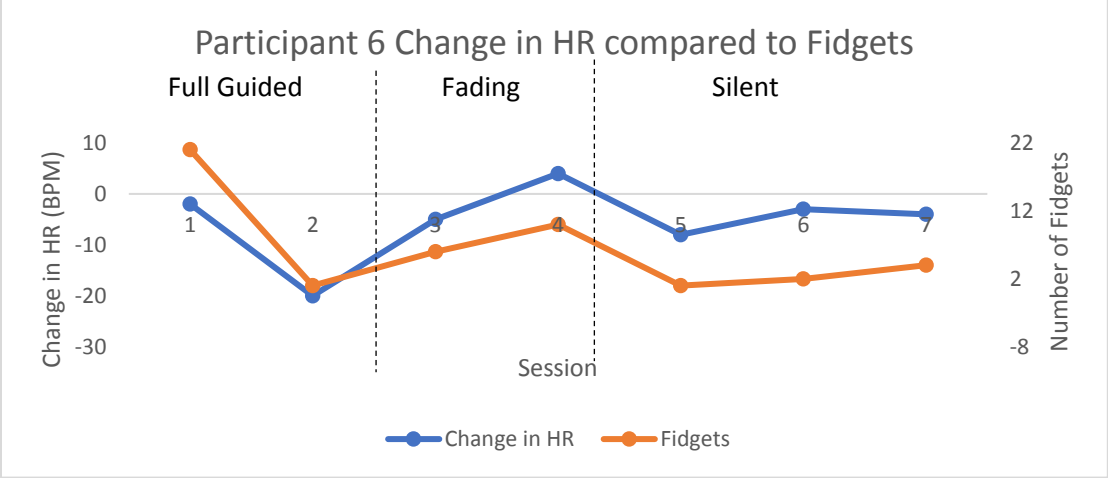


Figure 15 shows a large decrease in the number fidgets for Participant 6. During session 1, they did not close their eyes, which is also associated with the 21 fidgets observed. After noticing the discomfort the participant was experiencing with their eyes open, the instructor directed them to close their eyes in the second session, which resulted in a decrease to one fidget for the entire duration of the session. This was the largest decrease in fidgets across all participants. In subsequent sessions, fidgeting behaviors increased again for the remainder of the full guided meditation sessions, decreased again with the faded guided meditation, and then increased again in the music only and silent session. From beginning to end, the number of fidgets decreased from 22 to 4. The changes in heart rate session to session directly related to the number of fidgets produced each session as displayed in the second graph of figure 15. This was the clearest relationship observed between the two variables for all participants. In other words, as heart rate decreased, the number of fidgets decreased as well (from the previous session), and the same relationship occurred when the change heart rate increased.

Figure 15: Individual fidgeting data as well as change in heart rate compared to fidgeting data for Participant 6





Enjoyment/Easiness

Figures 16 and 17 display enjoyment/easiness graphs for all participants. Participant 1 rated the fading and silent meditations the highest as "highly enjoyable" and rated the first couple guided meditations, the faded meditation, and all silent meditations as the easiest sessions. Participant 2 rated all sessions "very high" for enjoyment except one where they rated one of the full guided meditations as just "high" for enjoyment. All sessions were rated very easy, and this can be seen in figure 16. Participant 3 rated the first guided meditation and the final silent meditation the highest with a "high" rating, while all other sessions were rated as "moderate." The hardest sessions for Participant 3

were rated “moderately hard” and “hard” and were all silent meditation sessions. For Participant 4, the most enjoyable sessions were the first guided meditation and the music only session. There two were also rated “easy” by Participant 4. The lowest rating went to the silent meditation, which was also rated the hardest by Participant 4. Participant 5 rated all but one (faded guided session) “high” for enjoyment, and rated all sessions as “easy.” This can be seen in figure 16. For Participant 6, the hardest session was the one with music only (“moderate” rating), All other sessions were rated “easy” or “very easy.” The highest rating for enjoyment went to the first full guided meditation (very high) and the remaining sessions were most commonly rated “moderate.”

Figure 16: Enjoyment/easiness graphs for participants 1, 2, and 3

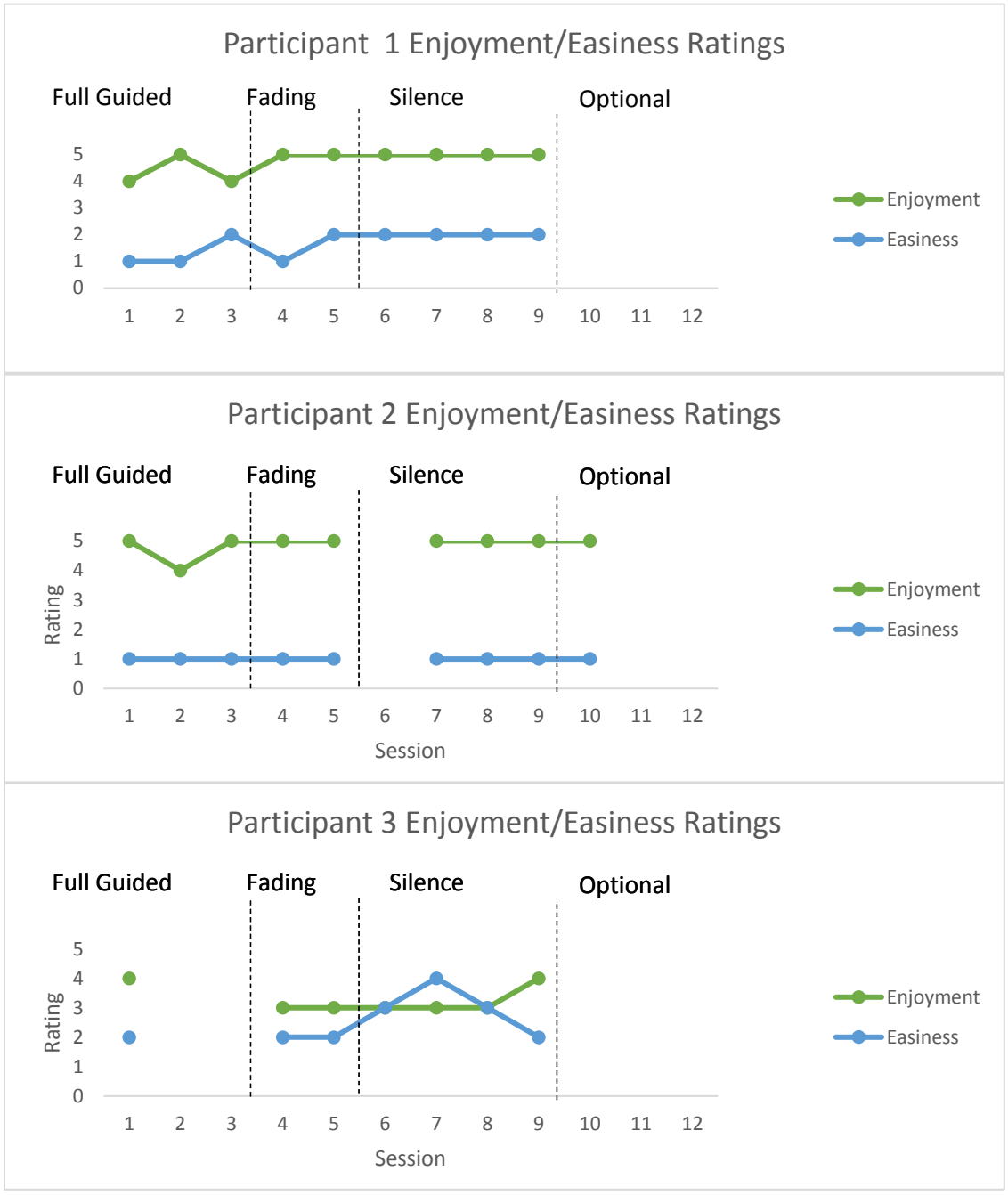
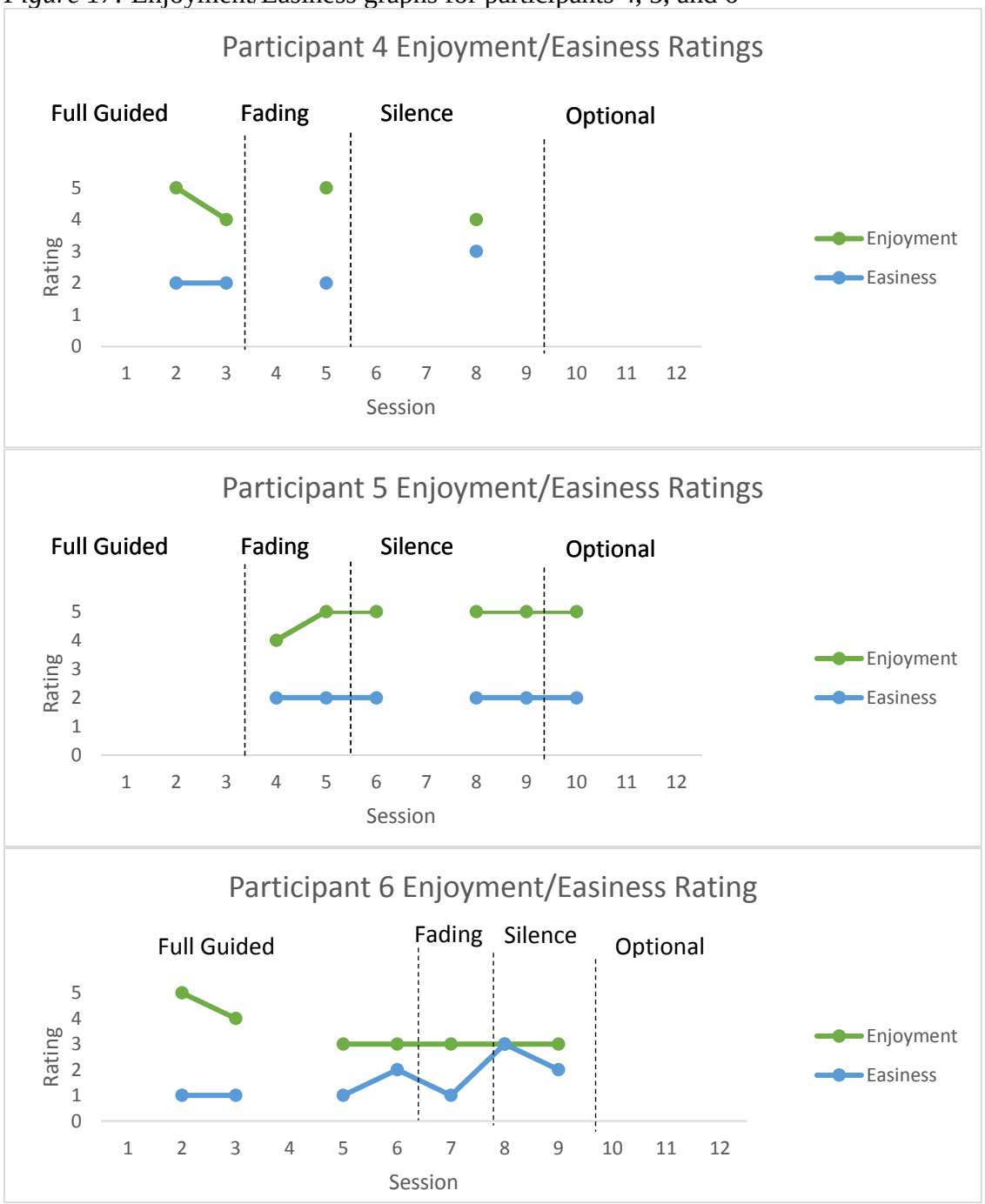


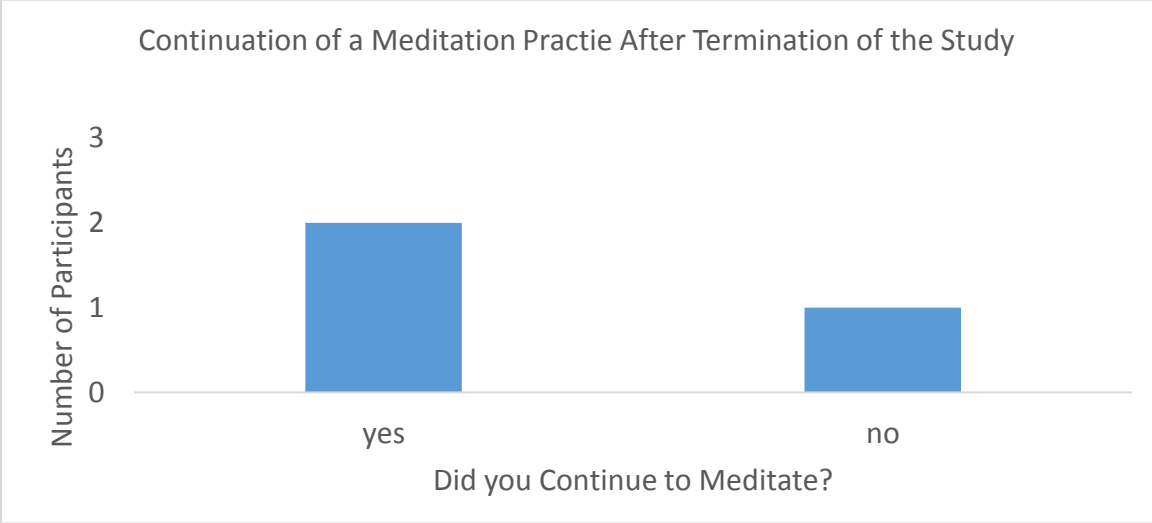
Figure 17: Enjoyment/Easiness graphs for participants 4, 5, and 6

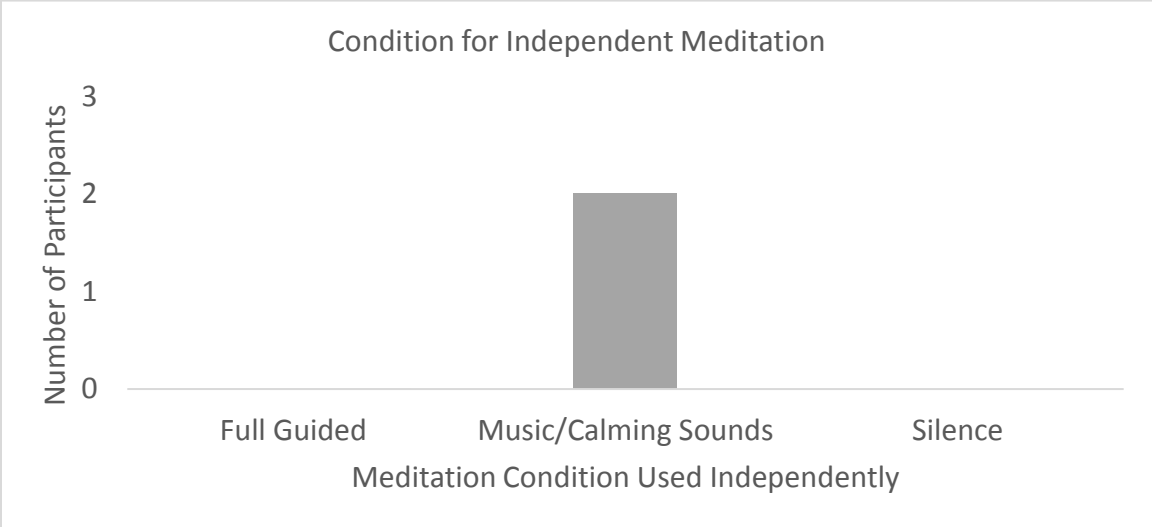


Follow up

Follow up data for continuation of a meditation practice is displayed in Figure 18. Of the six participants, only half responded to the follow up questionnaire that was emailed to them. The survey was distributed via email to all participants with a link to survey monkey to complete it. Out of the three respondents, two reported still meditating on their own, and one reported having stopped. For both participants who responded "yes" to continuation of the program on their own, they have chosen to meditate in the music only condition, 1-2 times per week. Respondents to the follow-up questionnaire reported feeling that their stress and anxiety levels both decreased from this program. This seemed to mirror the self-report measures of stress and anxiety. On the intake questionnaire given at the very beginning of the program, Participant 2 reported a "high" level of stress, and in the follow-up questionnaire she reported having a "moderate" level of stress signaling a decrease. The self-reported anxiety levels for Participant 2, in the intake and follow-up questionnaire indicated that they reported having "moderate" anxiety levels, signaling no change. For Participant 5, at intake, they reported their stress and anxiety levels to be "moderate." Anxiety levels appeared to decrease from "moderate" to "low," however, stress levels remained the same. For Participant 6, "low" stress and anxiety levels were reported in the intake questionnaire. In the follow-up questionnaire, both stress and anxiety remained at a "low" level.

Figure 18: Follow-up data pertaining to the continuation of the program after its termination. Graph one represents the number of participants who did or did not continue to meditate after the study had ceased, and the second graph displays the condition in which participants continued to meditate in





An inter-observer reliability (IOR) measure was calculated by counting how many agreements of either occurrences or non-occurrences of behavior between both observers and dividing that number by the total number of agreements plus disagreements between the observers. That dividend is then multiplied by 100 to get a percentage (Total # of

Agreements/ Agreements + Disagreements) x 100). Accurate recording is achieved if the IOR is above 80%.

Table 2: IOR scores for number of agreed upon occurrences for each session and the total IOR for occurrences calculated across all sessions.

	Session												Total
	1	2	3	4	5	6	7	8	9	10	11	12	63.6%
IOR (%)	54.5	31.3	66.7	60	42.3	70	36.4	81.3	57.1	100	--	100	

Table 2 displays the IOR for occurrences in each session and in total (across the program). All sessions besides sessions 8, 10, and 12 have an IOR under 80%, meaning that the observers were relatively inaccurate in recording the number of fidgets for each participant. However, this table seems to underrepresent the data. Therefore, an IOR was also calculated for agreements on non-occurrences. Non-occurrences means intervals in which a fidget was not observed by any of the observers for a given participant. This data is displayed in Table 3, in which all sessions besides sessions 1, 2, and 5 are about 80%.

Table 3: IOR scores for number of agreed upon non-occurrences for each session and the total IOR for non-occurrences calculated across all sessions.

	Session												Total
	1	2	3	4	5	6	7	8	9	10	11	12	83.8%
IOR (%)	52.8	71.9	90.6	83.1	76.2	85	83.33	94	90.4	100		100	

Discussion

Almost all participants experienced an overall decrease in heart rate from their initial resting heart rate recording from the first session, to their final recording of their resting heart rate. All participants also displayed a decrease in heart rate after most sessions, however some participants experienced one to two increases in heart rate, which was usually seen in the silent condition. This suggests that the meditation sessions had the predicted effect on participants.

Most participants experienced no change in their self-reported stress level, but as for self-reported anxiety level, participants were split evenly in either showing no change or decreasing. The variability from pre-session score to pre-session score across all sessions leaves room for doubt about the effectiveness of the intervention itself. There are a number of possible confounding variables that could have contributed to this result including the fact that this program was introduced after midterms and ended during the final weeks of the semester. Some extraneous variables that might have affected participants' performance could include menstrual cycle for women (Brar, 2015), familial problems, coursework, exams and papers, friend troubles, relationship issues, work, sickness, amongst many others. None of these variables were considered in the present study, but could be collected in future studies.

Most participants displayed a decrease in fidgeting behaviors from the start of the program to the end of the program while the others remained the same. None showed an increase in fidgets from the first session to the final session. As for enjoyment ratings, the full guided meditations most frequently got the highest scores, followed by the silent

sessions. For easiness, the full guided meditations were rated the easiest by most participants.

The majority of participants (who gave follow-up responses) persisted with their meditation practice after the study was terminated. These participants reported meditating in the "music/calming sounds" condition one to two times during the first week after the program ended. This condition was one of the "fading" conditions in the program, which implies the fading procedures themselves were effective in getting participants to continue their practice, and should be used to help transfer self-control to the person themselves. Doing so is a common strategy to promote behavior change maintenance (Martin & Pear, 2014).

After interpreting the results gathered across sessions, it can be concluded that fading procedures used to reduce verbal and audible prompts in a meditation program were also effective in decreasing participants' heart rates and frequencies of fidgeting behaviors. It is evident that a high heart rate is correlated with elevated levels of stress and anxiety, and low heart rates are correlated with relaxation (Schneiderman et al., 2005). For this reason, heart rate was measured to represent an evaluation of relaxation. Heart rate is a measure that provides information describing in physiological terms whether the intervention does create effects that are correlated with relaxation. It was observed that heart rate decreased over the course of the intervention, both from the beginning of each session to the end, and from the beginning of the program to the end.

Self-reported stress levels seemed to remain the same, which indicates that the intervention does not decrease reported stress levels after completion. In the intake questionnaire, we measured self-reported stress levels associated with certain stressors;

however, the same questions were not asked of the participants in the follow-up questionnaire. This is something that future studies should consider doing to ensure consistency throughout the program, and to obtain more accurate data on self-reported stress levels and what is potentially affecting them. Stress levels decreased from before the session to after the session 46.5% of the time, and remained the same 51.1% of the time with one reported increase. Anxiety levels, however, decreased (53.5%) from before the session to after the session, which suggests that anxiety levels decreased due to the intervention. While seemingly at odds, these findings might suggest that meditation can be used to reduce anxiety levels even if stress levels remain the same.

Verbal prompts in the form of guided meditation were faded out over time. In other words, the verbal prompts were decreased, and the amount of time spent meditating with just music increased. Then the music, which is an extra-stimulus prompt, was faded until there were no sounds/prompts at all. The purpose of doing this was to decrease the individual's dependency on prompts to meditate and to be able to generalize meditating behaviors in any situation in which prompts are unavailable. Meditating successfully was operationally defined by a consistent decrease in heart rate from before the intervention to after completion of the meditation program, (both after each session and cumulatively) as well as a decline from high to moderate rates of fidgeting to a low-frequency rate of fidgeting behaviors, which were both observed.

Fidgeting was a variable that helped estimate a reduction in anxiety levels caused by an initial introduction to meditation. This might have been due to a lack of positive social reinforcement while among others as in meditation. Participants might not have been used to not being reinforced in a social situation. By being reinforced in a social

situation, what meant is that participants were probably used to their behaviors leading to some type of overt reaction from another person, or generally using their phones to keep themselves from getting bored in class. These behaviors normally result in receiving a consequence that will increase the likelihood of those behaviors occurring again. Therefore, with participants being placed in a setting in which no social reinforcement would result from their behaviors, we expected to observe an extinction burst of fidgeting in the first few sessions for many participants where their fidgeting behaviors would characteristically begin at high rates, and eventually decreased over time. The reasoning for this is that it is possible that when surrounded by other people, those who are not acquainted with a meditative practice might feel uncomfortable because they are not receiving any social feedback from the others in the room (Crone-Todd, D.E., Personal Communication, 12/15/16). If this was the case, participants were expected to be caught looking around the room to see what everyone else is doing to gain some social reinforcement for what they were doing themselves. However, with the noted decrease in fidgeting, we were able to determine that the program was successful in producing effects that are correlated with relaxation in regards to fidgeting.

In recruiting participants, we encountered several issues that led to a small number of recruits and an even smaller number of participants who attended the sessions. After collecting emails, names, etc. the first time around, one week into the study an attempt was made to recruit more people to join the study but to no avail. The common issue when trying to get students to sign up for the study involved scheduling conflicts with the session times that were offered. Many students expressed great interest in the study; however, due to conflicting classes or work, many were unable to commit to the

study. In the future, it would be beneficial to offer several session times across morning, afternoon, and evening hours to allow a larger variety of people to have the freedom to participate in a time that works best for them. However, this is easier said than done, because the researcher would have to then clear all days and all times of their own schedules to allow for this, which is unrealistic. Also, it might be beneficial to increase the number of total sessions, the number of days per week the sessions are held, and the duration of the sessions. Research has shown that practicing meditation for twenty minutes per day reduces stress levels (Murphy & Donovan, 1997). A decrease in self-reported stress levels is something that was not observed in the present study, however we did not use the same stress scales to obtain these results.

There is a possibility that heart rate, anxiety levels, stress levels, and fidgeting data were the result of habituation to the room or to the room becoming a conditioned stimulus for relaxation (e.g., decrease in heart rate/anxiety levels). Pierce and Epling (1998) define habituation as occurring if an unconditioned stimulus is habitually presented, and repeatedly elicits an unconditioned response. Eventually, the individual will become habituated to the stimulus being presented so that the initial response (e.g., the initially higher heart rate) is gradually diminished the longer that the stimulus is present. The participants will be returning to the same room (initially the neutral stimulus) with the same people, with relatively the same meditation-related stimuli (e.g., the unconditioned stimuli) being present, so after a while, it is possible that their initial anxiousness of being in a new setting around potentially unfamiliar people decreased due to the total amount of time spent in the room (habituation). The participants potentially habituated to the setting of the meditation room itself or the room could have become a

conditioned stimulus for relaxation/decrease in heart rate. An example of habituation in the program is as follows: during the fifth session for group one, about three minute into the meditation (music only condition) there was a loud beeping noise coming from outside; however, after the session, all participants reported not hearing the beeping at all. This would be an example of habituation, because habituation itself is similar to "getting used to" certain stimuli (noises). Participants might have habituated to the sounds of the music playing during the session, and stopped attending to the noises both in and out of the room, resulting in the beeping not affecting their practice.

After coming to only two sessions of the program, one participant contacted the author with very encouraging words. After having back surgery, a year ago, he reported that he was living in constant pain. He told me that before beginning the session that day, his pain ranking was at a self-reported "7," and after participating in the meditation session, his pain level decreased to a "5" and had remained there for hours. This statement added evidence for the many benefits of meditation and the clinical effectivenesss of the program (Bear, Wolf, & Risley, 1968). The alleviation of chronic pain is a benefit of meditation (Goyal et al., 2014); however, it was not a factor that had been measured in the study. Therefore, in the future, adding chronic pain measures would be a beneficial addition to this study.

The present study drew a lot from Goyal et al., (2014) in creating a procedure that could include learning techniques as well as meditation itself. The researchers conclude, "Thus, more training with an expert and practice in daily life should lead to greater competency in the skill or practice, and greater competency or practice would presumably lead to better outcomes" (p.365). In future studies, it would be beneficial to

keep the point that this quote has in mind, and include more training than the present study had been limited to.

References:

American College Health Association. (2015). American College Health Association – National College Health Assessment II: Reference group executive summary spring 2015. *American College Health Association*. http://www.acha-ncha.org/docs/NCHA-II_WEB_SPRING_2015_REFERENCE_GROUP_EXECUTIVE_SUMMARY.pdf

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1*(1), 91–97.

Baghurst, T. and Kelley, B.C. (2014). An examination of stress in college students over the course of a semester. *Health Promotion Practice.* 15(3).

Barker, M.J., Greenwood, K.M., Jackson, M. and Crowe, S.F. (2004) Cognitive effects of long-term Benzodiazepine use, *CNS Drugs*, *18*(1), pp. 37–48

Barnes, V., Treiber, F., & Davis, H. (2001). Impact of Transcendental Meditation® on cardiovascular function at rest and during acute stress in adolescents with high normal blood pressure. *Journal Of Psychosomatic Research*, *51*(4), 597-605. http://dx.doi.org/10.1016/s0022-3999(01)00261-6

Bass, R. (2010). Zen and behavior analysis. *Behavior Analysis*, *33*(1), 83–96.

Brar, T. (2015). Effect of Different Phases of Menstrual Cycle on Heart Rate Variability (HRV). *Journal of Clinical* and *Diagnostic Research*. http://dx.doi.org/10.7860/jcdr/2015/13795.6592

Bruning, N. S., & Frew, D. R. (1987). Effects of exercise, relaxation, and management skills training on physiological stress indicators: A field experiment. *Journal of Applied Psychology*, *72*, 515-521.

Cardoso, R., de Souza, E., & Leite, J. R. (2004). Meditation in health: an operational definition. *Brain Research Protocols*, *14*, 58–60.

Chang, E.C. (2006). Perfectionism and dimensions of psychological well-being in a college student sample: A test of a stress – A mediation model, *Journal of Social and Clinical Psychology*, *25*(9), pp. 1001–1022.

Dill, P. L., & Henley, T. B. (1998). Stressors of college: A comparison of traditional and nontraditional students. *The Journal of Psychology*, *132*(1), 25–32.

Doran, J., & Holland, J. G. (1979). Control by stimulus features during fading. *Journal of the Experimental Analysis of Behavior*, *31*(2), 177–187

Ghaemi, N.S., Hsu, D.J., Soldani, F. and Goodwin, F.K. (2003). Antidepressants in

bipolar disorder: The case for caution. *Bipolar Disorders, 5*(6), pp. 421–433.

Goyal, M., Singh, S., Sibinga, E., Gould, N., Rowland-Seymour, A., Sharma, R., Cramer, H. (2014). Meditation programs for psychological stress and well-being: A systematic review and Meta-analysis. *Deutsche Zeitschrift für Akupunktur*, *57*(3), 26–27.

Hommel, B., Ozturk, A., & Colzato, L. (2012). Meditate to create: The impact of focused-attention and open-monitoring training on Convergent and divergent thinking. *Frontiers In Psychology*, *3*. http://dx.doi.org/10.3389/fpsyg.2012.00116

Horan, R. (2009). The neuropsychological connection between creativity and meditation. *Creat Res. J.* 21, 199–222.

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness* (15th ed.). New York, NY: Delacorte Press.

Kadison, R. D., & DiGeronimo, T. F. (2004). *College of the overwhelmed: The crisis in campus mental health and what we must do about it*. San Francisco: Jossey-Bass.

Krisanaprakornkit, T., Sriraj, W., Piyavhatkul, N., & Laopaiboon, M. (2006). Meditation therapy for anxiety disorders (review). The Cochrane Collaboration:Wiley Publishers.

Lazar, S. W., Bush, G., Gollub, R. L., Fricchione, G. L., Khalsa, G., & Benson, H. (2000). Functional brain mapping of the relaxation response and meditation. *NeuroReport, 11*(7), 1581–1585.

MacDuff, G.S., Krantz, P.J., & McClannahan, L.E. (2001). Prompts and prompt fading strategies for people with autism. In C. Maurice, G. Green & R.M. Foxx (Eds.), *Making a difference: Behavioral intervention for autism* (pp.37-50). Austin, TX: pro ed.

Martin, G., & Pear, J. (2015). *Behavior modification: What it is and how to do it* (10th ed.). Boston, MA, United States: Pearson Education Inc.

Massion, A. O., Teas, J., Hebert, J. R., Wertheimer, M. D., & Kabat-Zinn, J. (1995). Meditation, melatonin and breast/prostate cancer: Hypothesis and preliminary data. *Medical Hypotheses*, *44*(1), 39–46.

McCabe, S. E., & Boyd, C. J. (2005). Sources of prescription drugs for illicit use. *Addictive Behaviors*, *30*(7), 1342–1350. doi:10.1016/j.addbeh.2005.01.012

Meditation and Heart Health. (2017). *Heart.org*. Retrieved 18 April 2017, from

http://www.heart.org/HEARTORG/Conditions/More/MyHeartandStrokeNews/Meditation-and-Heart-Disease-Stroke_UCM_452930_Article.jsp#.WPV2j1Pyu1s

Pear, J. J. (2007). *A historical and contemporary look at psychological systems.* United States: Lawrence Erlbaum Associates.

Pierce, D. W., & Epling, F. W. (1998). *Behavior analysis and learning* (2nd ed.). London, United Kingdom: Prentice Hall.

Schneiderman, N., Ironson, G., & Siegel, S. D. (2005). Stress and health: Psychological, behavioral, and biological determinants. *Annual Review of Clinical Psychology, 1*, 607–628.

Sundquist, J., Lilja, A., Palmer, K., Memon, A., Wang, X., Johansson, L., & Sundquist, K. (2014). Mindfulness group therapy in primary care patients with depression, anxiety and stress and adjustment disorders: randomised controlled trial. *The British Journal Of Psychiatry*, *206*(2), 128-135. http://dx.doi.org/10.1192/bjp.bp.114.150243

Turner, R. M., & Ascher, L. M. (1979). Controlled comparison of progressive relaxation, stimulus control, and paradoxical intention therapies for insomnia. *Journal of Consulting and Clinical Psychology*, *47*(3), 500–508. doi:10.1037//0022-006x.47.3.50

Understanding the stress response: Chronic activation of this survival mechanism impairs health. (2011, March). *Harvard Health*. Retrieved 21 April 2017, from http://www.health.harvard.edu/staying-healthy/understanding-the-stress-response

Appendix A: Questionnaires

DAY ONE QUESTIONNAIRE

Identification Number:
_____
Date: _____

Directions: Please fill out questionnaire honestly and to the best of your ability. Honesty and accuracy are extremely important, and your names will never be matched with the results. This is strictly confidential information.

1. Circle your sex
    a. Female
    b. Male
    c. Transgender/Transitioning
2. Write your age in the space below:

3. What year of study are you in at Salem State University?
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. Graduate Student
4. Write in how many classes you are taking this semester? How many credits are you taking?

5. On a scale of very low to very high, how would you rate your stress levels today?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
6. On a scale of very low to very high, how would you rate your stress level due to classes and course load?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
7. On a scale of very low to very high, how would you rate your stress level due to family?
    a. Very low
    b. Low

c. Moderate
d. High
e. Very high

8. On a scale of very low to very high, how would you rate your stress level due to friends?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
9. On a scale of very low to very high, how would you rate your stress level due to illness?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
10. On a scale of very low to very high, how would you rate your stress level due to the media?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
11. On a scale of very low to very high, how would you rate your stress level due to grades?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
12. On a scale of very low to very high, how would you rate your stress level due to economic status
    a. Very Low
    b. Low
    c. Moderate
    d. High
    e. Very high
13. On a scale of very low to very high, how would you rate your stress level due to your job?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high

14. On a scale of very low to very high, how would you rate your stress level due to this study?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
15. On a scale of very low to very high, how would you rate your anxiety level due to classes and course load?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
16. On a scale of very low to very high, how would you rate your anxiety level due to family?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
17. On a scale of very low to very high, how would you rate your anxiety level due to friends?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
18. On a scale of very low to very high, how would you rate your anxiety level due to illness?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
19. On a scale of very low to very high, how would you rate your anxiety level due to the media?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
20. On a scale of very low to very high, how would you rate your anxiety level due to grades?
    a. Very low
    b. Low

    c. Moderate
    d. High
    e. Very high

21. On a scale of very low to very high, how would you rate your anxiety level due to economic status
    a. Very Low
    b. Low
    c. Moderate
    d. High
    e. Very high
22. On a scale of very low to very high, how would you rate your anxiety level due to your job?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high
23. On a scale of very low to very high, how would you rate your anxiety level due to this study?
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very high

24. Please write in your initial heart rate using the HeartRateFree/Instant Heart rate app:

PRE SESSION QUESTIONNAIRE

Identification Number: _____

Date: _____

1. Please record your heart rate using the HeartRateFree/Instant Heart Rate app:

2. On a scale of very low to very high, how would you rate your stress level overall right now:
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very High
3. On a scale of very low to very high, how would you rate your anxiety level overall right now:
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very High

AFTER SESSION QUESTIONNAIRE

Identification Number: _____

Date: _____

1. Please record your heart rate using the HeartRateFree/Instant Heart Rate app:

2. On a scale of very low to very high, how would you rate your stress level overall right now:
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very High
3. On a scale of very low to very high, how would you rate your anxiety level overall right now:
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very High
4. On a scale of very low to very high, how would you rate your overall enjoyment of this session:
    a. Very low
    b. Low
    c. Moderate
    d. High
    e. Very High
5. On a scale of very easy to very difficult how would you rate the easiness of this session:
    a. Very easy
    b. Easy
    c. Moderate
    d. Difficult
    e. Very difficult

FOLLOW-UP QUESTIONNAIRE

1. What is your Identification Number for the Study?

2. Do you still meditate even though the program is over?
   a) Yes
   b) No

3. How often do you meditate?
   a) Once a day
   b) More than once a day
   c) 1-2 times a week
   d) 3-4 times a week
   e) 5-6 times a week
   f) 7+ times a week
   g) Never

4. On a scale of very low to very high, how would you rate your stress level today?
   a) Very low
   b) Low
   c) Moderate
   d) High
   e) Very high

5. On a scale of very low to very high, how would you rate your stress level today?
   a) Very low
   b) Low
   c) Moderate
   d) High
   e) Very high

6. Did you feel like the meditation program you participated in helped decrease your stress?
   a) Yes
   b) No

7. Did you feel like the meditation program you participated in helped decrease your anxiety?
   a) Yes
   b) No

8. Under what condition do you meditate in the most now that the program is over?
   a) Guided meditation
   b) Calming music/sounds
   c) Silence
   d) None, I do not meditate.

9. Have you ever meditated before this Program?
    a) yes
    b) no
    c) unsure

10. How frequently did you meditate before the program?
    a) I have never mediated before the program
    b) 1-2 times a week
    c) 3-4 times a week
    d) 5-6 times a week
    e) 7+ times a week
    f) Once a month

Appendix B:

Directions for Observers (Meditation Recording)

On the next page of this packet, you will find recording sheets including tables that look like this:

PARTICIPANT NUMBER:	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00

In the section labeled "Participant Number" you will write in the numbers of the participants you are assigned, and match the corresponding sticker in the appropriate boxes. These numbers and stickers will be displayed on the name badges that the participants will be wearing so you will be able to identify them. You will be assigned four participants to keep track of. All four participants will also be observed by one other observer, meaning two of you will have the same participants. This is because we wish to establish an Inter-observer reliability (IOR) rate, which is the comparison of two observer's data to determine accuracy of the data.

You will be observing fidgeting behaviors of the participants. Fidgeting will be defined as any of the following:

- opening eyes
- looking around the room
- moving of fingers and toes beyond the positions demonstrated
- touching one's face/hair/arm/leg/torso/back
- tapping of fingers/feet beyond the positions demonstrated
- scrunching of face muscles when otherwise not prompted to do so
- movement of arms or legs without prompting to do so
- movement of head without prompting
- Shifting around in one's seat beyond a simple adjustment
- and other similar behaviors.

You will be looking for any of these things in all of your assigned participants during each 30 second interval, beginning with the starting chime that signals the beginning of the meditation. If the participant does engage in any of the above behaviors, then you would mark a "1" in the corresponding box for that interval. If none of the above behaviors occur, then you would mark a "0" in the corresponding box. **If you are unsure if a movement counts as a fidget, put an * in the corresponding interval, and then in the "Notes about Fidgets" section, write the interval you put the * in and describe the fidget.** At the end of the meditation (signaled by another chime) please draw a distinct line along the column line of the interval that the meditation terminated at.

For Example:

PARTICIPANT NUMBER:	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00	5:30
111MH01	1	0	0	1	1	0	0	0	

Once finished with recording, please compare data with your corresponding observer with the same participants, and calculate an IOR ((Total # of Agreements/ Agreements + Disagreements) x 100) Ex: (45/45+5) x 100 = 90%).

30s intervals recording sheet

PARTICIPANT NUMBER:	0:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30

PARTICIPANT NUMBER:	5:00	5:30	6:00	6:30	7:00	7:30	8:00	8:30	9:00

PARTICIPANT NUMBER:	9:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30

Notes about Fidgets:

Participant:_____	
Participant:_____	
Participant:_____	
Participant:_____	