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The Impact of Attachment Style and a Biofeedback Relaxation Intervention on Self-Regulation

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by

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Abstract

The transition to college is a critical developmental period during which young adults are uniquely vulnerable to high stress and anxiety due to the overwhelming demands of academic, social, emotional, and financial adjustment. This developmental transition often requires students to generalize previously developed self-regulatory skills, which are closely tied to early attachment patterns with caregivers (Feeney, 2000). Research continues to support the evidence for biofeedback as a promising psychophysiological intervention, especially when used in conjunction with relaxation techniques (Lynch & McGrady, 2006). The present study explored attachment style and the effectiveness a biofeedback-guided relaxation intervention on the ability to self-regulate among college students. Pre-intervention measures included self-reported general self-efficacy (GSE) and attachment style, as well as ability to self-regulate through a biofeedback procedure. Participants were randomly assigned to an intervention group and control group. The control group participants practiced the 5-minute relaxation intervention on their own 5 times per week, for 4 weeks. The intervention group participants also practiced the relaxation intervention on their own 5 times per week for 4 weeks but received an additional biofeedback-guided

intervention session each week with the opportunity to visually monitor their physiological responses. Post-intervention measures included the self-reported GSE measure and the biofeedback procedure used in the pre-intervention session.

The biofeedback data results showed there was no significant difference in ability to self-regulate based on the biofeedback-guided relaxation intervention. However, there was statistical significance in ability to self-regulate according to attachment style. The hypothesis that securely attached individuals would demonstrate a higher ability to self-regulate compared to the non-securely attached groups was not supported, suggesting important clinical implications for how attachment style may impact one's response to distress and ability to learn self-regulatory skills. Finally, results from the GSE self-report data showed a significant increase in perceived self-efficacy for individuals post-intervention. Though initial results did not show a significant difference in GSE scores based on the biofeedback-guided intervention, once pre-intervention GSE scores were covaried, the results showed a significant difference between intervention and control groups. Consistent with the biofeedback results, there was a significant difference in GSE scores between the different attachment styles.

Keywords: attachment, biofeedback, self-regulate, college students

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Chapter 1

Introduction

This research study sought to explore the impact of attachment style and the effectiveness of a biofeedback-guided relaxation intervention on the perceived self-efficacy and ability to self-regulate, among college students.

College: Developmental Stress

The vast and pervasive nature of stress and anxiety have a significant impact in our culture and across the general population (Henriques, Keffer, Abrahamson, & Horst, 2011). College students who are expected to navigate the critical developmental stage from adolescence to early adulthood are especially vulnerable to high stress and anxiety, as they learn to incorporate autonomy in their personal lives (Bayram & Bilgel, 2008). A recent survey found one-third of college students reported stress and anxiety negatively impacted their academic performance (Henriques, et al., 2011). This stress and anxiety come with the psychosocial transition from adolescence to early adulthood, including the development of organizational skills and autonomy necessary for adapting to adult roles, responsibilities, and social settings (Steinberg, 2009). In addition, adolescents must manage considerable psychophysiological changes, including emotional and cognitive flexibility.

Several research studies found psychological morbidity to be prevalent among college students across all different cultures, especially depression and anxiety (Bayram & Bilgel, 2008). Not surprisingly, anxiety symptoms have been consistently found to predispose college students to higher rates of substance abuse and difficulty graduating, often predicting a poor trajectory for mental health issues later in adulthood (Pedrelli, Nyer, Yeung, Zulauf, & Wilens, 2015). As adolescence is the critical period of transition into early adulthood, behavioral patterns

established during this time may determine the quality of an individual's functional system later in adulthood (Ben-Shlomo & Kuh, 2002, Halfon & Hochstein, 2002). Specifically, how well self-efficacy is developed and employed during the formative period of adolescence will determine an individual's future course, because self-efficacy ultimately impacts self-regulatory behaviors (Bandura, Caprara, Barbaranelli, Gerbino, & Pastorelli, 2003). Self-regulation is the ability to integrate executive functioning and emotion regulation skills in order to accomplish desired goals (Buckner, Mezzacappa, & Beardslee, 2009). Students who have greater self-regulation skills via greater control of thoughts, emotions, and behaviors during stressful times were found to have greater distress tolerance (DeRosier, Frank, Schwartz, & Leary, 2013). Additional research found the greater the ability to self-regulate predicted better adjustment and more adaptive coping strategies under stress in adolescents (Buckner et al., 2009; Lengua & Long, 2002). Providing college students with adaptive skills to successfully self-regulate and cope with anxiety symptoms during this vulnerable period may help them to confront and overcome future life stressors.

Biofeedback-Guided Relaxation Techniques

There is extensive evidence of the intimate bond between psychological disorders and physical symptomology, specifically using biofeedback interventions. Biofeedback has been found to provide effective, non-invasive interventions for psychological disorders, especially in combination with therapeutic techniques (Schoenberg & David, 2014). In a meta-analysis done by Schoenberg & David (2014), three of four studies investigating Heart Rate Variability (HRV) biofeedback reported a significant reduction in anxiety symptoms when participants were consciously able to alter their heart rate. Additionally, applying multimodal forms of biofeedback interventions were found to effectively increase therapeutic efficacy by alleviating symptoms of

panic disorder, anxiety in perinatal depression, and other various anxiety disorders. The continuing need for research in this area is apparent from the evident biopsychosocial impact of anxiety on overall quality of life. Biofeedback interventions are readily available, inexpensive, easily utilizable by large numbers of people, and have minimal side effects (Henriques et al., 2011). Due to this, the use of psychophysiological interventions, like biofeedback, continue to be seen as a promising alternative to the over-utilization of medication in mental health (Ryan & Gevirtz, 2004).

Simple relaxation techniques have been found to decrease stress and anxiety (Lynch & McGrady, 2006). However, several research studies suggest applying biofeedback interventions in conjunction with relaxation techniques increases therapy effectiveness. Prato and Yucha (2013) found statistically significant changes in respiratory rate, pulse, and skin temperature in participants who were trained in diaphragmatic breathing, autogenic techniques, and progressive muscle relaxation techniques. Henriques et al. (2011) found that a computer-based HRV biofeedback program was effective in reducing anxiety in college students, which was used in combination with therapeutic techniques including regulation of breathing and cultivation of positive affect. More specifically, the use of meditation, relaxing music, and affect management techniques helped to reduce negative emotion and increase positive emotion. This, in turn, resulted in the enhancement of vagal tone and HRV, or a decrease in heart rate. This computer-based HRV biofeedback program from the research study of Henriques et al. (2011) is available for download onto personal computers of the general public, thus providing a means for improved self-regulation and higher perceived self-efficacy.

Ryan & Gevirtz (2004) also found a biofeedback-guided breathing, relaxation, and problem-solving interventions were successful in reduced symptom severity for various

disorders, including anxiety with somatic features. However, there were a significant number of patients who dropped out from the treatment group after a few sessions. This brings attention to the individuals who are at risk for poor prognosis of certain mental health interventions due to various complex factors, which are worth investigating. In this present study, attachment style is one of these complex factors that will be investigated.

Attachment

Different attachment styles (secure, anxious-avoidant, and anxious-ambivalent) significantly impact emotional and relational patterns, beliefs about self-worth, and ability to trust others in adulthood (Mickelson, Kessler, & Shaver, 1997). According to Bowlby, attachment theory refers to:

> A person's characteristic ways of relating in intimate caregiving and receiving relationships with "attachment figures," often one's parents, children, and romantic partners. The concept involves one's confidence in the availability of the attachment figure for use as a secure base from which one can freely explore the world when not in distress as well as a safe haven from which one can seek support, protection, and comfort in times of distress (Levy, Ellison, Scott, & Bernecker, 2010, p. 193).

Attachment patterns to caregivers can either encourage or hinder emerging adults in the psychological exploration of new adult roles and subsequently, self-efficacy (Haydon, 2015). Bowlby highlighted the innate proximity-seeking behaviors of the infant, in which the history of interactions between an infant and caregiver affect the formation of attachment security, expectations of the availability of others, views of self, and strategies for affect regulation (Mikulincer, Shaver, & Pereg, 2003). A strong sense of attachment security has been found to promote a positive view of the self and the world, healthy reliance on others for support in times

of need, high optimism regarding distress management, a competent internal working model, and effective coping and self-regulation under stress.

Welle and Graf (2011) further supported that the young college student population is at high risk for anxiety, stress, and emotional dysregulation, especially without the aid of adaptive coping mechanisms. During adolescence, the prefrontal cortex undergoes extensive structural and functional changes, preceding maturation of neural connections with the limbic system (Steinberg, 2008). These changes are critical for self-regulation and cognitive control over emotions. Early attachment styles with caregivers have been linked to many aspects of health and sense of well-being, particularly with affect regulation and stress management (Feeney, 2000), as well as risk for mental health problems (Christian, Sellborn, & Wilkinson, 2017; Russo et al., 2017). In a 10-year longitudinal study on the role of adolescent-parent attachment and adult psychopathology, results showed secure attachment during the crucial developmental periods of childhood, adolescence and early adulthood is a protective factor against various symptoms of psychopathology (i.e. depression, anxiety, antisocial behaviors, etc.) in adulthood (Pascuzzo, Moss, & Cyr, 2015). Early established attachment and bonding continue to shape and affect interpersonal relationships and adaptive social-emotional functions necessary for survival throughout adulthood (Schore, 2014), and the formation and maintenance of relationships is one of the main areas of stress for college students (Ainsworth, 1989).

Very few studies have looked specifically at the relationship between attachment style and ability to use learned therapeutic techniques to self-regulate anxiety symptoms. Yet, there is important information to be gleaned from studies examining the correlation between attachment style and response to therapeutic interventions. Research found the healthy and stable development of self-regulation and self-efficacy is largely dependent on the quality of co-

regulation or attachment-figure availability in early development (Mikulincer, et al., 2003; Schore, 2014). Walczak et al. (2017) supported this in their study of attachment style as a predictor of non-response to cognitive behavioral therapy (CBT) treatment in children with anxiety disorders. Both children's and their parents' attachment patterns are known to be linked with the presence of pediatric anxiety disorders. These researchers found maternal anxious attachment to be the strongest predictor of poor CBT treatment outcome, suggesting clinicians should pay close attention to how the relationship between anxious children and their anxiously attached mothers could inhibit positive treatment outcomes. Namely, children who are insecurely attached were found to have difficulty regulating emotions, and consequently adhering to treatment interventions. This is likely because children must often lean on the support of primary attachment figures to co-regulate their emotions, which is challenging if a child's primary attachment figure is also anxiously attached.

Geller and Porges (2014) found neurophysiological evidence within the vagal circuit that safety in attachment with others promotes the development of new neural pathways, ultimately leading to the downregulation of defenses and positive social engagement behaviors. When the vagal circuit is functioning optimally, the autonomic nervous system helps to regulate emotions, encourage calm and spontaneous social interactions, dampen stress-related physiological symptoms of the hypothalamic-pituitary-adrenal (HPA) axis, slow heart rate, and inhibit the fight-or-flight response of the sympathetic nervous system. An individual with poor early attachment with primary caregivers likely perceives oneself to be in danger, which causes emotional dysregulation and the autonomic nervous system to maintain heightened defensive mechanisms. This provides potential clues to the ability of self-regulation in securely versus non-

securely attached college students when provided biofeedback-guided relaxation and breathing interventions.

Rationale for Study

Looking more deeply into the factors predicting the ability to develop self-regulatory skills could provide a clearer pathway for effective implementation of programs to help students build the requisite skills to manage developmental stressors. Exploring the impact of attachment style and the effectiveness of biofeedback-guided relaxation interventions on the ability to self-regulate could guide us toward more effective mental health treatment. This could also help us to more accurately conceptualize patient presentations, predict treatment outcome, and improve intervention strategies. Understanding the difference in adherence to treatment depending on attachment style is also important for overall quality of life, as individuals with maladaptive attachment patterns have been found to be more vulnerable to a wide range of physical symptoms predisposing serious medical disorders (Kim, 2006). The evidence that attachment styles impact physiological health may contribute a significant means for finding more effective and widespread treatment options for mental health disorders. It is also pertinent to note that attachment theory can be applied across a diverse range of theoretical orientations within clinical psychology, making it an accessible and worthwhile construct for clinical research. The variables assessed in this study include attachment style and the ability to self-regulate using a biofeedback-guided relaxation intervention.

Hypothesis 1. Ability to self-regulate is differentiated by attachment style as measured at baseline, regardless of group assignment. Additionally, the participants with secure attachment style will demonstrate an increased ability to self-regulate compared to the non-securely attached groups.

Hypothesis 2. Students using the relaxation intervention five times per week will demonstrate improvement in self-regulation as measured by change in root mean square of successive differences (RMSSD; measurement of HRV captured by the PPG) and EDA, with those in intervention group showing significantly greater increases than students in the control group.

Hypothesis 3. Students will experience improvement in self-efficacy in both the control and intervention group, with those in the intervention group (regardless of attachment style) showing significantly greater increases than students in the control group.

Chapter 2

Methods

Participants

Participants initially consisted of 39 undergraduate students aged 18 to 21, recruited from a private university. A total of 33 participants completed the study following the attrition of 6 participants throughout the study. Participants included male (n = 7) and female (n = 26) undergraduate students from various religious, socioeconomic status (SES), and ethnic backgrounds. Exclusion criterion included individuals currently receiving mental health counseling or therapy services. Participation was voluntary and involved incentives in the form of class research credits for the undergraduate introductory Psychology course equivalent to the duration of participation, as well as a gift card for participants that completed the entire study. Informed consent was obtained from each patient prior to conducting the intervention. This study was approved by the Human Subjects Review Committee (HSRC) at George Fox University.

Materials

Attachment Style. Adult attachment style was measured using the Adult Attachment Scale (AAS). The AAS was created by authors Collins and Read (1990), which is an 18 item, 5-point Likert scale survey that focuses on close relationships (see Appendix B). This measure is comprised of three main subscales, each comprised of six items: Close, Depend, and Anxiety. These items categorize individuals into Secure, Preoccupied, Dismissive, and Fearful attachment styles. The authors measured internal consistency using three different samples of undergraduate students; Cronbach's alpha coefficient ranged from 0.80 to 0.82 for the Close subscale, 0.78 to 0.80 for the Depend subscale, and 0.83 to 0.85 for the Anxiety subscale. The AAS has also been found to have concurrent validity with other comparable attachment scales.

Self-Efficacy. Self-efficacy was measured using the General Self-Efficacy Scale (GSE), shown in Appendix C. The GSE is a 10-item, 4-point Likert scale measure that was created to assess an individual's perceived ability to deal with difficult life situations (Schwarzer & Jerusalem, 1995). The internal reliability, measured by Cronbach's alpha, is between .76 and .90. In terms of validity, the GSE scale was found to be correlated to the constructs of optimism, emotion, and work satisfaction. An individual's self-efficacy is measured by the total score from the GSE scale, which can range between 10 and 40. Higher GSE scores correlate with higher self-efficacy, and lower GSE scores correlate with anxiety, depression, stress, burnout, and general health complaints.

Biofeedback. Participants' biofeedback was measured using the BIOPAC MP160 data acquisition and analysis system (Part #: MP160WSW-FR; see Appendix D for product sheet). The wireless photoplethysmogram (PPG) was used to measure blood volume pulse (BVP), which provided heart rate variability (HRV), inter-beat interval, vasodilation, and vasoconstriction data. PPG has become an increasingly used method to assess for HRV, as it is conveniently worn at the wrist and minimally intrusive (Pinheiro, et al., 2016). The PPG data were converted into the root mean square of successive differences (RMSSD) between heart beats for subsequent statistical analysis, which is a measure of HRV. The higher the RMSSD, the more the sympathetic nervous system is aroused, causing vagal withdrawal and decreased self-regulatory abilities (i.e. increased anxious symptoms). The lower the RMSSD, the more the parasympathetic nervous system is activated, leading to vagal tone and increased emotional regulation and coping skills. Electrodermal activity (EDA) was also measured, which provided skin conductance activity, or eccrine (skin sweating) activity (Boucsein et al., 2012). Higher EDA correlates with high arousal or decreased ability for self-regulation, and lower EDA

correlates with increased self-regulatory abilities. Both the PPG and EDA were measured concurrently on the hand.

Relaxation Intervention Protocols. A 5-minute breathing exercise created by the medical doctors Brown and Gerbarg (2012) was used for the take-home relaxation intervention done by each participant individually (see Appendix E for specific audio tracks). Brown and Gerbarg (2012) focus on several techniques to help with several aspects of well-being, including the reduction of stress and anxiety, enhancement of concentration, and balance of emotions. They researched the importance of the impact of breathing patterns on HRV and confirmed that changes in breathing resulted in important shifts in nervous system activity. More specifically, Brown and Gerbarg (2012) found evidence that breathing rate affects heart rate, and increasing HRV is associated with "a healthier, more flexible cardiovascular system, a more balanced and resilient stress-response system, and overall greater health and longevity" (p. 11).

A 15-minute biofeedback-guided grounding and relaxation intervention was created for the intervention group, facilitated in-person by the researcher (see Appendix F).

Procedure

This experimental study took place in a graduate school neuropsychology laboratory of a private university. Following the random assignment process, 18 participants were in the clinical group and 15 participants were in the control group during the six-week, six session study. A graduate school research assistant aided in the process of collecting biofeedback data.

Session 1 (pre-intervention): All participants were given an intake session by a master's level clinician, in which informed consent was obtained, background and demographic information (Appendix G) was collected, and the AAS and GSE self-report measures were completed. Each participant also underwent the following PPG and EDA biofeedback procedure

(see Appendix F for protocol) in order to collect pre-intervention data: baseline phase (2 minutes), stimulus phase – math problem task (3 minutes), and final resting phase back to baseline (2 minutes). Participants did not have access to the visual monitoring of their biofeedback data during this pre-intervention session.

Sessions 2-5 (intervention):

Control group: Each participant engaged in out-of-session practice of the 5-minute relaxation intervention 5 times per week. Participants were monitored and kept accountable by confirming their practice electronically with the researcher.

Intervention group: In addition to engaging in out-of-session practice of the relaxation intervention 5 times per week, participants in the intervention group participated in a 15-minute guided biofeedback session each week. The researcher facilitated the biofeedback sessions. Participants were connected to PPG and EDA biofeedback equipment and were able to visually monitor changes in their parasympathetic nervous system through observing their PPG and EDA responses.

Session 6 (post-intervention): Post-study data were collected from each participant using the GSE self-report measure and the same biofeedback procedure from the pre-intervention session: 2-minute baseline phase, 3-minute stimulus phase, and 2-minute resting phase (see Appendix F for protocol).

Chapter 3

Results

The first hypothesis proposed in this study predicted the ability to self-regulate is differentiated by attachment style as measured at baseline, with secure attachment demonstrating an increased ability to self-regulate compared to non-securely attached groups. The second hypothesis proposed that students using the relaxation app 5 times per week will demonstrate improvement in self-regulation as measured by change in RMSSD (measurement of HRV captured by the PPG) and EDA, with those in the intervention group showing significantly greater increases than students in the control group. Tables 1 and 2 show the overall demographics of the participants and the number of participants with each attachment style, with a final total sample size n = 33 following the attrition of 6 participants throughout the research study.

Table 1
Demographics

Factor	Total Sample (n = 33)	Intervention Group (n = 18)	Control Group (n = 15)
Gender			
Male	21.2% (7)	11.1% (2)	33.3% (5)
Female	78.8% (26)	88.9% (16)	66.7% (10)
Race			
European American	78.8% (26)	88.9% (16)	66.7% (10)
African American	6.1% (2)	5.6% (1)	6.7% (1)
Asian American	3.0% (1)	5.6% (1)	0
Latinx American	9.1% (3)	0	20.0% (3)
Biracial/Multiracial	3.0 % (1)	0	6.7% (1)
Age			
18 years	69.7% (23)	77.8% (14)	60.0% (9)
19 years	15.2% (5)	11.1% (2)	20.0% (3)
20 years	6.1% (2)	5.6% (1)	6.7% (1)
21 years	9.1% (3)	5.6% (1)	13.3% (2)
Year in School			
Freshman	75.8% (25)	83.3% (15)	66.7% (10)
Sophomore	12.1% (4)	11.1% (2)	13.3% (2)

Junior	3.0% (1)	0	6.7% (1)
Senior	9.1% (3)	5.6% (1)	13.3% (2)
Previous Mindfulness Training?			
Yes	15.2% (5)	11.1% (2)	20.0% (3)
No	84.8% (28)	88.9% (16)	80.0% (12)
Previous Therapy?			
Yes	42.4% (14)	22.2% (4)	66.7% (10)
No	57.6% (19)	77.8% (14)	33.3% (5)

Table 2
Attachment Style

	Total Sample (n = 33)	Intervention Group (n = 18)	Control Group (n = 15)
Secure	51.5% (17)	44.4% (8)	60.0% (9)
Preoccupied	24.2% (8)	33.3% (6)	13.3% (2)
Dismissive	12.1% (4)	11.1% (2)	13.3% (2)
Fearful	12.1% (4)	11.1% (2)	13.3% (2)

Hypothesis 1 and 2

EDA Findings. A repeated measures MANOVA was used to analyze the pre- and post-intervention EDA results and all assumptions were tested and met. Results showed a significant difference in the pre-intervention EDA results by attachment style ($F (3, 25) = 4.358$, $p<.05$; partial $\eta^2 = .343$) as well as a significant two-way interaction between attachment style and group ($F (3,25) = 3.271$, $p<.05$; partial $\eta^2 = .282$). Thus, the EDA results supported hypothesis 1 predicting there would an initial difference between attachment styles at baseline. Results showed no significant differences in the pre-EDA data between intervention and control groups, confirming assumptions were tested and met ($F (3, 25) = .434$, $p>.05$). Subsequent analyses focusing on the individual outcome variables of these main effects showed no initial significant differences between attachment style and group in the pre-intervention EDA phases (rest 1, stimulus, and rest 2). Tables 3a and 3b below show the overall pre-intervention and post-intervention EDA means and standard deviations by time, attachment style, and group.

Table 3a
Initial/Pre-intervention EDA Means and Standard Deviations

	Phase I (Rest 1) Mean (Std. Dev.)	Phase II (Stimulus) Mean (Std. Dev.)	Phase III (Rest 2) Mean (Std. Dev.)
Secure			
Intervention	6.91 (3.51)	7.67 (3.98)	7.35 (3.98)
Control	8.63 (4.43)	9.88 (5.28)	9.97 (5.49)
Preoccupied			
Intervention	7.98 (5.22)	8.68 (5.66)	8.59 (5.62)
Control	8.01 (5.33)	8.58 (6.20)	8.06 (7.03)
Dismissive			
Intervention	13.02 (2.53)	13.14 (1.91)	14.32 (3.11)
Control	9.07 (8.15)	9.02 (7.41)	8.49 (7.43)
Fearful			
Intervention	11.51 (7.89)	12.82 (9.82)	12.37 (8.69)
Control	7.33 (3.59)	7.64 (3.73)	7.88 (3.70)

Table 3b
Final/Post-intervention EDA Means and Standard Deviations

	Phase I (Rest 1) Mean (Std. Dev.)	Phase II (Stimulus) Mean (Std. Dev.)	Phase III (Rest 2) Mean (Std. Dev.)
Secure			
Intervention	9.27 (5.09)	10.28 (6.75)	10.08 (6.92)
Control	9.22 (4.45)	9.67 (5.40)	10.12 (3.97)
Preoccupied			
Intervention	11.74 (4.86)	12.64 (5.57)	12.24 (4.74)
Control	8.82 (3.37)	9.47 (4.38)	8.99 (3.37)
Dismissive			
Intervention	13.83 (6.21)	14.71 (7.26)	13.85 (6.38)
Control	25.74 (25.12)	25.32 (24.48)	24.55 (21.80)
Fearful			
Intervention	8.04 (6.46)	8.28 (6.83)	8.96 (7.50)
Control	14.11 (8.26)	14.82 (9.69)	16.77 (9.33)

The MANOVA results of the post-intervention EDA data showed there was a significant difference in attachment style ($F (3, 25) = 4.043$, $p<.05$; partial $\eta^2 = .327$). There were no significant differences between intervention and control groups ($F (3, 23) = 1.225$, $p>.05$), though there was a moderate effect size (partial $\eta^2 = .138$). There were also no significant

interactions between group and attachment style ($F (3, 25) = 1.764$, $p>.05$) but there was again, a moderate effect size (partial $\eta^2 = .175$). Additional analyses focusing on the different levels of the independent variables did not show significant differences by group, attachment style, or the interaction between group and attachment style. However, results showed moderate effect by attachment style in each phase (rest 1; partial $\eta^2 = .225$, stimulus: partial $\eta^2 = .178$, and rest 2: partial $\eta^2 = .186$), and moderate effect by the interaction between group and attachment style in each phase (rest 1; partial $\eta^2 = .119$, stimulus: partial $\eta^2 = .095$, and rest 2: partial $\eta^2 = .120$).

Additional analysis was completed in order to explore the change in EDA over time. Results showed a significant difference and moderate effect in EDA over time ($F (1, 25) = 4.417$, $p<.05$; partial $\eta^2 = .150$) and a significant difference and large effect by phase ($F (2, 24) = 7.258$, $p<.01$); partial $\eta^2 = .377$). There were no significant interactions between time and group or time and attachment style, but there was a moderate effect for the three-way interaction between time, group, and attachment style (partial $\eta^2 = .202$). Figures 1a through 1c depict the mean pre- and post-intervention EDA results by attachment style and differentiated by phase. Figures 2a through 2d depict the mean pre- and post-intervention EDA results differentiated by time as well as by group.

Though hypothesis 2 was not supported due to results showing no significant differences of EDA between the intervention and control groups, there was still a moderate effect on EDA between groups suggesting a possibility for hypothesis 2 to reach statistical significance using similar analyses with a greater sample size. Although the present results did not support the hypothesis that the securely attached individuals would demonstrate an increased ability to self-regulate compared to the non-securely attached groups, those with a secure attachment style

showed a consistently stable ability to self-regulate as compared with the other non-secure attachment styles (see figures 2a – 2d).

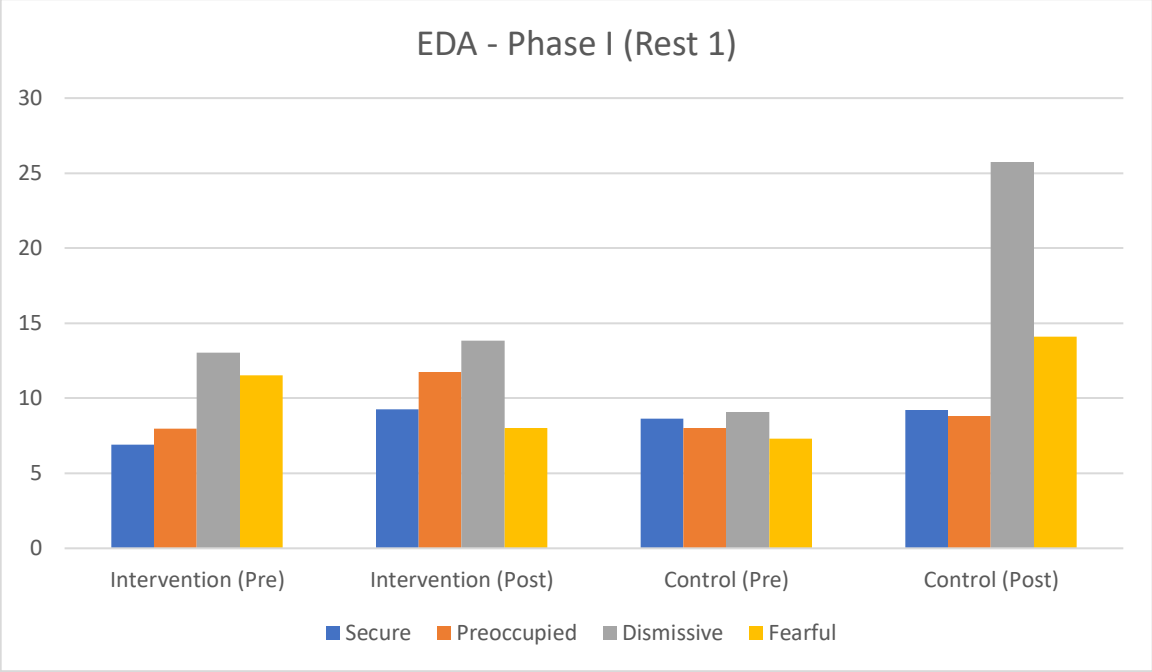

Figure 1a. Pre- and post-intervention mean EDA results of Phase I (Rest 1).

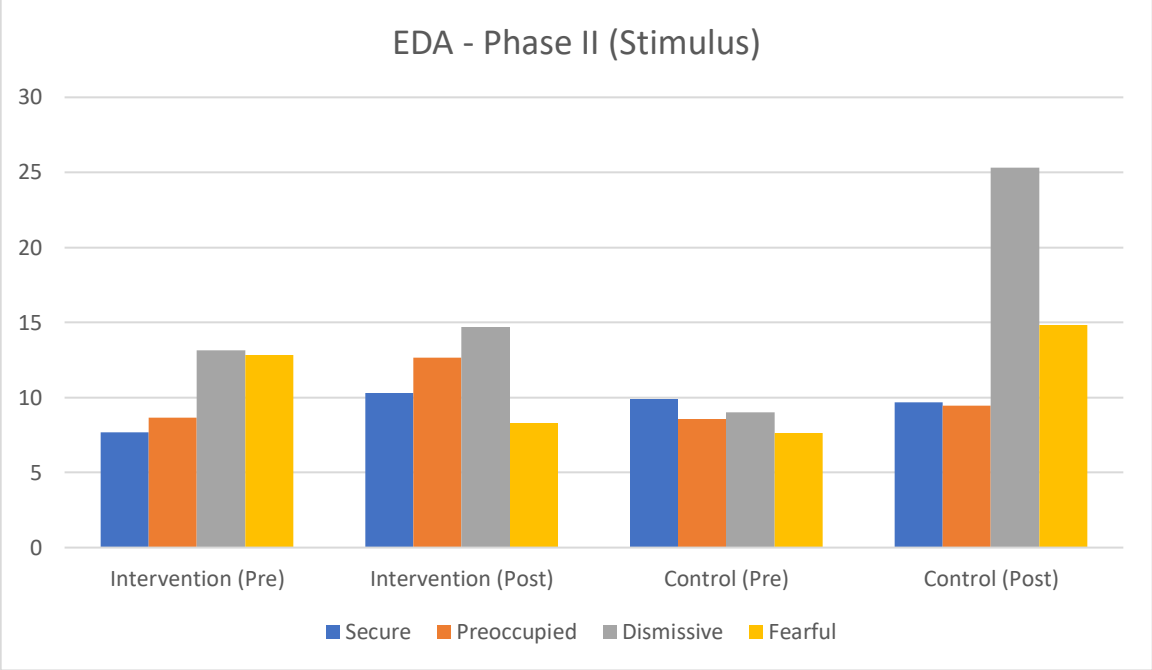

Figure 1b. Pre- and post-intervention mean EDA results of Phase II (Stimulus).

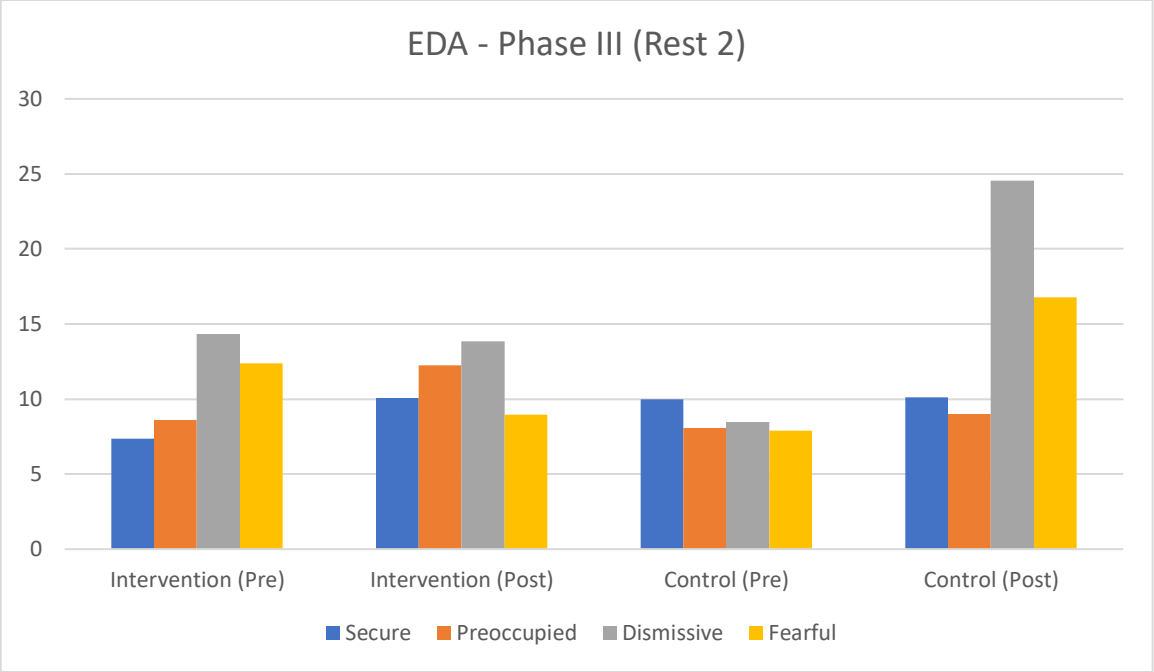

Figure 1c. Pre- and post-intervention mean EDA results of Phase III (Rest 2).

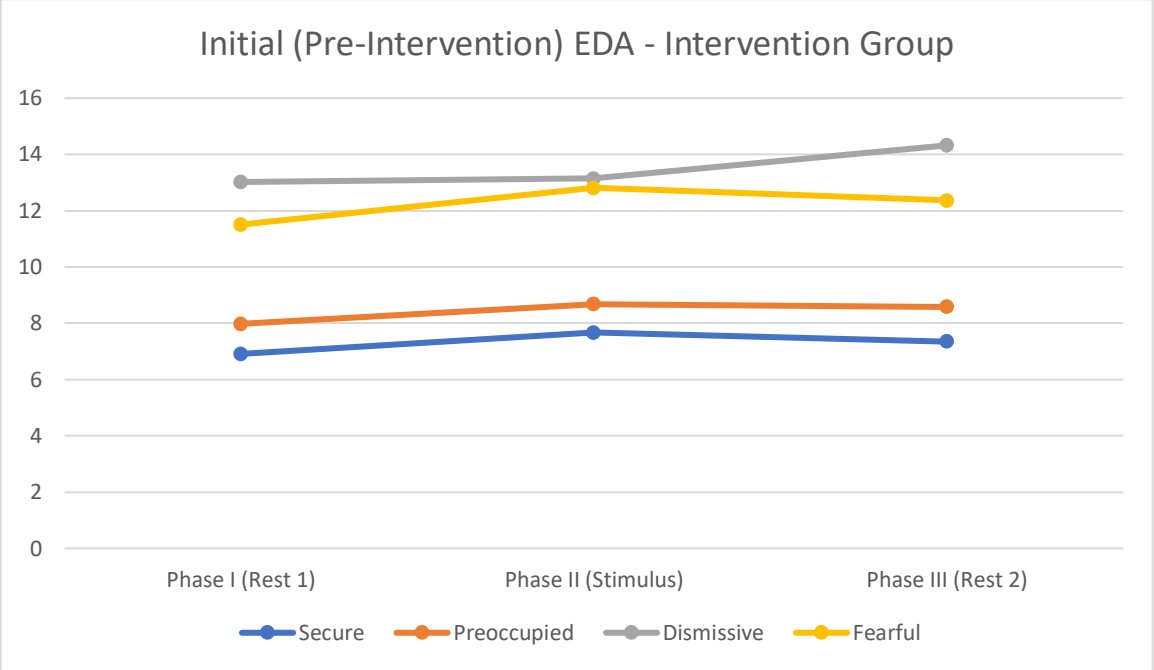

Figure 2a. Pre-intervention mean EDA results of intervention group.

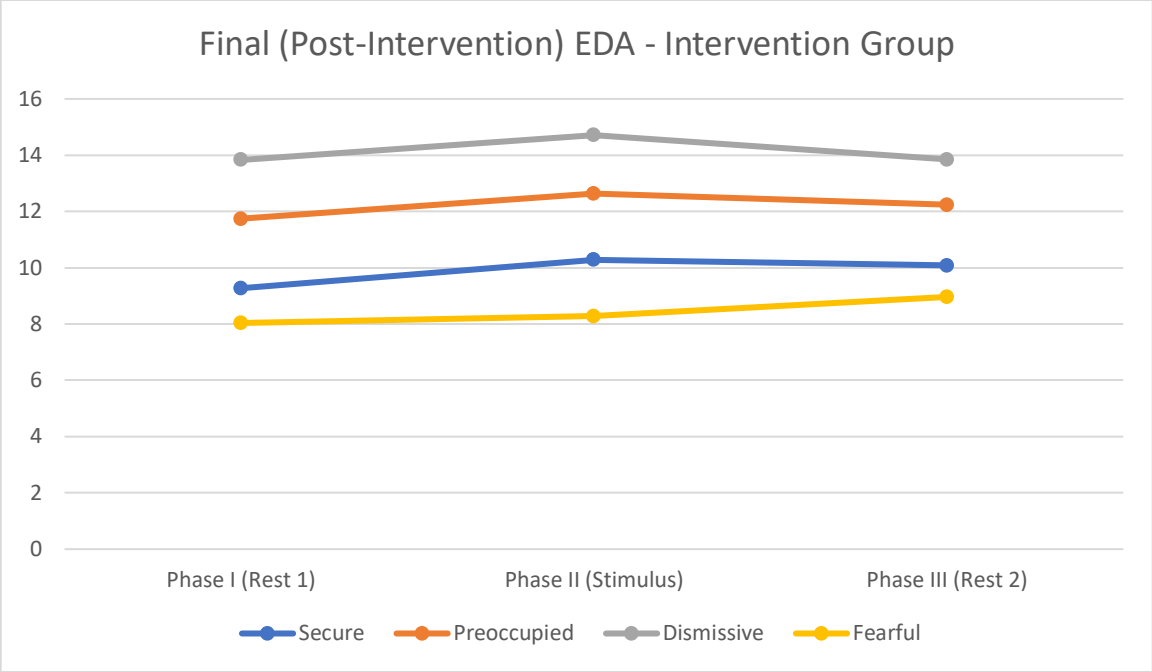

Figure 2b. Post-intervention mean EDA results of intervention group.

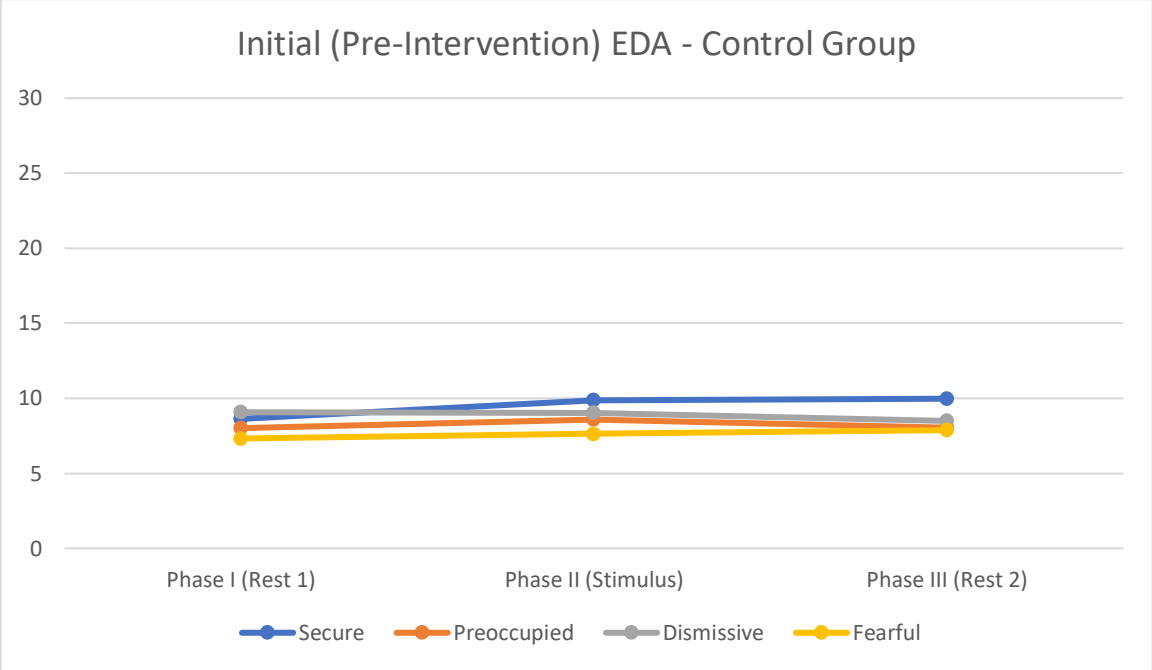

Figure 2c. Pre-intervention mean EDA results of control group.

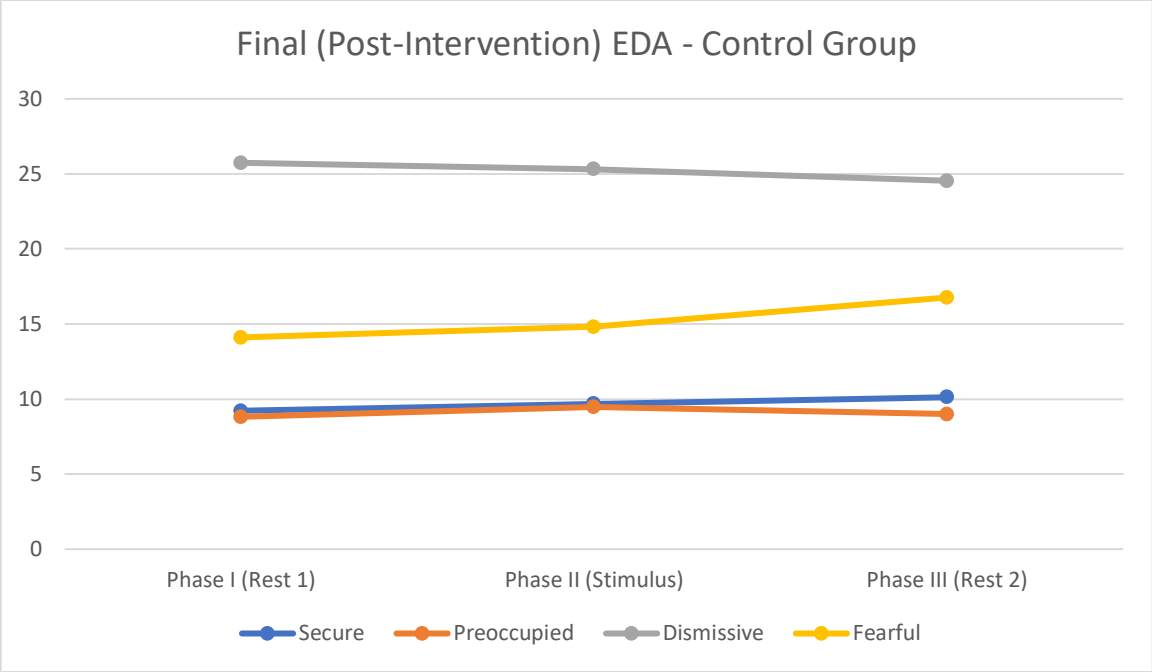

Figure 2d. Post-intervention mean EDA results of control group.

PPG findings. A Repeated Measures MANOVA was used to analyze the pre and post-intervention RMSSD results from the PPG biofeedback data. Due to a procedural error, one data set was omitted because of an unreadable PPG result leading to a total sample size of n = 32 for this subsequent statistical analysis. Results of the statistical analysis showed a significant interaction and large effect between time and attachment style ($F (3, 24) = 3.711$, $p<.05$; partial $\eta^2 = .317$) as well as a significant interaction and large effect between phase and attachment style ($F (3, 24) = 4.317$, $p<.05$; partial $\eta^2 = .350$). There was a significant difference in variance for one variable, phases, therefore analysis of phases should be interpreted accordingly. Assumptions of all other variables were tested and met. Results showed no significant difference between time and group ($F (1, 24) = .643$, $p>.05$) or phases and group ($F (2, 23) = .500$, $p>.05$). Tables 4a and 4b below show the overall pre-intervention and post-intervention RMSSD means and standard deviations by time, attachment style, and group.

Hypothesis 1 was partially supported by the statistical significance and large effect of attachment style differentially affecting the ability to self-regulate HRV (as measured by RMSSD) across time and phases. Similarly with the EDA results above, although the present results did not support the hypothesis that the securely attached individuals would demonstrate an increased ability to self-regulate compared to the non-securely attached groups, those with a secure attachment style again showed a consistently stable ability to self-regulate in both the intervention and control groups. Hypothesis 2 was not supported as the results showed no significant differences of RMSSD between time and group or phases and group, showing the biofeedback intervention was not effective in differentiating self-regulation abilities through the PPG/HRV data between the intervention and control groups. Figures 3a through 3c below illustrate the mean pre- and post-intervention RMSSD results differentiated by phase. Figures 4a through 4d illustrate the mean pre- and post-intervention RMSSD results differentiated by time and group.

Table 4a
Initial/Pre-intervention RMSSD Means and Standard Deviations

	Phase I (Rest 1) Mean (Std. Dev.)	Phase II (Stimulus) Mean (Std. Dev.)	Phase III (Rest 2) Mean (Std. Dev.)
Secure			
Intervention	58.67 (23.56)	56.16 (29.96)	82.57 (49.75)
Control	61.15 (26.97)	57.97 (32.68)	65.55 (26.06)
Preoccupied			
Intervention	49.67 (17.30)	35.95 (14.25)	55.03 (18.51)
Control	57.60 (17.95)	50.18 (7.61)	89.84 (66.63)
Dismissive			
Intervention	42.79 (22.32)	39.56 (16.05)	62.64 (28.03)
Control	42.91 (32.68)	23.94 (14.90)	31.89 (6.40)
Fearful			
Intervention	115.95 (94.44)	77.47 (51.37)	58.84 (10.61)
Control	112.26 (--)	54.04 (--)	127.62 (--)

Table 4b
Final/Post-intervention RMSSD Means and Standard Deviations

	Phase I (Rest 1) Mean (Std. Dev.)	Phase II (Stimulus) Mean (Std. Dev.)	Phase III (Rest 2) Mean (Std. Dev.)
Secure			
Intervention	64.62 (33.64)	57.56 (25.15)	65.10 (31.83)
Control	72.33 (39.01)	63.78 (54.06)	64.43 (43.37)
Preoccupied			
Intervention	46.79 (27.54)	34.40 (17.15)	43.18 (22.07)
Control	110.23 (65.27)	101.59 (104.92)	102.19 (71.87)
Dismissive			
Intervention	52.07 (10.50)	39.24 (0.24)	67.29 (8.73)
Control	25.83 (8.48)	20.47 (1.92)	32.79 (8.40)
Fearful			
Intervention	42.20 (8.51)	24.24 (4.04)	39.48 (9.20)
Control	102.07 (--)	17.65 (--)	23.12 (--)

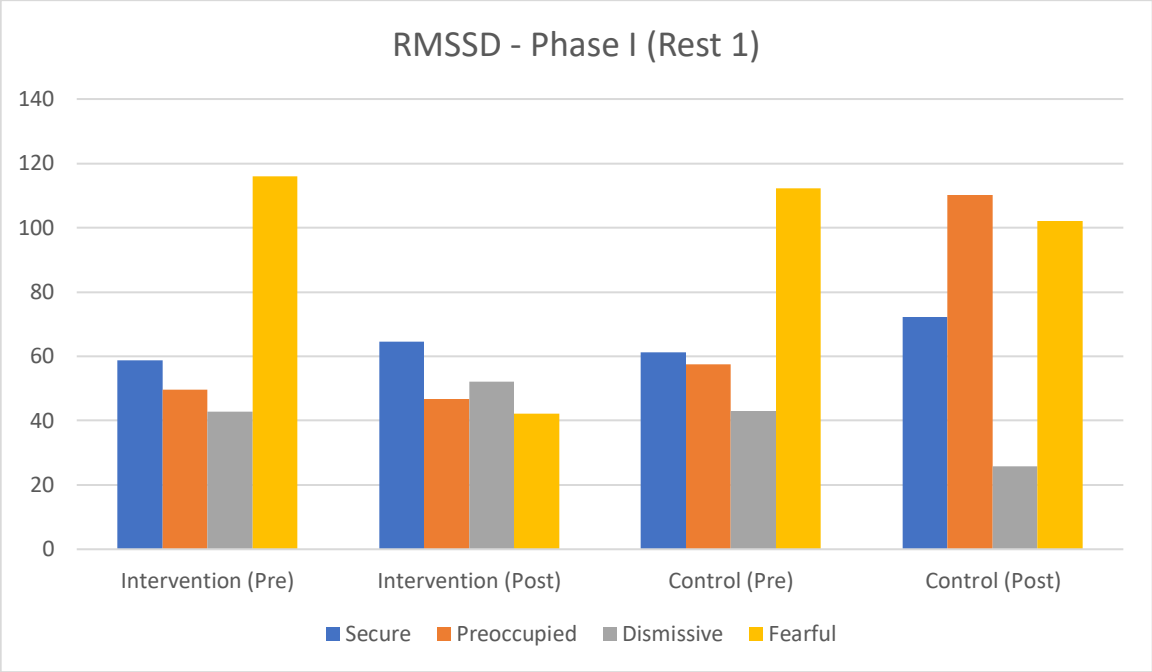

Figure 3a. Pre- and post-intervention mean RMSSD results of Phase I (Rest 1).
**As pictured in the figure above, Post Hoc tests showed a significant difference in the RMSSD of the intervention group during phase I between the fearful* attachment style *and all other attachment styles. There were no significant differences in subsequent phases.*

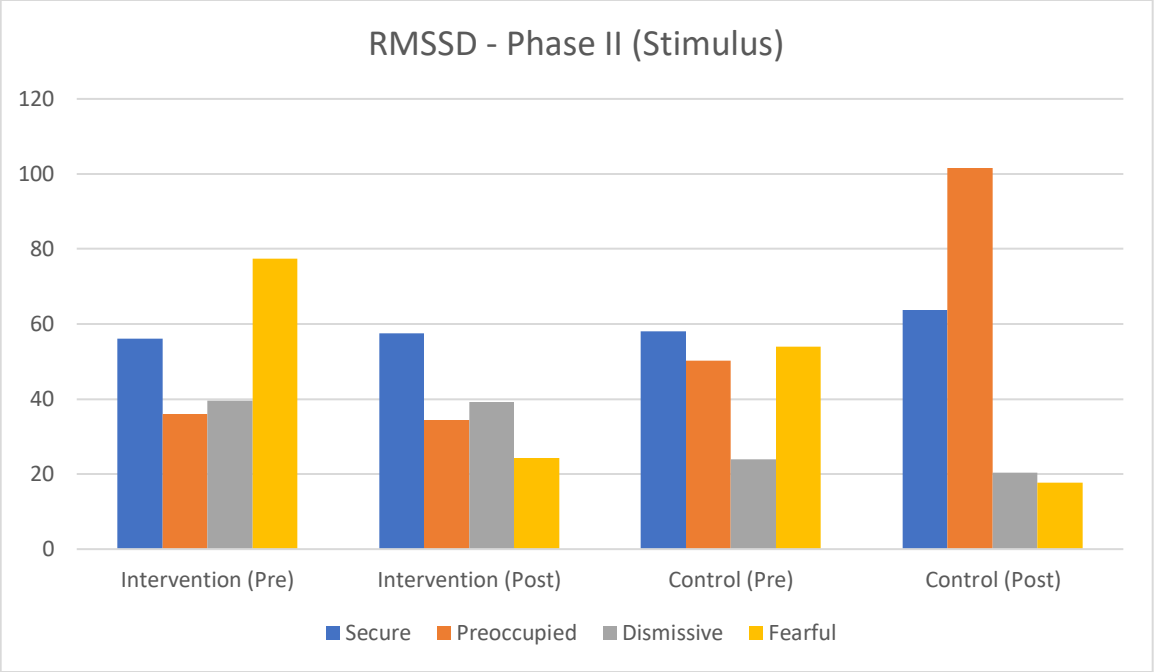

Figure 3b. Pre- and post-intervention mean RMSSD results of Phase II (Stimulus).

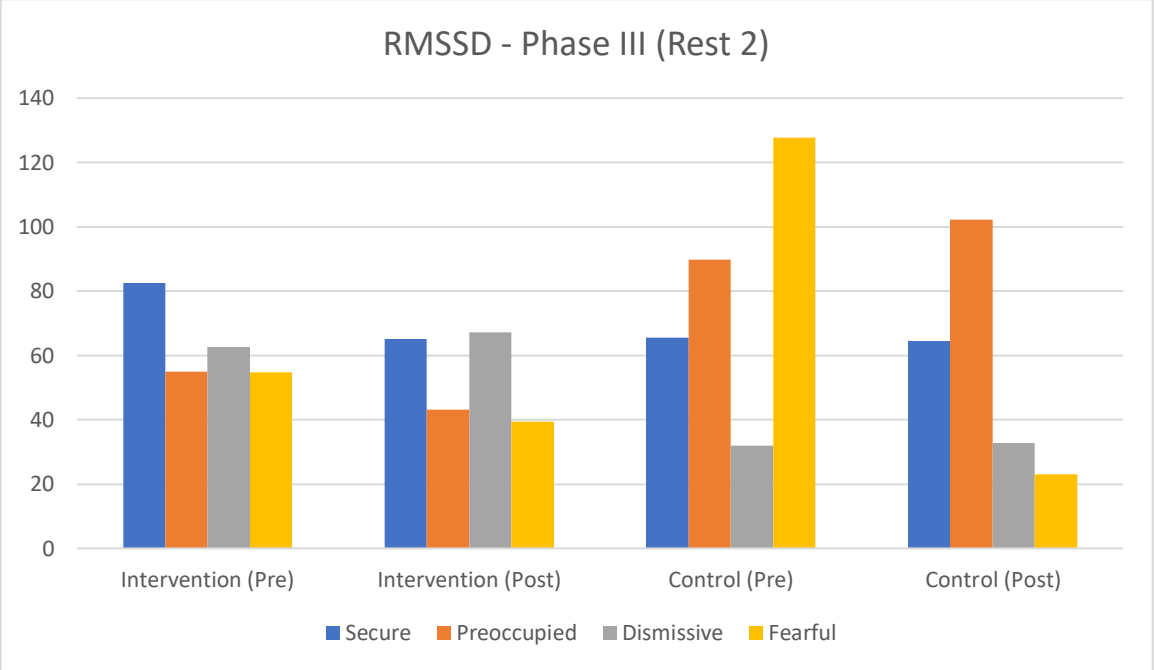

Figure 3c. Pre- and post-intervention mean RMSSD results of Phase III (Rest 2).

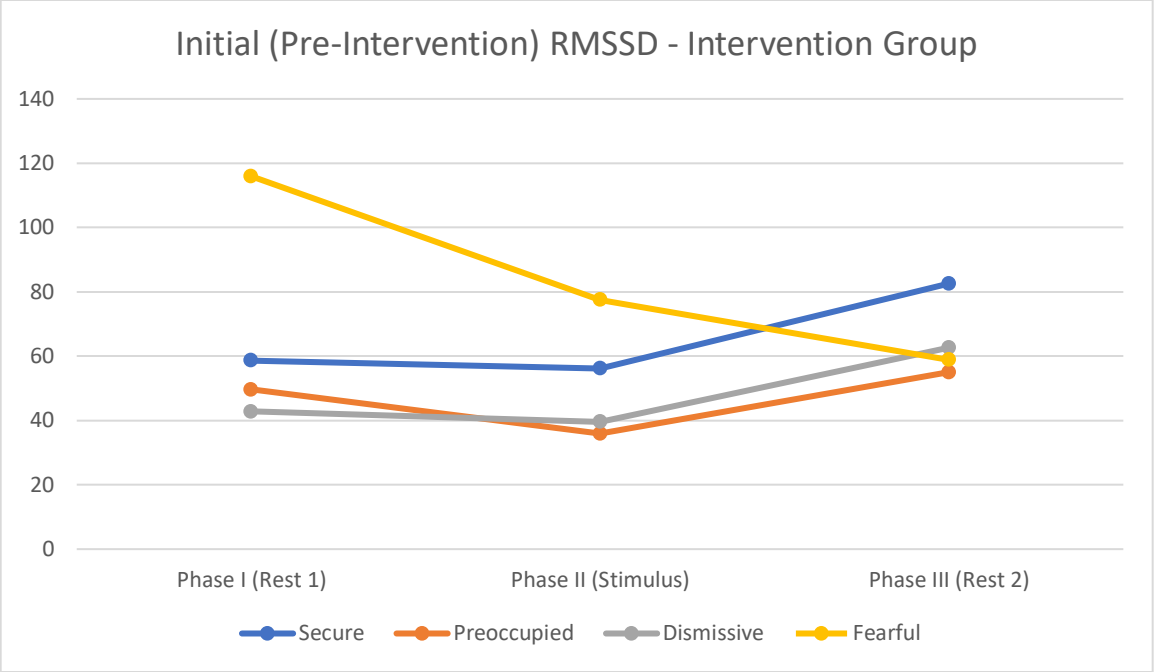

Figure 4a. Pre-intervention mean RMSSD results of intervention group.

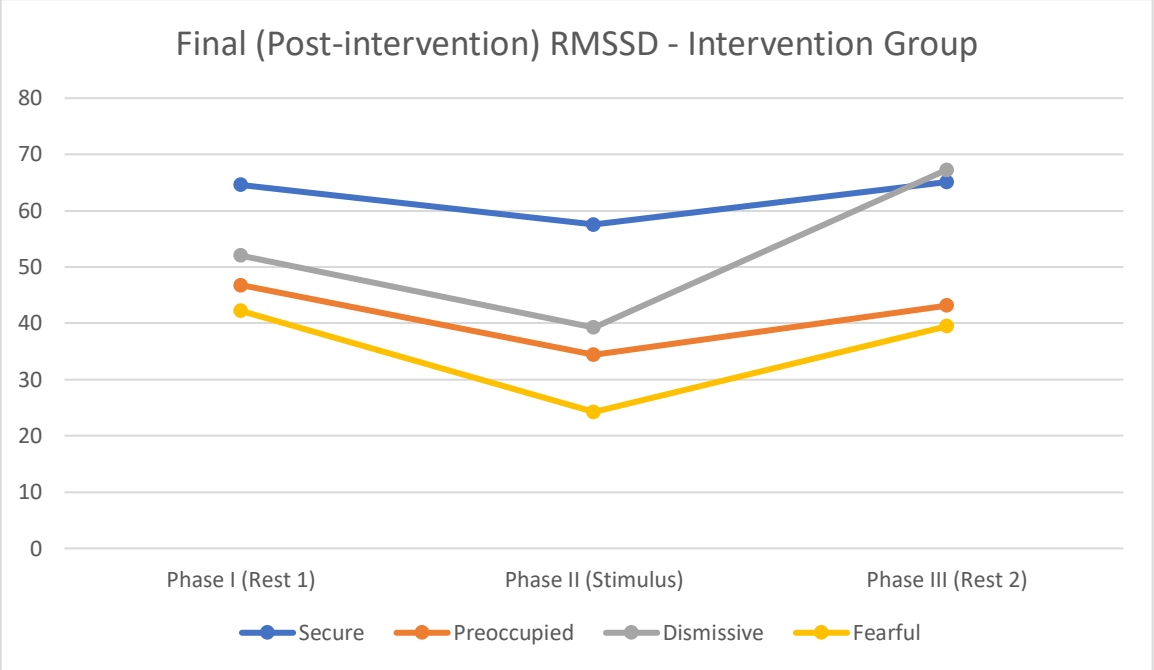

Figure 4b. Post-intervention mean RMSSD results of intervention group.

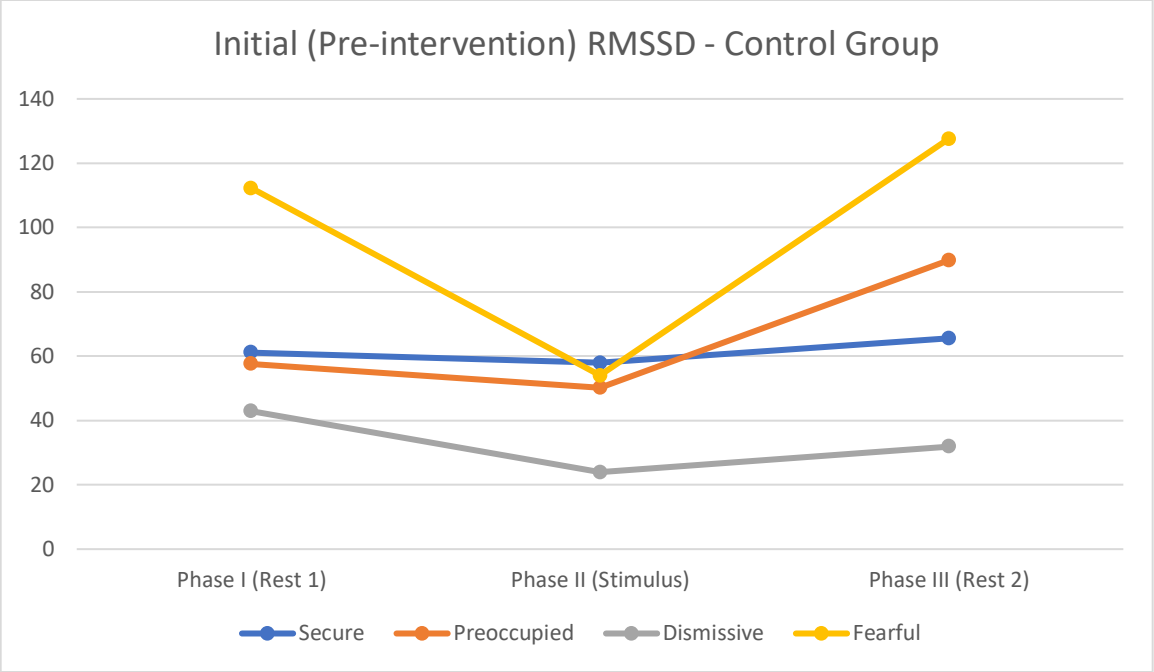

Figure 4c. Pre-intervention mean RMSSD results of control group.

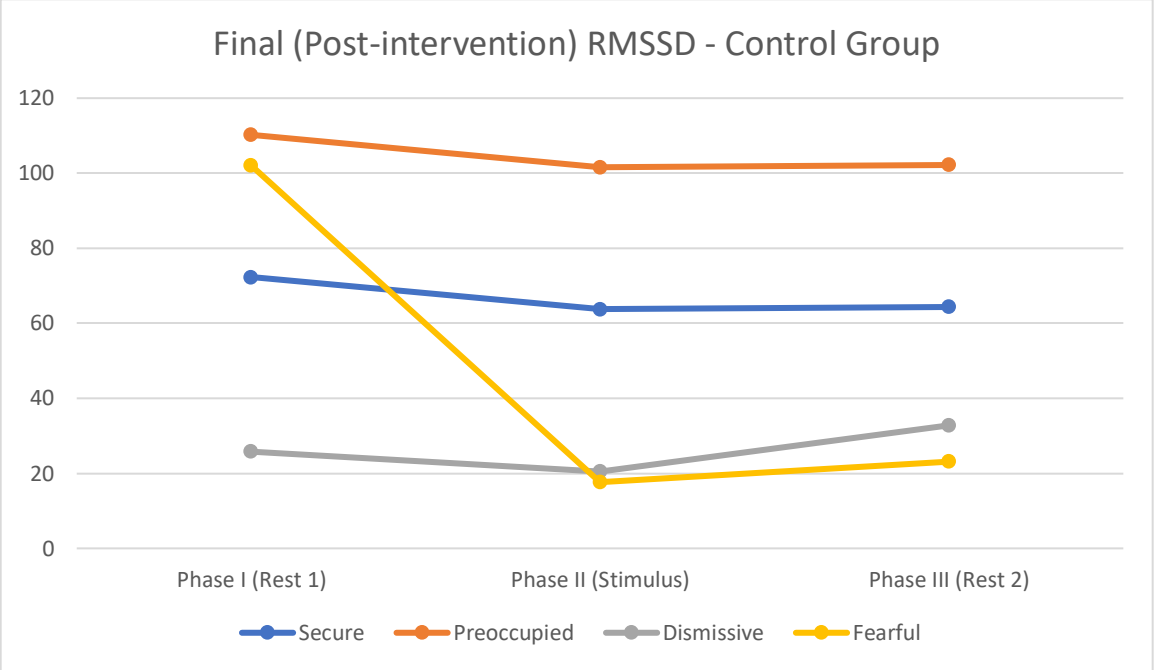

Figure 4d. Post-intervention mean RMSSD results of control group.

Hypothesis 3

General Self-Efficacy. The third hypothesis stated students will experience improvement in self-efficacy in both the control and intervention group regardless of attachment style, with

those in the intervention group showing significantly greater increases than students in the control group.

Table 5 shows the pre- and post-intervention mean GSE scores by group. Table 6 and Figure 5 show the pre- and post-intervention mean GSE scores by attachment style. A repeated measures ANOVA was used to compare interactions within and between subjects for change in GSE over time (pre- and post-intervention) according to group and attachment style, shown in Table 7. All assumptions were tested and met. Results showed statistical significance and moderate effect of change in GSE over time within groups ($F (1, 31) = 8.359$, $p<.05$; partial $\eta^2 = .212$) as well as statistical significance and large effect over time within attachment style ($F (3, 29) = 4.064$, $p<.05$; partial $\eta^2 = .296$). Results indicate a significant difference and moderate effect size of change in GSE over time and between attachment style ($F (3, 29) = 3.029$, $p<.05$; partial $\eta^2 = .239$). However, there was no significant difference in GSE over time between intervention and control groups ($F (1, 31) = .775$, $p>.05$).

Table 5
Pre-intervention and Post-intervention Mean GSE Scores According to Group

	Pre-GSE		Post-GSE	
Group	Mean	SD	Mean	SD
Intervention Group (n = 18)	30.28	3.691	32.61	4.203
Control Group (n = 15)	32.33	3.716	32.80	3.299

Table 6
Pre-intervention and Post-intervention Mean GSE Scores According to Attachment Style

	Pre-GSE		Post-GSE	
Attachment Style	Mean	SD	Mean	SD
Secure (n = 17)	32.76	2.587	34.29	2.779
Preoccupied (n = 8)	28.62	1.996	31.38	2.615
Dismissive (n = 4)	28.50	6.245	29.25	5.909
Fearful (n = 4)	32.50	5.066	32.00	4.830
Total (n = 33)	31.21	3.789	32.70	3.762

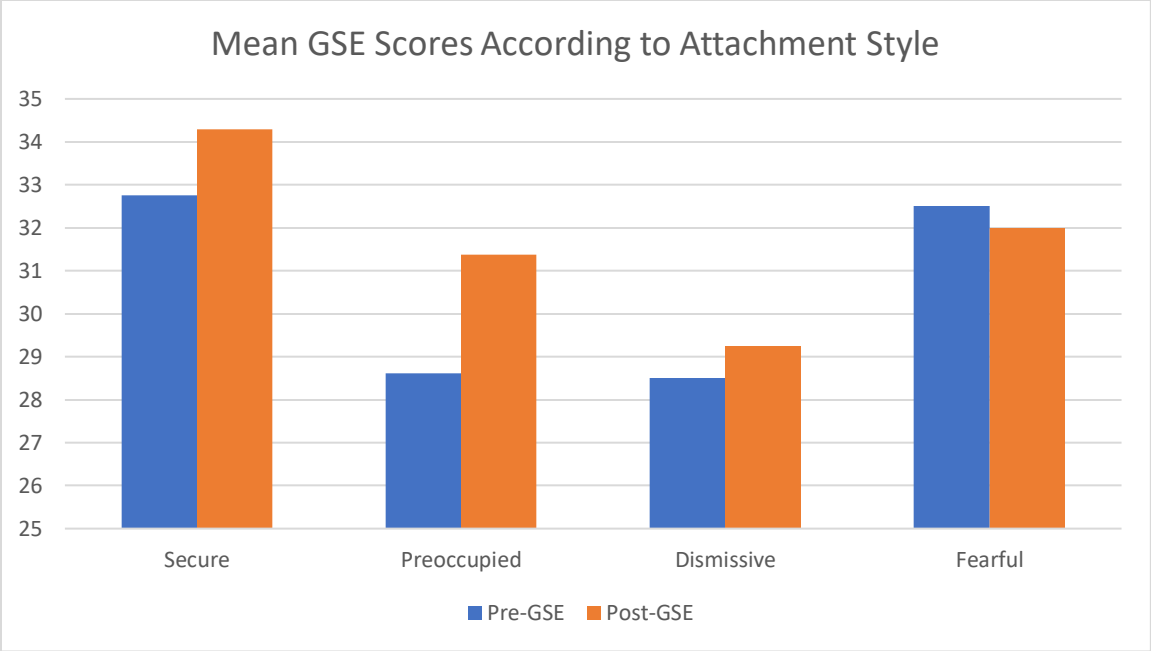

Figure 5. Pre- and post-intervention mean GSE scores by attachment style.

Table 7
Within-Subjects and Between-Subjects Interactions for Change in GSE Over Time According to Group and Attachment Style

	Sig.	Partial Eta Squared
Within-Subjects		
Time*Group	.007	.212
Time* AS	.016	.296
Between-Subjects		
Group	.386	.024
AS	.045	.239

**AS = attachment style*

A repeated measures ANCOVA was used to co-vary out the pre-intervention GSE to focus on comparing the interactions for change in GSE over time between control and intervention groups as well as attachment style, shown in Table 8. All assumptions were tested and met. Results showed the main effect for time within subjects was lost ($F(1, 24) = 1.601$, $p>.05$), eliminating any potential confounding factors including social support. Consistent with the previous results, these results showed statistical significance and moderate effect for change in GSE over time within groups ($F(1, 24) = 4.464$, $p<.05$; partial $\eta_2 = .157$) as well as statistical

significance and large effect within attachment style ($F (3, 24) = 3.602$, $p<.05$; partial $\eta^2 = .310$). Results also showed statistical significance and large effect for change in GSE over time between attachment style ($F (3, 24) = 3.602$, $p<.05$; partial $\eta^2 = .310$). Contrary to the previous ANOVA results, there was also statistical significance and moderate effect for change in GSE over time between the intervention and control groups ($F (1, 24) = 4.464$, $p<.05$; partial $\eta^2 = .157$). This indicates the intervention group showed greater improvement in GSE than the control group, illustrated in figures 6a and 6b below. Although there was no statistical significance between the interaction of group and attachment style, there was still a moderate effect (partial $\eta^2 = .152$), suggesting a potential significant difference of change in GSE in this interaction if a similar analysis was to be replicated with a larger sample size.

These results supported hypothesis 3 following the co-varying of pre-intervention GSE scores, with the intervention group exhibiting significantly greater improvement GSE scores than the control group. Additionally, though not part of the original hypothesis, results strongly supported a significant difference in GSE scores both within and between the different attachment styles with or without covarying pre-intervention GSE scores, with the secure and preoccupied attachment styles exhibiting the greatest increase in GSE over time.

Table 8
Within-Subjects and Between-Subjects Interactions for Change in GSE Over Time According to Group and Attachment Style with pre-GSE as a Covariate

	Sig.	Partial Eta Squared
Within-Subjects		
Time	.218	.063
Time*Pretest	.394	.030
Time*Group	.045	.157
Time*AS	.028	.310
Time*Group*AS	.258	.152
Between-Subjects		
Group	.045	.157
AS	.028	.310
Group*AS	.258	.152

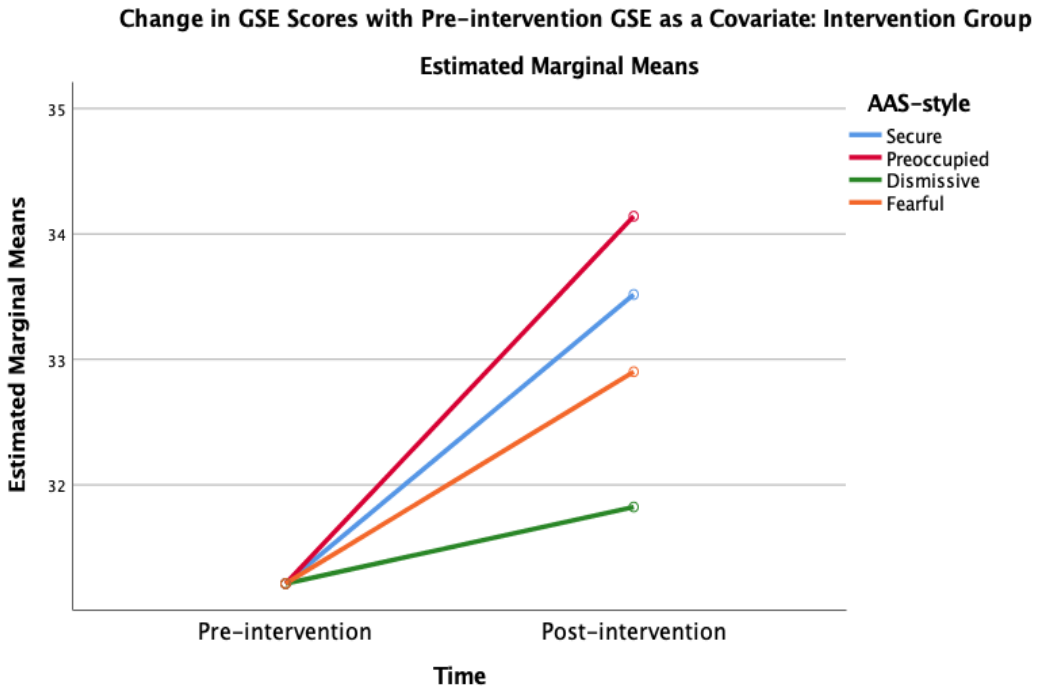

Figure 6a. Change in GSE scores over time with pre-intervention GSE scores as a covariate for intervention group.

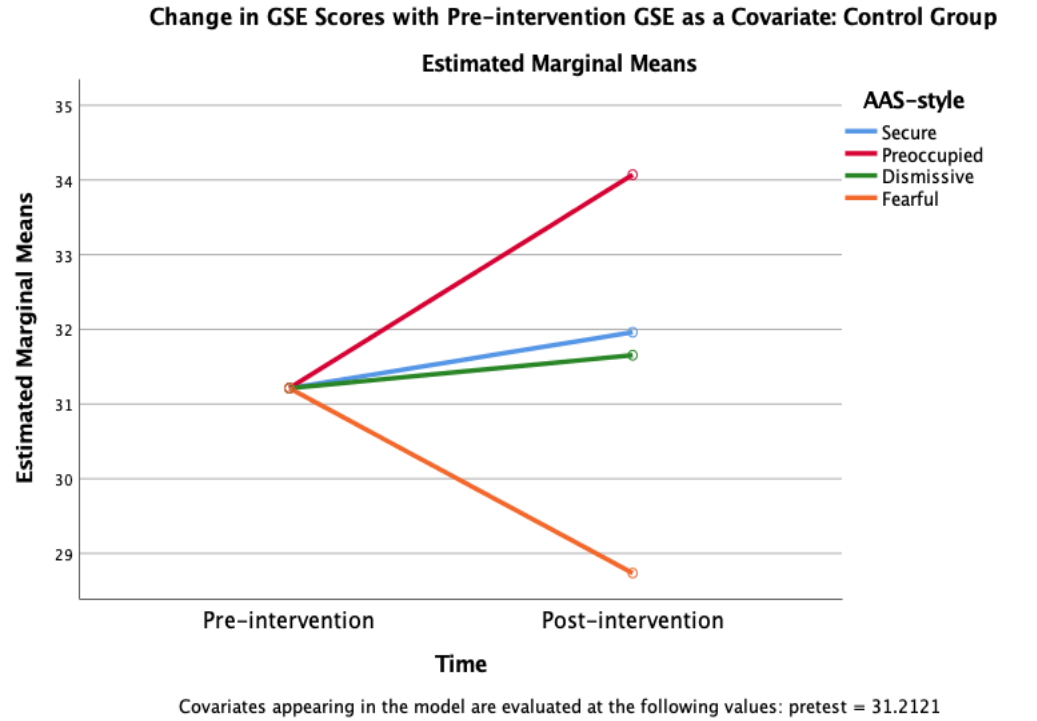

Figure 6b. Change in GSE scores over time with pre-intervention GSE scores as a covariate for control group.

Chapter 4

Discussion

The purpose of this experiment was to explore the effectiveness of a biofeedback-guided relaxation intervention as well as attachment style on the ability to self-regulate among college students with hopes for more effective approaches to mental health treatment. This study was specifically interested in whether those with a secure attachment style and those in the intervention group showed an increased ability to self-regulate as measured by PPG and EDA biofeedback data, as well as whether those in the intervention group exhibited a significant increase in self-efficacy as measured by the GSE self-report data.

Results from EDA and RMSSD data showed there was no significant difference in ability to self-regulate based on the intervention and control groups, which is divergent with current research that found applying relaxation techniques concurrently with biofeedback interventions increases self-regulation (Prato & Yucha, 2013; Henriques, et al., 2011). This may be a function of the strength of the biofeedback-guided relaxation intervention adapted for the present study. However, there was consistent evidence of a moderate to large effect for change in EDA based on group as well as interactions between time, group, and attachment style. Though hypothesis 2 was not fully supported at this time, these results suggest potential statistical significance with either an increased sample size and/or a more robust biofeedback-guided relaxation intervention that would support current research on biofeedback-based therapy interventions.

Both EDA and RMSSD data analysis exhibited statistical significance and moderate to strong effect for change in self-regulation abilities according to attachment style. These results are also convergent with current research corroborating the effects of early attachment styles on abilities to regulate affect and manage stress, which are important components of self-regulation

and perceived self-efficacy (Feeney, 2000; Christian, Sellborn, & Wilkinson, 2017). However, the hypothesis that the securely attached individuals receiving the intervention would demonstrate a higher capability to self-regulate compared to the non-securely attached groups based on biofeedback data was not supported with the current results. One possible explanation for the lack of differential response may be related to the baseline level of functioning. Overall, participants with a secure attachment style began the study with relatively stronger abilities to self-regulate compared to those with other attachment styles. This high level of baseline functioning could reflect the impact of a ceiling effect which may limit the effect of an intervention with moderate power.

Another unexpected finding was the main effect for decreased biofeedback arousal during the stimulus phase compared to the rest phases in part of the data. The fearful attachment group in particular demonstrated the largest disparity in decreased arousal during the stimulus phase versus the rest phases, which may be due to feeling less threatened and anxious when distracted with tasks like math problems in the stimulus phase. This may further support the prevalent differences in attachment style even regarding the response to types of sympathetic nervous system arousal.

Results from self-reported GSE data showed there was a significant increase in perceived self-efficacy for individuals post-intervention compared to their pre-intervention baseline GSE scores. Initial results did not show a significant difference in GSE scores differentiated by intervention or control groups, indicating hypothesis 3 was not supported. However, the present data appears to be consistent with current research that found biofeedback in combination with therapeutic techniques to be effective interventions for psychological symptoms, whether that be through a take-home 5-minute relaxation exercise or a 15-minute guided biofeedback relaxation

intervention, as evidenced by the significant change in individual GSE scores over time (Schoenberg & David, 2014).

Consistent with biofeedback data results, there was a significant difference in GSE scores between the different attachment style groups, which is convergent with research that found the quality of co-regulation and consistent availability of primary attachment-figures early in development largely impacts an individual's development of self-efficacy (Mikulincer, et al., 2003; Schore, 2014). While the securely attached group had the overall highest GSE scores both pre- and post-intervention, the preoccupied attachment style individuals showed the greatest improvement in GSE scores post-intervention. Following the additional analysis of co-varying out the pre-GSE scores for the purpose of focusing on the interaction of change in GSE in groups and attachment style over time, results showed a main effect for both attachment style and group with change in GSE, supporting hypothesis 3. Once pre-intervention GSE scores were co-varied, the intervention group showed greater improvement in self-reported self-efficacy compared to the control group. Though there was no significant interaction between group and attachment style for change in GSE scores, there was still a moderate effect. This suggests a potential for statistically significant changes in GSE scores between the attachment styles differentiated by intervention and control groups if similar analyses were to be replicated on a larger sample size.

Further research with a larger sample size may be warranted in order to compare findings with existing research on biofeedback-guided interventions, attachment style, ability to self-regulate, and perceived self-efficacy. Nonetheless, results from the present study further substantiated current research that studied how different attachment styles may impact response and adherence to treatment involving physiological therapeutic interventions for self-regulation. This moves the field of psychophysiology research a step closer to discovering clearer pathways

for effective implementation of psychophysiological therapeutic programs for college students to gain the necessary self-regulatory skills to manage developmental stressors.

Implications for Clinical Practice

It is worth exploring the pervasive implications of the patterns of biofeedback results with each respective attachment style, as the attachment patterns seemed to reveal the narrative of how one may respond to distress physiologically. Mikulincer, et al. (2003) stated the main goal of therapy is to repair a healthy attachment base in order to cultivate the necessary skills for self-regulation. The present study offers fertile soil for the implications of learning and applying self-regulation skills with regards to the construct of co-regulation and the focus of unique interventions for each respective attachment style.

In the present study, the EDA results showed to be more responsive or sensitive to change than the PPG or HRV results. This is likely because EDA is collected from the skin, a large and immediately responsive organ, whereas PPG requires the autonomic nervous system to respond. There are more steps involved for the HRV to be impacted by a stimulus, as HRV is not completely controlled by the conscious mind. This is illustrated by the dismissive attachment style group, which showed to have a more regulated HRV but a higher arousal in EDA. This discrepancy between the different components of the autonomic nervous system implies that individuals have adapted to different ways of physiological regulation. Relatedly, this study shows utilizing a more intuitive biofeedback reading such as EDA may be more helpful as a therapeutic intervention, as the EDA readings were what the researcher used to facilitate the guided-relaxation intervention with participants in this study. So long as the participants perceive themselves to have self-efficacy over controlling and lowering their visible EDA biofeedback, self-regulatory abilities may improve; self-efficacy is the perceived belief that one has agency

and control over their environment in times of distress, which directly impacts self-regulatory behaviors (Bandura, et al., 2003).

Self-regulatory abilities in those with a preoccupied attachment style either worsened or showed little improvement in their biofeedback response, which may be due to the final biofeedback session feeling performative or like a "test." The preoccupied attachment style group showing the greatest improvement in self-report GSE data appears to further support their anxious attachment style, possibly desiring to perform well and be seen in a favorable light. It may be essential to focus on the sense of fear of isolation or abandonment with these individuals in order to nurture a sense of self-efficacy and agency in overcoming life stressors, rather than depending solely on an external locus of control for emotional regulation and self-worth.

Those in the intervention group with a fearful attachment style showed great improvement in their ability to self-regulate, while those in the control group exhibited an irregular or decreased ability to self-regulate. This was further supported by the GSE self-report data, as those in the intervention group exhibited an increase in perceived self-efficacy while those in the control group exhibited a decrease in perceived self-efficacy post-intervention. This implies those with a fearful attachment style showed an increased ability to self-regulate due to the face to face guided biofeedback intervention compared to those in the control group who had to practice the relaxation intervention alone. Thus, working with individuals with this form of insecure attachment may necessitate a more prolonged, gentle holding environment within the therapeutic relationship, perhaps along the lines of trauma-informed care. This may help with the development of a strong sense of self in order to move towards empowering their sense of agency and internal locus of control similar to those with a preoccupied attachment style.

Participants with a dismissive attachment style consistently revealed a poor ability or no change in ability to self-regulate, regardless of the intervention or human contact with the researcher facilitating the intervention. This implies individuals within this attachment style are not able to be soothed by others or desire to avoid contact with others. As a result, they may become more dysregulated at the sight of their inability to control their biofeedback responses, viewing the biofeedback intervention as disempowering rather than empowering their sense of self-efficacy. Working therapeutically with those of avoidant or dismissive attachment style may involve focusing on re-building connection with their emotions as well as with others, as these individuals may not have been provided a safe holding container to express anxiety for fear of dismissal or disregard of their personhood. It may be crucial to allow more time and space to build trust in order to validate and encourage the worth of their emotional experience, as well as facilitate a "re-parenting" of co-soothing and emotional bonding before engaging in psychophysiological interventions with them.

To further support these implications for non-securely attached individuals, the present results showed the securely attached individuals in both the intervention and control groups exhibited a consistent ability to self-regulate post-intervention. This implies that the securely attached individuals already had the necessary coping skills early on to self-soothe and self-regulate, regardless of whether the intervention was through an in-person guided intervention or a 5-minute coping intervention done on their own. These individuals are projected to respond favorably to psychophysiological therapeutic interventions due to experiencing strong attachment security from an early age, which is the vital therapeutic goal for non-securely attached individuals.

This experimental study suggests a multitude of both theoretical and clinical implications within the realm of understanding the intimate bond between psychological and physiological symptoms, ability to self-regulate in times of distress, and delivery of clinical services while taking into consideration the responsiveness and adherence to mental health treatment according to attachment style. Utilizing the co-regulatory therapeutic space to help restore healthy, secure attachment through unique interventions corresponding to each patient's individual attachment style may be helpful to cultivate self-efficacy and self-regulation, just as Emotionally Focused Therapy focuses on transforming interpersonal conflict within couples to adaptive co-regulation during times of distress (Pascuzzo, et al., 2015). Assessing each patient's attachment style may inform the path to successful psychophysiological treatment and aid mental health care providers to tailor ways of therapeutic connection unique to each individual's way of coping with adverse life experiences, making relational contact with others, and thriving in the world.

Limitations

The small sample size is the largest limitation of the present study, restricting the power and generalizability of the findings. Similarly, this study utilized a convenient sample of undergraduate college students from a small, private university, which may not accurately account for various diverse factors. As such, the limitation of the sample should be taken into consideration when interpreting experimental findings. Another potential limitation to consider within the experimental design is the use of math problems for the stimulus phase in order to induce sympathetic nervous system arousal, as previous affinity for math was not measured before utilization. This may have affected the participant's biofeedback responses, with some experiencing less sympathetic arousal than others. As mentioned above, it may be important to assess what type of stimulus is appropriate to induce sympathetic arousal for the purposes of this

research experiment on self-regulatory abilities. Regarding the methodology of this study, the inability to completely monitor individual participant adherence to the 5-minute relaxation intervention, 5 times per week during their own time is another limitation to this study.

Suggestions for Future Research

There are several pathways leading from the present study that may be worthwhile for future research. The first is to replicate these experimental methods with a larger clinical population, with a more accurate representation of the geographical region or specific population in focus, in order to appraise the generalizability of the findings. Increasing the sample size may also help to clarify whether the PPG biofeedback data substantiates or contradicts the EDA biofeedback results in order to discern how physiological intervention can be best paired with therapeutic interventions in clinical practice. Other potential future research could work to adapt and test a more robust biofeedback-guided intervention, perhaps over a longer period of time in order to examine the effects of the intervention itself. Additional research focusing on the impact of co-regulation used to increase self-regulatory or self-soothing behaviors based on attachment styles may help further contribute to the understanding of how people are able to gain self-regulatory abilities by increasing healthy attachment patterns.

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Appendix A

Informed Consent for Research Participants
George Fox University
Graduate School of Clinical Psychology

Description of Study and Your Involvement
The purpose of this research is to examine the relationship between adult attachment style and the ability to self-regulate physiological responses using relaxation techniques. This is a 6-week research study that will involve approximately 30-45 minutes of participation per week. The first session will be an individual meeting with the primary researcher, and you will be asked to fill out 2 questionnaires and personal background information. Electrodes will also be attached to your palm using adhesives in order to measure your pulse and skin temperature, and your ability to decrease your pulse and skin temperature will be measured. During the 2nd through 5th weeks, you will be asked to practice a 5-minute relaxation intervention, 5 times during the week before you come to the next session. You will be kept accountable electronically with the researcher. You may also be asked to meet with the primary researcher individually once per week for a 10-15 minute biofeedback-guided relaxation intervention. The 6th session will be another individual meeting with the primary researcher, and you will be asked to fill out another questionnaire, and go through the same procedure as the first meeting with the electrodes measuring your pulse and skin temperature.

Possible Risks and Benefits of This Study
Some questions on the questionnaires or parts of the relaxation treatment procedure may cause you to think about your stressors or other negative emotions. The relaxation treatment procedure may decrease stress and anxiety symptoms, and teach you techniques to control these symptoms on your own once your participation is complete.

Compensation
You will receive research credits for your psychology course equivalent to the duration of your participation in this study. In addition, gift cards will be given to participants who complete the entire 6-week study.

Confidentiality
All data will be kept in secure files in accordance with the standards of the University, Federal regulations, and the American Psychological Association. Your name will be replaced by a code and will be separated from the data as soon as your participation is complete. Data will kept confidential and only the main investigator and faculty advisor will have access to identifying information.

Questions or Concerns
Any questions or concerns about this research may be directed to:

Primary Researcher: Priscilla Shim, MA
pshim16@georgefox.edu/(616) 635-7192

Supervisor: Mary Peterson, PhD, ABPP
mpeterso@georgefox.edu/(503) 442-3237

Consent
I have read the description of this research regarding an intervention for relaxation, and have voluntarily chosen to participate. I understand the questionnaire, background, pulse, and skin temperature information is to be received and maintained in confidence and used for research purposes only. I also understand that I may discontinue participation at any time prior to the completion of data collection, and will still receive the equivalent number of research credits for my hours participated, but will forfeit the gift card. I have also received a signed copy of this consent form.

_____ _____
Signature of Participant Date

Appendix B

Adult Attachment Scale (AAS)

The following questions concern how you generally feel in important close relationships in your life. Think about your past and present relationships with people who have been especially important to you, such as family members, romantic partners, and close friends. Respond to each statement in terms of how you generally feel in these relationships.

Please use the scale below by placing an X in the appropriate space provided to the right of each statement.

1----------2----------3----------4----------5

Not at all characteristic of me Very characteristic of me

How much would you agree with the following statements?

	1	2	3	4	5
1. I find it relatively easy to get close to people					
2. I find it difficult to allow myself to depend on others					
3. I often worry that other people don't really love me.					
4. I find that others are reluctant to get as close as I would like.					
5. I am comfortable depending on others.					
6. I don't worry about people getting too close to me.					
7. I find that people are never there when you need them.					
8. I am somewhat uncomfortable being close to others.					
9. I often worry that other people won't want to stay with me.					
10. When I show my feelings for others, I'm afraid they will not feel the same about me.					
11. I often wonder whether other people really care about me.					
12. I am comfortable developing close relationships with others.					
13. I am uncomfortable when anyone gets too emotionally close to me.					
14. I know that people will be there when I need them.					
15. I want to get close to people, but I worry about being hurt.					
16. I find it difficult to trust others completely.					
17. People often want me to be emotionally closer than I feel comfortable being.					
18. I am not sure that I can always depend on people to be there when I need them.					

Appendix C

General Self-Efficacy (GSE) Scale

Scoring:

	Not at all true	Hardly true	Moderately true	Exactly true
All questions	1	2	3	4

General Self-Efficacy Scale (GSE)

	Not at all true	Hardly true	Moderately true	Exactly true
1. I can always manage to solve difficult problems if I try hard enough	☐	☐	☐	☐
2. If someone opposes me, I can find the means and ways to get what I want.	☐	☐	☐	☐
3. It is easy for me to stick to my aims and accomplish my goals.	☐	☐	☐	☐
4. I am confident that I could deal efficiently with unexpected events.	☐	☐	☐	☐
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	☐	☐	☐	☐
6. I can solve most problems if I invest the necessary effort.	☐	☐	☐	☐
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	☐	☐	☐	☐
8. When I am confronted with a problem, I can usually find several solutions.	☐	☐	☐	☐
9. If I am in trouble, I can usually think of a solution	☐	☐	☐	☐
10. I can usually handle whatever comes my way.	☐	☐	☐	☐

Appendix D

BIOPAC Product Sheet

See: https://www.biopac.com/wp-content/uploads/MP160-Systems.pdf

Appendix E

The Breath Practice Audio Protocol

(Refer to Brown and Gerbarg's (2012) book for full details and protocols)

Total run time – 72:01

Track 1 – Introduction (30 seconds)

***Track 2 – Instruction: Coherent Breathing Chime Track at 5 bpm (5 minutes)**

Track 3 – Instruction: Resistance Breathing (3 minutes)

Track 4 – Instruction: Breath Moving with Coherent Breathing (6 minutes)

Track 5 – Instruction and Practice: "Ha" Breath (2 minutes)

Track 6 – Instruction and Practice: Breath Counts 4-4-6-2 (2 minutes)

Track 7 – Instruction and Practice: Om and Song Kong Tong Dong (5 minutes)

Track 8 – Practice: Total Breath with Chime Track at 5 bpm (21 minutes)

Track 9 – Practice: Body Scan (5 minutes)

Track 10 – Practice: Total Breath with Chime Track at 6 bpm (21 minutes)

Track 11 – Practice: Body Scan (5 minutes)

*Used for the 5-minute relaxation intervention

Appendix F
Biofeedback-guided Grounding and Relaxation Intervention Protocol

Initial Session – Week 1

Resting (2 min): Just relax, and try to keep your arm and hand as still as you can.

Stimulus (3 min): Now I'm going to give you some math problems to solve. Try to solve as many and as quickly as you can, while keeping your other arm as still as possible. Please don't write on the packet, use the blank sheet of paper. Just try your best.

Resting (2 min): Now try to relax, just like before you solved the math problems.

Biofeedback Intervention Protocol
Weeks 2 – 5

Intro: We're going to practice some relaxation exercises today. This top part is your heart rate, and the bottom part is your skin conductance or skin sweat response, which is very sensitive to any anxiety or stress. You can see the green bar increase or spike when you think about stressful things or anything else that is worrying you.

4 minutes: Focus on this green bar and the number below it. Try to relax to get the green bar and number down as low as you can. Use the breathing technique you've been practicing throughout the week on your own. Try your best to empty your mind, and just focus on your breathing pattern.

4 minutes: Continue to focus on your breathing, slowing it down and breathing in and out deeply. Focus on how your body is feeling right now. Place your other hand on your stomach and feel how it moves out as you breathe in through your nose, and moves in when you breathe out through your mouth. Try that several more times.

7 minutes: Focus on how your body feels as the number or green bar decreases. Pay attention to your breathing and how the different parts of your body feel.

- Let's start from your feet, notice how your feet feel in your shoes, against the ground, if there's any tension there or clenching, try to release that. (pause for several seconds)…
- Move your attention up to your lower legs/calves, release any tension in your muscles…
- Move your attention up to your upper legs/thighs, release any tension in your muscles, notice how your legs feel against the chair…
- Focus on your back and your posture, how it feels against the chair…
- Your stomach and the rhythm as you breathe in and out…
- Your chest and your shoulders, if there is any tension or knots, let those go…
- Relax your arms…
- Pay attention to if there's any strain in your neck and relax…

- Focus on your head and your face, notice any tension in your eyebrows, any clenching in your jaws, and relax those.

    As you keep breathing in and out slowly, continue to notice how each part of your body feels.

Great job. Try to remember what we practiced here for our next biofeedback session.

Final Session – Week 6

Resting (2 min): Just relax, and try to keep your arm and hand as still as you can.

Stimulus (3 min): Just like our first session, I'm going to give you some math problems to solve. Try to solve them as quickly as you can, while keeping your other arm as still as possible.

Resting (2 min): Now use the relaxation skills you've learned these past several weeks to relax, just like before you solved the math problems.

Appendix G
Demographic Questionnaire

1. Name:
2. SONA ID# (if remembered):
3. Date of birth:
4. Year in school:
5. Gender:
6. Race/Ethnicity:
7. Have you ever done a mindfulness or relaxation training before? Y/N
8. Have you ever received therapy or counseling in the past? Y/N