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The Impact of Applied Mental Health Classes on Eudaimonia, Gratitude, and Heart Rate Variability

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ABSTRACT

The Impact of Applied Mental Health Classes on
Eudaimonia, Gratitude, and
Heart Rate Variability

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Rates of depression, anxiety, and stress have been increasing and college students are especially at risk. College counseling centers often have long waitlists and have difficulty addressing the growing need for psychotherapy. Researchers have suggested that depression and anxiety may arise because of low levels of eudaimonia and self-compassion. Depression and anxiety not only have a toll on mental health but on physical health as well, as researchers have observed decreased HRV in individuals with depression and anxiety. To address the disparity between available resources and treatment need, applied mental health classes were developed to see if teaching psychotherapeutic principles in the classroom setting would lead to decreases in depression, anxiety, stress, and improvements in eudaimonia, gratitude, self-compassion, and HRV. Data was collected from students in the applied mental health classes and were compared to a control group of students who were not in those classes. HRV was measured twice (beginning and end of the academic semester), and questionnaire data was collected three times (beginning, middle, and end of the academic semester). A total of 44 students (86% female) were recruited from the applied mental health classes with 34 completing the whole study and 190 students (62% female) were recruited for the control group with 76 completing the study. SEM was used to analyze change across time for each of these variables. There were not significant changes in distress, eudaimonia, gratitude, self-compassion, or HRV across the semester in both the experimental and control group. More specifically, the students in both the applied mental health class and control group were not significantly distressed at baseline and had high HRV. There were many ceiling and floor effects in this sample which left little room for improvement. Testing this class in a more distressed sample will help elucidate the impact that these classes can have.

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Mental illness is a significant health crisis. Approximately 46% of the population will experience some form of mental illness during their lifetimes (Kessler & Zhao, 2010; Nochaiwong et al., 2021). This rate goes up for those ages 18 to 29 with that percentage increasing to 52.4% (Kessler & Zhao, 2010; Nochaiwong et al., 2021). Unfortunately, the number of clinicians that provide mental health treatment is not enough to meet the growing demand and researchers suggest that this gap between supply and demand will continue to exist for years to come (Center for Behavioral Health Statistics and Quality, 2018; U.S. Department of Health and Human Services, 2017; Vostanis & Bell, 2020). Many private practices, university counseling centers, and clinics have long waitlists, suggesting that many people must wait months before they can get the treatment they need (Thomas et al., 2020).

University counseling centers are often overwhelmed by the vast need of mental health services (Fu & Cheng, 2017). Researchers observing the prevalence of mental illness in college students found that about 20% to 35% of college students qualified for a diagnosis of a mental disorder (Auerbach et al., 2016, 2018), but the mean percentage of students served by counseling centers is only 13% of the student population (Gorman et al., 2020). Additionally, the annual survey of college counseling centers found that 45.6% of counseling centers have session limits, meaning that therapy often ends before full therapeutic benefit is reached. Given the estimated prevalence of mental disorders and mean percentage of students served, about 35% to 63% of students with a diagnosis of a mental disorder are not receiving the full mental health services that they can benefit from.

Depression and anxiety are the most common symptoms of mental illnesses that college students experience (Moeller & Seehuus, 2019). Many college students are having to cope with a variety of new stressors like moving out of home, having decreased support from parents, exposure to new ideas and cultures, new financial responsibilities, making new friends, and making future life plans (Falsafi, 2016). The culmination of all these new stressors can often lead to depression and anxiety if adaptive coping strategies are not present (Falsafi, 2016). Depressed and anxious college students report significant academic problems, lower GPA, inability to concentrate, missed classes, lower academic productivity, and interpersonal difficulties (Fazio & Palm, 1998; Pritchard & Wilson, 2003). The incidence of depression and anxiety in college students is high (33%) and can lead to great impairment (Sarokhani et al., 2013).

One reason for the incidence of depression and anxiety may be because of low eudaimonia and gratitude (Coleman et al., 2016; Emmons & Mishra, 2011; Harris, 2019; Liu et al., 2009; Ryff & Singer, 2008; Stein et al., 2021). A review by Ruini & Cesetti (2019) observed that many of the studies demonstrating increased depression and anxiety with low eudaimonia and gratitude are correlational while many treatment studies show that depression and anxiety decrease with interventions that focused on gratitude and eudaimonia. There are varying ways that eudaimonia has been conceptualized over time. Aristotle posited that life was more than being happy and that one should pursue a self-realization that was unique to everyone based on their talent and disposition while others suggested that eudaimonia was self-actualization or optimal functioning (Ryff & Singer, 2008). This paper will use Ryff's definition of eudaimonia, which includes self-acceptance (i.e., positive attitude toward the self, acceptance or acknowledgement of both good and bad qualities of the self), autonomy (i.e., self-determining, independent, one's ability to evaluate themself by personal standards), environmental mastery

(i.e., competence in managing one's environment and making effective use of their present opportunities), personal growth (i.e., feeling of continued development and seeing improvement in oneself and their behavior over time), positive relationships (i.e., having warm, empathic, satisfying, and trusting relationships with others), and meaning and purpose in life (i.e., sense of directedness, feels there is meaning to life; Ryff, 1989). Various therapeutic orientations assume that psychological distress arises because of impairments or a lack of these eudaimonic principles. In Acceptance and Commitment Therapy (ACT), psychological distress arises from disconnection from values, lack of present moment focus, avoidance of thoughts and emotions, and rigidity in a client's perception of themselves and their world (Harris, 2019). In positive psychology, psychopathology develops because of a dysregulation of strengths such as deficits in environmental mastery, positive relationships, gratitude, and in being overanalytical (Rashid & Seligman, 2018). Individuals may have depression or anxiety because of a lack of purpose, environmental mastery, perspective, positive relationships, or acceptance (Rashid & Seligman, 2018). Compassion Focus Therapy (CFT) focuses on reducing self-criticism, shame, and inaccurate perspectives of the self which leads to psychopathology (Coleman et al., 2016; Gilbert, 2014). This excess of self-criticism can move individuals away from self-acceptance and can negatively impact one's sense of environmental mastery and competence (Gilbert, 2014). These theoretical assumptions of psychopathology are also supported in the research. Those with depression and anxiety have showed decreased amounts of gratitude, self-compassion and self-acceptance, environmental mastery, a lack of values and value focused behavior, diminished personal growth, and decreased positive relationships (Goodman et al., 2018; Knight et al., 2011; Mehr & Adams, 2016; Popov, 2019; Watkins et al., 2004; Zaman & Naqvi, 2018).

Depression and anxiety can also take a toll on an individual's physical health (Nelson et al., 2013; Pettit et al., 2001; Ryff et al., 2004; van de Pavert et al., 2017). For example, those with higher psychopathology are at higher risk for heart disease, chronic pain, and other medical conditions (e.g., asthma, chronic headache/ migraine, eczema) (Beauchaine & Thayer, 2015; Carleton et al., 2018; Chalmers et al., 2016; Cox et al., 2002; Di Simplicio et al., 2012; van Rijen et al., 2005). Mental disorders are also linked to increased morbidity and mortality (World Health Organization, 2018). One potential explanation for this increased risk is lower heart rate variability (HRV; mean of successive differences in heart beats), a measure of autonomic balance and higher levels of HRV is associated with an increased ability to adapt to stressors, be resilient, and have improved physical health (Shaffer & Ginsberg, 2017). The burden of mental health goes beyond psychological well-being as mental health negatively impacts physical well-being as well.

The negative impact of psychopathology on mental and physical health is concerning; however, psychological treatments that incorporate breathing, mindfulness, and self-compassion have observed increases in both measures of psychological and physical well-being (e.g., HRV). For example, Mankus et al. (2013) found that participants with severe levels of anxiety experienced a decrease in anxious symptoms and an increase in HRV during mindfulness-based psychotherapy. Comparable results were observed in individuals with depression in a treatment study implementing CBT with an additional breathing component (Chien et al., 2015). Psychotherapy that involves mindfulness and breathing exercises have demonstrated both decreases of depressive and anxious symptoms and significant improvement in HRV.

Considering the high prevalence of individuals with depression and anxiety on college campuses and the deleterious effects of mental disorders on both psychological and physical

health, some universities have introduced applied mental health classes that teach

psychotherapeutic principles in the classroom setting in hopes of reaching more students in need.

Some studies have found positive treatment outcomes from cognitive and behavioral therapy

(CBT) and acceptance and commitment therapy (ACT) in the classroom setting (Bennett-Levy et

al., 2001; Pistorello et al., 2013). The positive outcomes from these classes are promising, as this

alternative treatment setting may help reach more students in need. This may be particularly

important given that early detection of depression and anxiety in college can reduce symptom

severity, and duration of future mental health problems (Cuijpers et al., 2008; Kupfer et al.,

1989). These classes can provide at least a partial solution to the gap between supply and

demand in psychotherapy in the university setting.

No study to date has examined the effects that applied mental health classes can have on

eudaimonia, gratitude, and HRV. Individual psychotherapy has been shown to increase

eudaimonia and an initial study examining changes in gratitude from psychotherapy shows

increases in gratitude as well (Danitz & Orsillo, 2014; Pearce et al., 2016). The relationship

between therapy outcomes, eudaimonia, gratitude, and HRV are less clear as both significant and

non-significant relationships were observed in studies examining changes in HRV after therapy

(Caldwell & Steffen, 2018; Chien et al., 2015; Jans-Beken et al., 2020; Redwine et al., 2016;

Sloan et al., 2017; Trimmel, 2015). The present study examined the outcomes of applied mental

health courses and whether they led to decreases in depression and anxiety, and increases in

facets of eudaimonia, gratitude, and measures of HRV. This study also examined the potential

mediating effects of eudaimonia, compassion, and gratitude on depression, anxiety, stress and

HRV (RMSSD, HF HRV). The rest of this paper will discuss the relationships between

depression and anxiety with eudaimonia and gratitude, the impact of eudaimonia on both mental

and physical health, and how psychotherapy can improve eudaimonia and gratitude in the classroom setting.

Depression and Anxiety are Associated with Diminished Eudaimonia and Gratitude

A lack of eudaimonia plays an important role in the development of depression and anxiety. The influence of Ryff's six facets of eudaimonia on depression and anxiety were tested by Liu et al. (2009) using structural equation modeling (SEM). They observed that autonomy, environmental mastery, positive relationships, and self-acceptance were significantly negatively related to depression and that environmental mastery, personal growth, positive relationships, purpose in life and self-acceptance were significantly negatively related to anxiety (Liu et al., 2009). In another 10-year longitudinal study, researchers observed that individuals low in psychological well-being (as measured by Ryff's six facets) were 7.16 times more likely to be depressed 10 years later (Wood & Joseph, 2010). After controlling for personality, negative functioning, prior depression, physical health variables, and demographic variables those with low psychological well-being were still over twice as likely to be depressed (Wood & Joseph, 2010). Research on meaning and its impact on depression and anxiety observed that a higher sense of meaning was related to lower symptoms of both depression and anxiety and that meaning was a significant predictor of less symptoms of depression (Marco et al., 2021; Vehling et al., 2011). Meaning in life is also a protective factor against self-harm behaviors common in individuals with depression and anxiety (Kress et al., 2015). Those low in eudaimonia are more at risk for the onset of depression and anxiety.

Gratitude also plays a role in depression and anxiety (Emmons & Mishra, 2011). Gratitude can be defined as an acknowledgment that one has received something of value, a quality of being thankful, or an appreciation for the positive things in life (e.g., people, life

events; Emmons et al., 2019). People that are frequently grateful appreciate what they have and gain (e.g., relationships, resources) which helps maintain a positive perception of life (Wu et al., 2018). Gratitude has been broken down into two different facets: dispositional gratitude and state gratitude (Emmons et al., 2019). Dispositional gratitude (or trait gratitude) is associated with long lasting patterns or stable affective traits of gratitude, while state gratitude (or gratitude as an emotion) is understood to be an acute and intense psychophysiological reaction to being a recipient of a benefit from another (McCullough et al., 2004). Many individuals with depression and anxiety have lower levels of gratitude and see the world through a negative lens (Watkins et al., 2004). Beck (1979) described this negative perspective as the cognitive triad, or a negative perception of the self, of the world, and of the future. This negative perception of the self, world, and future directly opposes a grateful disposition, which values an appreciation for others and life circumstances.

Many studies suggest that a lack of gratitude plays a role in the development and maintenance of depression and anxiety. Gratitude can be impaired from adverse childhood experiences which often leads to depression and anxiety (Coleman et al., 2016; Vartanian et al., 2014). Individuals who experienced neglect and abuse in childhood experience increased difficulty in appreciating others and circumstances in adulthood (Wu et al., 2018). Wu et al. (2018) found that gratitude was a mediator between childhood neglect and sexual abuse in the development of adult depression. Similar deficits in gratitude are observed in individuals with depression and anxiety outside of adverse childhood experiences as well (Scott et al., 2021). A grateful perspective plays a key protective role in resilience and preventing the onset of depression and anxiety.

Increasing Eudaimonia and Gratitude Improves Both Mental and Physical Health

Self-Acceptance

The following sections will explore the relationships between each facet of eudaimonia and both mental and physical health. Increased amounts of self-acceptance led to improvements in mental health. Self-acceptance can be defined as the ability to see and accept one's strengths and weaknesses (Ryff et al., 2004). In a study comparing the impact of self-acceptance and self-esteem on depression and anxiety, researchers observed that self-acceptance predicts lower levels of anxiety, depression, negative affect, and increased positive affect (Popov, 2019). In a sample of university students, self-acceptance was related with lower general symptoms of psychopathology (Liu et al., 2009). Self-acceptance is also associated with increased emotional regulation (Droutman et al., 2018). Self-acceptance was related to fewer internalizing and externalizing problems and authors suggested that self-acceptance and nonreactive observing may be key facets in the impact of mindfulness on psychopathology (Stein et al., 2021).

The positive effects of self-acceptance are also carried over to physical health. A 20-year longitudinal study observed that those high in self-acceptance had decreased mortality risk when controlling for other components of psychological well-being (e.g., purpose in life, positive relationships, personal growth, and environmental mastery) and potential confounding variables (e.g., personality, depression, self-rated health, smoking status, illness, body mass index; Ng et al., 2020). More specifically, self-acceptance decreased mortality risk by 19% and added three years of life (Ng et al., 2020). The relationship between self-acceptance and mortality may be explained by relationships with positive health behaviors. Many studies found that self-acceptance is also associated with a number of positive health behaviors like healthy eating, exercise, smoking cessation, medical adherence, and seeking medical care (Adams & Leary, 2007; Brion et al., 2014; Kelly et al., 2010; Magnus et al., 2010; Terry et al.,

2013). Self-acceptance is also related to higher levels of perceived physical health (Bekenkamp et al., 2014). Overall, self-acceptance had a significant impact on decreasing risk for mortality.

Although the positive relationships between self-acceptance and physical health have been repeatedly observed in numerous studies, these positive findings have not been observed in HRV thus far. A large study by Sloan and colleagues (2017) using the midlife development in the U.S. (MIDUS) data did not observe significant relationships between self-acceptance and HF HRV in 967 participants at baseline when controlling for sex, age, body mass index (BMI), menstrual status, exercise, and smoking status. Self-acceptance has a clear positive influence on physical health, but the evidence of this relationship in HRV has not been observed.

Self-Compassion

Research on self-compassion demonstrated that self-compassion is also a strong predictor of reduced depression, trait anxiety and greater life satisfaction (Dryden, 2013; Mehr & Adams, 2016). Self-compassion, although similar to self-acceptance in its emphasis on being mindful of one's strengths and weaknesses, differs in that self-compassion adds a level of self-kindness and common humanity (i.e., acknowledgement that humans are imperfect and that one is not alone in their suffering; Germer & Neff, 2013; Neff & Vonk, 2009). Researchers have also observed that self-compassion partially mediates change in anxiety and depression (Mehr & Adams, 2016; Takahashi et al., 2019). A recent meta-analysis of randomized controlled trials on self-compassion found large effect sizes for self-compassion's effects on rumination ($g = 1.37$) and moderate effect sizes for stress ($g = 0.67$), depression ($g = 0.66$), and anxiety ($g = 0.57$; Ferrari et al., 2019). Researchers have suggested that the positive relationships between self-compassion and positive health behaviors are explained by self-compassion's relationship to increased self-regulation (Terry & Leary, 2011). Those that are self-compassionate are willing to face their

failures and challenges with acceptance and as something that commonly happens instead of becoming consumed by negative feelings or stress (Homan & Sirois, 2017).

When observing self-compassion in a lab setting, individuals high in self-compassion showed lower sympathetic nervous system (SNS) activation and reduced inflammatory response following exposure to a lab stressor (Breines et al., 2014). Another study examining the root mean square of successive differences of beat to beat differences in heart rate (RMSSD), a measure of vagally mediated HRV, observed that those high in self-compassion had higher RMSSD following an acute stressor (Svendsen et al., 2016). Additionally, interventions designed to increase self-compassion produced decreases in perceived stress (Brion et al., 2014; Finlay-Jones et al., 2015; Pinto-Gouveia et al., 2014). A recent meta-analysis by Di Bello and colleagues (2020) observed a significant positive association between compassion and HRV. The effect size was reported at $g = 0.40$ after removing an extreme outlier. Compared to other interventions, the effect size of compassion on HRV was stronger than the impact of mindfulness-based interventions on HRV (Di Bello et al., 2020). Self-compassion has clear positive impacts on HRV.

Autonomy

In self-determination theory, autonomy plays a key role in leading to psychological well-being. Autonomy can be defined as having the strength to follow one's beliefs and convictions (Ryff et al., 2004). Autonomy is a fundamental dimension in shaping the psychological well-being of adolescents and young adults and is negatively correlated with loneliness and self-perceived isolation during this stage of life (Charry et al., 2020; Inguglia et al., 2015; Parra et al., 2015). Researchers have observed that daily psychological well-being may be understood in terms of the degree to which three needs, autonomy, competence, and relatedness are satisfied in

daily activity (Reis et al., 2018). Autonomy also predicts favorable outcomes on measures of positive emotion, negative emotion, and depression (Liu et al., 2009; Reis et al., 2018). Autonomy is an important facet in psychological well-being and is a significant predictor of mental illness.

Higher levels of personal autonomy result in improved physical well-being largely by increasing health behaviors (Williams et al., 2011). A randomized trial of 1,006 adult smokers, those that received an intensive self-determination theory based intervention on autonomy for tobacco dependence increased six and 18 month prolonged abstinence by more than 2.5 times compared to community care (Williams et al., 2006). In a 12 month longitudinal study of 128 patients with diabetes, personal autonomy was significantly negatively correlated with baseline measures of glucose control in their hemoglobin at the beginning of the study, and at a four and 12 month check in (Williams et al., 1998). Another study found that autonomy predicted a healthier diet and increased physical activity in individuals with coronary heart disease (Williams et al., 2005). Research on the influence of autonomy on physical health shows significant relationships through positive health behaviors.

Personal Growth

Personal growth predicts positive outcomes in depression and anxiety (Liu et al., 2009). Personal growth can be defined as the feeling that one's personal talents and potential are being realized over time (Ryff et al., 2004). Those with higher levels of personal growth were less likely to have depression in a 10 year longitudinal study (Wood & Joseph, 2010). Personal growth serves as an important moderator between the relationship of stress and mental health in teenagers (Zaman & Naqvi, 2018). This study observed that those with high levels of stress had low scores on mental health (as measured by a broad measure of emotional, psychological, and

social functioning), however, this relationship was buffered by personal growth (Zaman & Naqvi, 2018). Those with high stress and high personal growth had significantly higher measures of mental health in comparison to those with high stress and low personal growth (Zaman & Naqvi, 2018). Personal growth can be protective against poor mental health despite high amounts of stress.

Personal growth has been shown to impact an individual's physiology. Individuals with higher levels of personal growth have significantly improved neuroendocrine regulation (i.e., lower cortisol at the beginning and throughout the day) compared to those with lower levels of personal growth (Ryff et al., 2004). Personal growth was also significantly positively correlated with high-density lipoprotein (HDL) cholesterol, the cholesterol that lowers one's risk for heart disease and stroke (Ryff & Singer, 2008). A study examining HRV and personal growth observed that those with high levels of personal growth had significantly greater parasympathetic activity (as measured by High Frequency HRV (HF-HRV)) after a social stressor than those with low levels of personal growth (Mihara et al., 2020). Those high in personal growth have increased measures of physical health in comparison to those low in personal growth.

Environmental Mastery

Environmental mastery predicts positive mental health outcomes and can serve as a buffer to stress. Environmental mastery can be defined as the ability to manage the demands of everyday life (Ryff et al., 2004). Those with higher levels of environmental mastery were less likely to have depression in a 10 year longitudinal study (Wood & Joseph, 2010). Environmental mastery is also related to lower levels of depression and anxiety in young adults (Liu et al., 2009). Environmental mastery can also serve as a buffer to stress and an individuals' perception of stress, and positively predicts harmony in life (i.e., balance, mindful non-judgmental

acceptance, being attuned to one's life; Garcia et al., 2014; Montpetit & Tiberio, 2016). Environmental mastery significantly predicts positive mental health outcomes and can serve as a buffer to stress.

Environmental mastery also predicts positive physical health outcomes. Those with higher levels of environmental mastery had lower levels of glycosylated hemoglobin (a marker for insulin resistance) in comparison to those with lower levels of environmental mastery (Ryff et al., 2004). Individuals with higher environmental mastery experienced longer periods of Rapid Eye Movement (REM) sleep and faster entry into REM sleep (Ryff et al., 2004). Individuals with higher environmental mastery had greater left than right superior frontal activation in EEG, which has been linked to more positive dispositional styles and reduced likelihood of depression (Urry et al., 2004). Higher amounts of environmental mastery was also negatively correlated with amounts of cortisol in the morning and lower overall cortisol throughout the day (Lindfors & Lundberg, 2002). Environmental mastery has significant positive impacts on markers of physical health.

Positive Relationships

Positive relationships have a significant impact on improving an individual's mental health. Positive relationships can be defined as having close and valued relationships with others (Ryff et al., 2004). Loneliness, or the absence of positive relationships, is a large contributor to depression and as loneliness decreases, depression tends to decrease as well (Erzen & Çikrikci, 2018). People high in positive relationships are less at risk for depression 10 years later in a longitudinal study (Wood & Joseph, 2010). Those with lower social strain, increased social support, or rich overall relationship quality had significantly lower risk of depression in 10 years in another longitudinal study (Teo et al., 2013). Similar findings were observed in college

students with anxiety; those with higher ratings of positive relationship had decreased anxiety

(Liu et al., 2009). Having strong interpersonal relationships was also negatively correlated with

stress (Bester, 2019). Positive relationships play a large role mental health and lead to positive

outcomes.

Positive relationships also positively impact physical health. Those with higher levels of

positive relations with others had lower levels of glycosylated hemoglobin, a marker for insulin

resistance (Ryff & Singer, 2008). Research on individuals in satisfying marriages have observed

that those with high marital satisfaction have lower risk of cardiovascular disease, decreased

atherosclerotic burden, and reduced cardiovascular reactivity during marital conflict (Donoho et

al., 2015). Those with increased marital satisfaction had higher HF-HRV, a measure of activation

in the parasympathetic nervous system (PNS), in comparison to those with decreased marital

satisfaction (Donoho et al., 2015).Social support can also impact physical health outcomes

through increased health behaviors and decreased stress appraisal (Uchino et al., 1999). Positive

relationships have a positive impact on physical health in many ways.

Meaning and Purpose

Meaning and purpose are associated with many positive mental health outcomes.

Meaning and purpose could be defined having goals and objectives that give life a sense of

direction (Ryff et al., 2004). A literature review of 155 articles seeking to define "good mental

health" identified both meaning and purpose as key components in life satisfaction and an

increased ability to cope with normal life stresses (Fusar-Poli et al., 2020). Meaning and purpose

also predicts positive interpersonal outcomes (e.g., positive relationships, satisfaction with family

life), decreased depressive symptoms and suicidality, and lower levels of psychopathology

overall (Costanza et al., 2019; Elizabeth & Chang, 2021; Mascaro & Rosen, 2005; Sadler et al.,

2011). Meaning and purpose is a protective factor against suicidal ideation and suicide attempts (Costanza et al., 2019). In a treatment study examining change in meaning and purpose, researchers found that changes in symptoms of depression and anxiety were partially mediated by change in meaning and purpose (Marco et al., 2021). Meaning and purpose are important mediators in the reduction of depressive and anxious symptoms as well as a key component in psychological health.

Meaning and purpose and its positive impact on physical health has been well documented. Studies on meaning and purpose showed that higher levels were associated with lower levels of daily salivary cortisol, pro-inflammatory cytokines, cardiovascular risk, and increased amounts of REM sleep when compared with those showing lower levels of meaning and purpose (Ryff et al., 2004). In an epidemiological study, older adults with higher levels of purpose in life at baseline had reduced risk of death 6 years later and reduced risk of Alzheimer's disease and mild cognitive impairment (Boyle et al., 2009, 2010). A major national longitudinal study known as the health and retirement study provided evidence that older adults with higher levels of purpose in life had reduced risk of stroke and myocardial infarction among those with coronary heart disease (Kim et al., 2013a; Kim et al., 2013b). Additional studies found that purpose in life reduces risk of mortality across adult life (Hill & Turiano, 2014; Kim et al., 2019; Koizumi et al., 2008). Meaning and purpose have a significant positive impact on physical health.

The literature is mixed regarding the relationship of meaning/ purpose and HRV. Studies on meaning in life have found that high meaning in life was a buffer to stress, suggesting improved stress regulation and adaptability with increased meaning in life (Kim et al., 2019). With the findings of high meaning in life suggesting improved stress regulation, it would be

expected to see similar results in HRV, however, initial analyses have found null results. In a large secondary analysis of 967 participants, HF-HRV was only negatively associated with negative affectivity and was not significantly related to meaning and purpose (Sloan et al., 2017). Other studies that measured life satisfaction and HRV also found a non-significant relationship between HF-HRV and life satisfaction (Geisler et al., 2010; Krygier et al., 2013). A study using a different measure of general well-being observed that HRV had significant positive correlations with general well-being (i.e., positive affect, low stress, low negative affect), as measured by the General Well-Being Schedule, in a sample of 60 participants (Trimmel, 2015). Many of the studies that stated they measured well-being only measured general well-being or life satisfaction, and only one of these studies found a significant relationship (Geisler et al., 2010; Krygier et al., 2013; Trimmel, 2015). The one study that did measure specifically meaning and purpose observed a non-significant relationship in a large sample of 967 participants, however, this study examined only one measure of HRV (e.g., HF-HRV; Sloan et al., 2017). It is of note that many of these initial studies observing the relationship between HRV and purpose in life have only observed one aspect of HRV. HRV is a complicated and multifaceted physiological measure, and one measure only represents a part of this construct.

The relationship between HRV and meaning and purpose becomes even more clouded when examining nonlinear relationships (Dang et al., 2021; Duarte & Pinto-Gouveia, 2017; Kogan et al., 2013; Silvia et al., 2014). A recent study examining vagal tone and meaning in life found a non-linear, quadratic relationship between meaning in life and vagally mediated HRV (e.g., RMSSD, HF HRV), suggesting that those with both high and low levels of meaning had higher HRV in comparison to those around the mean scores, while a linear relationship did not produce a significant finding in a sample of 77 participants (Dang et al., 2021). Researchers

observed a different quadratic relationship between positive affect and HRV, where those with moderate levels of positive affect/ contentment had the highest levels of HF-HRV and those high and low in positive affect/ contentment had lower HF-HRV (Duarte & Pinto-Gouveia, 2017). When examining the quadratic relationship between HF HRV and life satisfaction, researchers examined a similar relationship where those with moderate levels of HF HRV had the highest life satisfaction and those low and high in HF HRV had lower life satisfaction (Kogan et al., 2013). Others attempting to replicate the findings of Kogan and colleagues found non-significant relationships when studying HRV and its relationship to personality traits and dispositional positive emotions (Silvia et al., 2014). One of the biggest criticisms of the study by Kogan and colleagues was that the baseline measurements of HRV was only two minutes long, where the standard baseline measurements usually are at least five minutes long; a two-minute baseline line is not long enough to obtain enough data to accurately represents an individual's baseline HRV measurements (Silvia et al., 2014). Both Kogan et al., Dang et al., and Duarte & Pinto Gouveia observed a significant non-linear relationship with depression and HRV, but there was disagreement on the directionality of the relationship. Kogan and colleagues suggested that those with moderate HRV had high levels of depression while Dang et al. and Duarte & Pinto-Gouveia argued the opposite. The non-linear relationships between HRV and life satisfaction, depression, and positive affect have observed mixed results. The one study looking exclusively at meaning in life found a significant non-linear relationship (Dang et al., 2021). Research on other measures of physical health have yielded significant results, but the evidence of this relationship in HRV has not been confidently established.

Gratitude

Dispositional gratitude is positively associated with both general (i.e., self-esteem, life satisfaction, decreased psychopathology) and eudaimonic well-being (Emmons & Mishra, 2011; Nezlek et al., 2017). Gratitude can be defined as an acknowledgement that we have received something of value from others (Emmons & Mishra, 2011). Those that participated in a gratitude intervention demonstrated higher reports of life satisfaction, self-esteem, and eudaimonic well-being (Nezlek et al., 2017; Rash et al., 2011). A meta-analysis of gratitude and its effects on general well-being found a medium to strong positive correlation between these two constructs in a sample of 100,099 participants and another meta-analysis examining the effects of a gratitude intervention on symptoms of depression and anxiety found that the gratitude intervention significantly reduced symptoms of both depression and anxiety (Cregg & Cheavens, 2021; Portocarrero et al., 2020). Empirical evidence of the positive influence of gratitude on general and eudaimonic well-being is well established.

Dispositional gratitude is also associated with better physical health (Hill et al., 2013). This relationship appears to be mediated by many factors, namely: psychological health, healthy activities, and willingness to seek help for health concerns (Hill et al., 2013). Researchers have observed that lower reported levels of perceived loneliness and stress also mediated the relationship between gratitude and physical health (O'Connell et al., 2016; Schache et al., 2019). When examining biomarkers of health, researchers have observed that a gratitude intervention led to decreases in blood pressure and increased sleep quality (Boggiss et al., 2020; Jackowska et al., 2016). Gratitude's impact on health has been well documented and this relationship seems to be mediated by psychological health and loneliness.

Many studies have observed a positive relationship between self-reports of physical health and gratitude; however, the evidence of a positive relationship between HRV and

gratitude is understudied. A recent review of gratitude and its effects on health only identified one study by Redwine and colleagues that examined the relationship between HRV and gratitude (Jans-Beken et al., 2020). The researchers in this pilot study observed increased parasympathetic activation during a gratitude journaling task after 8 weeks of regular gratitude journaling in comparison to a treatment as usual, however, there were no significant differences in resting HRV in either the pre intervention or post intervention time points (Redwine et al., 2016). Redwine et al., (2016) also observed significant improvements in dispositional gratitude when comparing pre and post-test gratitude scores, but those improvements did not carry over to baseline measures of HRV (e.g., RMSSD, HF HRV). An important consideration in this study is that there was no control group. Because there was no control group, it is possible that external confounding factors were present in this study and the confidence that the changes or lack of changes were due to the treatment diminishes greatly. Taken together, this pilot study demonstrated that RMSSD appears to increase during a gratitude journaling task, but an 8-week intervention did not lead to significant changes in baseline HRV (e.g., RMSSD, HF HRV) despite observing significant positive changes in dispositional gratitude. Additional and better controlled studies are needed to confirm or counter this finding.

Psychotherapy Increases Eudaimonia, Gratitude, and HRV and Can Be Effective in the Classroom Settings

Psychotherapy improves eudaimonia. A meta-analysis of randomized controlled trials on psychological interventions observed moderate effect sizes (Cohen's d = 0.44) on measures of psychological well-being (as measured by Ryff's six facets; Weiss et al., 2016). This meta-analysis in particular examined a large variety of interventions including CBT, ACT, mindfulness-based interventions, positive psychology, and life coaching (Weiss et al., 2016).

Other researchers found that CBT improved meaning in life and that change in depressive and anxious symptoms were partially mediated by change in meaning of life (Marco et al., 2021). Researchers also observed that an acceptance based behavioral therapy led to increases in purposeful and valued living, decreases in depressive symptoms, and increases in acceptance (Danitz & Orsillo, 2014). An online intervention of ACT in university students found similar increases in life satisfaction, meaningfulness, manageability of stressors, mindfulness skills and decreases in depression in comparison to a waitlist control group (Räsänen et al., 2016). Experimental studies show that self-compassion can be a skill that can be acquired in specific interventions targeting self-compassion like the mindful self-compassion program and compassion focused therapy (Gilbert, 2014; Neff & Germer, 2013). Overall, researchers have observed that different modalities of psychotherapy lead to increases in eudaimonia.

Few studies have examined changes in gratitude from therapy, but an initial study has found that gratitude increases in therapy (Pearce et al., 2016). A secondary analysis of a randomized controlled trial comparing religiously integrated CBT and conventional CBT observed significant increases in dispositional gratitude in both conditions after 10 sessions that persisted at a 12 and 24 week check in (Pearce et al., 2016). Both religiously integrated CBT and conventional CBT approaches contained a low dose gratitude component in this particular study that was discussed in one session. Gratitude is significantly correlated with meaning and purpose, and it is possible that as meaning and purpose increases, gratitude may increase as well (Rash et al., 2011; Wood & Joseph, 2010). Little research has been on this relationship, but initial findings suggest that gratitude increases from therapy.

Studies observing the relationship between therapy and HRV have found non-significant findings. In a study of female college students, the standard deviation of interbeat intervals (IBI)

of normal sinus beats (SDNN), a measure of HRV including SNS and PNS, did not improve with traditional therapy despite observing decreases in symptoms of depression (Caldwell & Steffen, 2018). Also, therapy tends to increase eudaimonic well-being, but researchers did not find statistically significant relationships between HF HRV and eudaimonic well-being in a large sample of 967 participants (Sloan et al., 2017). In a study of an eight-week mindfulness based cognitive therapy, researchers found that therapy did not lead to changes in HRV (e.g., SDNN, RMSSD) in a sample of 27 participants (Wheeler et al., 2014). These studies suggest that traditional therapy does not improve HRV despite decreases in symptoms.

Despite non-significant findings between traditional therapy and HRV, there is research support for significant changes in HRV in therapies that include mindfulness, self-compassion, and breathing techniques. In mindfulness integrated psychotherapy, researchers found an interaction where those high in generalized anxiety experienced greater change in HRV than those lower in generalized anxiety, suggesting that those with higher levels of generalized anxiety had more room for change in a sample of 67 undergraduate students (Mankus et al., 2013). In the treatment of depression in 30 patients with coronary heart disease, researchers observed positive changes in RMSSD following treatment for depression in severe patients, changing to a level similar to the control patients (Carney et al., 2000). Outside of severe populations, therapy that includes breathing exercises (e.g., mindfulness of breath, diaphragmatic breathing practice) observed significant positive changes in SDNN and low frequency HRV (LF HRV) in a study of 23 individuals that participated in treatment for depression in a forest environment and a study of 43 individuals in a CBT+ breathing relaxation group (Chien et al., 2015; Kim et al., 2009). In a study of CFT administered in a group therapy setting, researchers observed that those who showed reliable change in self-compassion also experienced significant

improvements in HRV in comparison to those who did not demonstrate reliable change (Steffen et al., 2021b). Although many of the significant findings between therapy and HRV has occurred in studies of severe populations or in studies were treatment included a breathing component, a recent study that examined those that improved in outcomes of self-compassion demonstrated significant improvement in HRV.

Therapy leads to improved outcomes in the clinical setting, and there is evidence that therapy offered in the classroom can also lead to similar outcomes (Bennett-Levy & Finlay-Jones, 2018; Pakenham & Viskovich, 2019; Pistorello, 2013; Pistorello et al., 2013). Pakenham & Viskovich (2019) studied the impact of personal practice in psychotherapy classes and found that a personal practice curriculum led to increases in psychological flexibility, self-awareness, life satisfaction, purpose, and self-care skills and efficacy. In this study, improvements in well-being were mediated by the amount of self-practice and psychological flexibility (Pakenham & Viskovich, 2019). Other psychotherapy training classes that involve personal practice in cognitive therapy have also found similar findings (Bennett-Levy et al., 2001; Bennett-Levy & Finlay-Jones, 2018). Increases in therapy outcomes were also seen in personal application of acceptance and commitment therapy (ACT) principles applied in the classroom setting (Pistorello et al., 2013). Therapy offered in a classroom setting leads to decreases in mental health concerns and increases in life satisfaction, purpose, and psychological flexibility.

The Present Study

The relationship between eudaimonic well-being and gratitude on psychological and self-reports of physical health has been well documented, but physiological measures, like HRV, have been limited and have produced mixed and contradicting results. The goals of the present study are to add to the current literature and examine the relationships between

psychotherapeutic techniques administered in a classroom setting, eudaimonia, gratitude, and HRV. The first hypothesis for this study was that the psychotherapeutic principles from CFT administered in the classroom settings led to increases in measures of eudaimonia and gratitude, and decreases in depression, anxiety, and stress. Many studies have documented increases in eudaimonia from therapy and an initial study observed similar increases in gratitude (Danitz & Orsillo, 2014; Marco et al., 2021; Pearce et al., 2016). This literature review has also identified many studies that observed significant decreases in depression, anxiety, and stress from many therapeutic orientations (Alvani et al., 2015; Caldwell & Steffen, 2018; Harris, 2019; Mankus et al., 2013). No studies to date, however, have examined the impact of applied mental health classes on outcomes.

The second hypothesis for this study was that HRV (RMSSD, HF HRV) significantly improved due to the applied mental health class. HRV improves in individuals that displayed reliable change in an intervention of CFT administered in a group setting (Steffen et al., 2021b). Other interventions that incorporate breathing and mindfulness have also seen benefits in HRV as well (Chien et al., 2015; Kim et al., 2009; Mankus et al., 2013). The applied mental health classes had components of self-compassion, breathing, and mindfulness and if the students actively engage the material, it is likely that their HRV improved.

The last hypothesis was that decreases in depression, anxiety, stress and increases in HRV (RMSSD, HF HRV) was mediated by eudaimonia and self-compassion. Previous studies show that gratitude decreases symptoms depression, anxiety, and stress, and similar findings are observed with aspects of eudaimonia (Emmons & Mishra, 2011; Marco et al., 2021). Various aspects of eudaimonia are often a target of therapy and as individuals live a more eudaimonic life, symptoms of depression and anxiety decrease (Harris, 2019; Liu et al., 2009). Similarly, as

individuals participated in gratitude interventions, their symptoms of depression, anxiety, and stress decreased (Emmons & Stern, 2013). HRV is related to adaptability in the face of a stressor and resilience. Eudaimonia and gratitude can be buffers to stress as those high in these often have more positive perceptions of themselves, of the world, and of the future (Emmons & Mishra, 2011; Kim et al., 2019). Studies examining self-compassion have also observed its mediating effects on depression (Pérez-Aranda et al., 2021). The impact of these interventions is well documented, and it is likely that they mediate changes in depression, anxiety, and HRV (RMSSD and HF HRV).

Methods

Participants

The participants were recruited from two different settings. The first group came from students in Brigham Young University's applied mental health classes and the second group, or control group, came from students not participating in an applied mental health class, recruited through an online research participation system. Participants that were recruited were at least 18 years old. Participants were excluded from the study if there was any history of heart disease or if the participant was currently taking medications for high blood pressure or heart disease. This screening process occurred when the participant responded to questionnaires prior to the lab portion of the study.

A total number of 234 participants were recruited for this study, with 44 recruited from the applied mental health classes and 190 recruited from the BYU SONA system. In the first semester the study was run, of the 44 participants from the class, 34 completed the study, and of the 90 from the BYU SONA system, only 16 completed the study. During the second semester the study was run, participants were not able to be recruited from the applied mental health

classes and 100 were recruited from the BYU SONA system and 60 completed the study in the

second semester. The number of participants at each time point for each group is presented in

Figure 1. A power analysis for two groups measured across two time points at 80% power with

an effect size of $g = .54$ showed that 22 participants were needed for each group. Many well

powered studies in HRV tend to have between 30 and 50 participants in each group (Steffen et

al., 2021a; Laborde et al., 2017). Effect sizes for studies tend to be moderate or large (Laborde et

al., 2017). It is also common to lose a small percentage (5% to 10%) of the data because of errors

and artifacts in the recording process. Given the effect sizes, predicted data loss, and recent

research, the sample for this study was sufficient to address the presented hypotheses.

Figure 1. Number of Participants at Each Data Collection Period
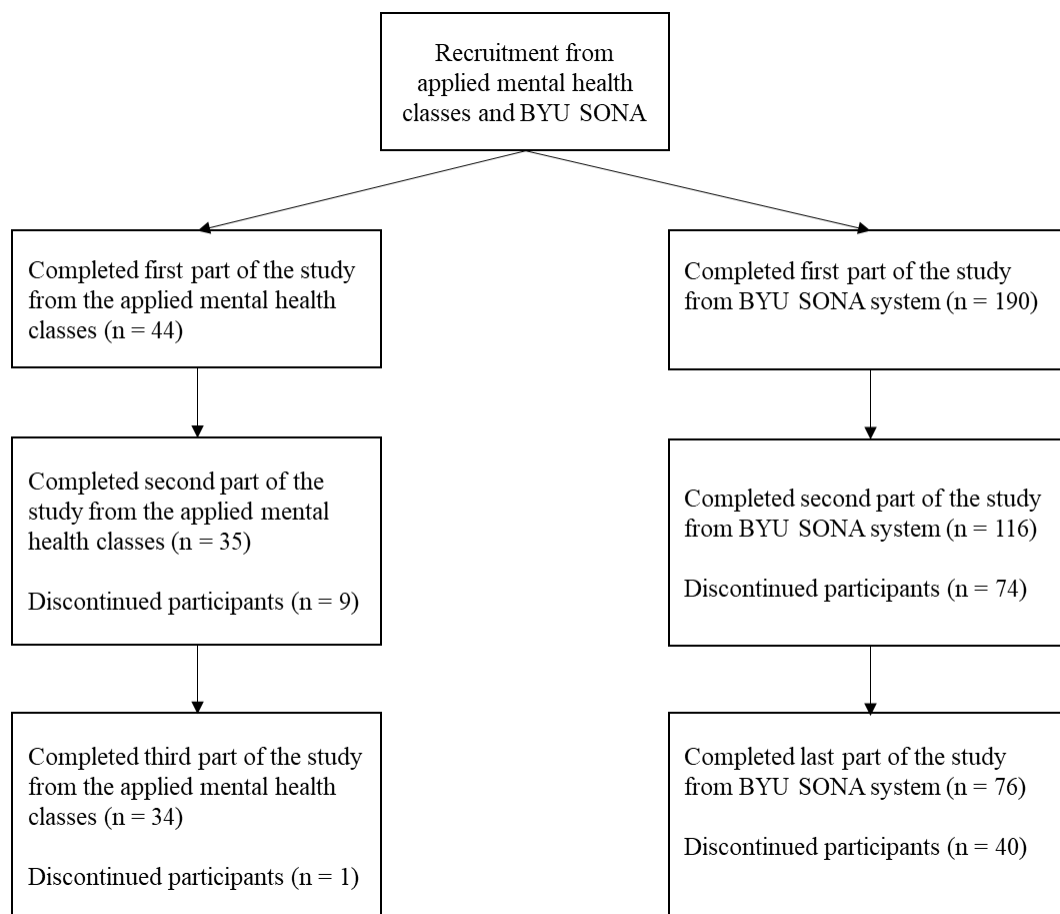
Procedure

Participants were encouraged to come into a lab twice to obtain their HRV, one time in the first month of the academic semester, and one time during the last month of the semester. Participants also responded to a set of questionnaires three times at the beginning, middle and end of the semester. When participants came into the lab setting, they went through a standardized protocol including a baseline, stressor, and recovery period. During the baseline and recovery periods, participants were asked to sit quietly with their eyes open. This protocol is commonly used in the HRV literature to capture the differences not only in baseline, but in how individuals react and recover from a stressful event (Laborde et al., 2017). When participants arrived at the lab, they were connected to an electrocardiogram (ECG) using three electrodes. Those electrodes were placed on both collarbones and on the lower most left rib as electrode placement on bones increase the strength of the electrical signal. A respiration belt was placed on the participants over their abdomen. Participants were sitting in a chair throughout the whole duration of the experiment protocol. Participants went through a 5-minute baseline, a 5-minute self-critical writing task, a 5-minute self-compassionate writing task, and a 5-minute recovery period. During the self-critical and self-compassionate writing tasks, participants were asked to write about something they feel insecure about or critical of themselves or compassionate statements about themselves, while considering the general manner, tone of voice, and feelings that came with those thoughts. Research that utilized this approach observed significant stress reactivity during the self-critical task (Steffen et al., 2021a; Steffen et al., 2021b). Studies also show that self-critical and self-compassionate writing tasks decrease and increase HRV respectively (Petrocchi et al., 2017; Rockliff et al., 2008). Throughout the lab portion of the study, participants filled out a measure of positive and negative mood at the beginning of the

study, after both writing tasks, and at the end of the study. This mood measure was used as a manipulation check to gauge engagement in the self-critical and self-compassionate tasks. Before going into the lab for both time periods, participants responded to a set of questionnaires aimed to observe eudaimonia, gratitude, compassion, depression, anxiety, stress, and demographic information (e.g., age, gender). Participants also responded to the questionnaires in the middle of the academic semester.

Students in the class participated in this study as an assignment in the class. They had the option to opt out of sharing their data at the end of the semester. Participants for the control group were compensated with both online research credit and money. Many introduction to psychology courses at Brigham Young University require participation in research as a part of their course grade. Students were given one credit for every 10 minutes they participate in a study. The amount of money that participants were compensated for their time increased due to significant attrition in the control group. During the first semester of the study, 90 participants were recruited in the first wave of the study and 75% of the participants did not complete the study with the original compensation plan ($10 per lab visit with a $30 bonus for completing the study). When researchers asked participants why they did not complete the study, many participants stated that they had obtained all of the online research credits needed for their class and were no longer interested in participating. To discourage attrition in the second semester, participants were given $35 after the first lab visit and $65 at the end of the semester for the last data collection period which reduced attrition significantly. In the second semester of the class, 100 participants were recruited and 61 completed the study.

Applied Mental Health Class Structure

The applied mental health classes included psychoeducation that covers many topics in CFT including compassion, the three systems of emotions, mindfulness, self-compassion, self-criticism, shame, forgiveness, multiple selves (i.e., multiple ways of behaving depending on the predominate emotion that is present) and extending compassion towards others. Each class period had an experiential homework assignment that corresponded to the discussion students had that day. This class took place over a single academic semester that met twice a week. The class also required students to do readings on the class topic prior to class and take a quiz on their engagement with the reading. The grade that students received were based on engagement with the reading and exercises rather than on remembering course content.

Psychological Measures

The Scales of Psychological Well-Being

The Scales of Psychological Well-Being is a measure of eudaimonic well-being that contains six facets (Kállay & Rus, 2014; Ryff, 1989). These facets include autonomy (i.e., self-determining, independent, evaluates self by personal standards), environmental mastery (i.e., competence in managing environment, makes effective use of present opportunities), personal growth (i.e., feeling of continued development, sees improvement in self and behavior over time), positive relations with others (i.e., has warm, satisfying, and trusting relationships with others, empathic), purpose in life (i.e., sense of direction in life, feels there is meaning in their life), self-acceptance (i.e., has a positive attitude toward the self, accepts and acknowledges both good and bad qualities of the self). Each facet consists of seven questions for a total of 42 questions. The participants were asked to respond to questions using a six-point Likert scale ranging to strongly disagree to strongly agree. This particular scale does not contain specific cut off scores for defining high or low scorers. The authors of the scale suggest that these

distinctions are best derived from distributional data from the data collected. Potential options

can be using those in the top quartile of the distribution as high scores or using those about 1.5

standard deviations above the mean as high scores and vice versa. Another option can be to use

the control group as the norm group for this sample. The test-retest reliability for all the scales

were between 0.81 and 0.88 and the Cronbach's alpha for all of the subscales were above 0.7.

The Cronbach's alphas from this sample were 0.81 for the autonomy scale, 0.78 for the

environmental mastery scale, 0.73 for the personal growth scale, 0.76 for the positive

relationships scale, 0.71 for the purpose in life scale, and 0.88 for the self-acceptance scale. The

six-factor model demonstrated good fit statistics with a χ^2 (887) = 2922.85, $p < 0.001$, RMSEA =

0.59, SRMR = 0.048, CFI = 0.973. This questionnaire was administered at the beginning,

middle, and end of the applied mental health classes to measure change in measures of each of

the six facets of eudaimonia.

The Gratitude Questionnaire

The Gratitude Questionnaire (GQ-6) is a measure that assesses dispositional or trait

gratitude in a short six item questionnaire (McCullough et al., 2002). This questionnaire uses a

seven-point Likert scale ranging from "strongly disagree" to "strongly agree." The questionnaire

demonstrated good model fit with a chi-square χ^2 (9, N = 235) = 30.34, $p < 0.001$. Other

measures of fit demonstrated good fit as seen in the CFI = 0.95 and the SRMR = 0.04. The

internal consistency of the scale was 0.82, demonstrating good reliability. The Cronbach's alpha

from this sample was 0.83. The gratitude questionnaire had positive correlations with measures

of life satisfaction (0.53), vitality (0.46), subjective happiness (0.50), and optimism (0.51) and

correlated negatively with psychological symptoms of anxiety (-0.20) and depression (-0.30). To

ensure that the questionnaire was measuring gratitude and not other constructs of well-being, the

gratitude questionnaire was combined with different questionnaires (e.g., life satisfaction vitality, happiness, optimism, and hope) and the fit of the data from these combined questionnaires were analyzed. Researchers found that when the questionnaires were combined and forced into a single factor, the indices of fit were poor as measured by chi square, CFI, and SRMR. Once a second factor was introduced into the model, the fit indices significantly improved, suggesting that gratitude, as measured by the gratitude questionnaire, was identified as a distinct and unique factor in comparison to similar constructs like optimism and satisfaction with life (McCullough et al., 2002). This measure was administered at the beginning and end of the study to assess change in gratitude from the applied mental health classes.

The Depression, Anxiety, and Stress Scale

The Depression, Anxiety, and Stress Scale (DASS) is a set of three self-report scales designed to measure the negative emotional states of depression, anxiety, and stress (Sinclair et al., 2012). The DASS is composed of 21 items with 7 items for each scale. The DASS was designed as a dimensional measure of general depression, anxiety, and stress. Reliability is very good with Cronbach's alphas of 0.91 for the depression scale, 0.84 for the anxiety scale and 0.80 for the stress scale. The Cronbach's alphas of this sample were 0.87 for the depression scale, 0.82 for the anxiety scale, and 0.81 for the stress scale. In comparison to similar measures, the DASS displayed validity in each scale. The depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia. The anxiety scale assesses general symptoms of anxiety including autonomic arousal, situational anxiety, and subjective experience of anxious affect. The stress scale is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient. Subjects were asked to respond on a 4-point

severity/frequency scale to rate the extent to which they have experienced each state over the past week. Scores for Depression, Anxiety and Stress are calculated by summing the scores for the relevant items. Because the DASS is not a diagnostic tool, symptoms of depression, anxiety, and stress may not qualify them for a diagnosis of a mood or anxiety disorder but may represent the distress of an individual in a particular area (Sinclair et al., 2012). This questionnaire does not ask about changes in sleep, appetite, and sexual disturbances and if one wishes to diagnose an individual a clinical interview should be used. This measure was used to assess changes in depression and anxiety. It was administered at the beginning and end of the study.

The Survey of Positive and Negative Experiences

The Survey of Positive and Negative Experiences (SPANE) is a 12-item questionnaire that assesses positive (six items) and negative (six items) mood (Diener, 2009). Participants are asked to rate their experience during the past 10 minutes in terms of feeling positive, negative, good, bad, etc. Each question was rated on a five-point scale, with one being "Very Rarely or Never" and five being "Very Often or Always." The positive and negative mood items have shown good reliability with Cronbach's alpha 0.87 for positive mood and Cronbach's alpha of 0.81 for negative mood. The SPANE demonstrated good convergent validity with other scales measuring similar concepts with correlations ranging from 0.59 to 0.77. A factor analysis of the subscale for positive emotions yielded one eigenvalue of 3.6 which was the only eigenvalue above 1.0 which explained 60% of the variance in the items. For the subscale of negative emotions, a factor analysis only contained one eigenvalue of 3.1, which was the only eigenvalue above 1.0 which explained 52% of the variance in the items. The SPANE was used in this study as a manipulation check to evaluate whether the experimental conditions elicited the desired effects and was given at the end of each experimental phase (baseline, self-critical writing, self-

compassionate writing, and recovery phase). For example, during the self-critical writing task, a participant's positive mood should decrease, and their negative mood should increase.

Compassion Engagement and Action Scales

The Compassion Engagement and Action Scales (CEAS) Consists of three different scales, a self-compassion scale, compassion from others scale, and a compassion for others scale (Gilbert et al., 2017). For this study, only the self-compassion scale and compassion from others scale were used. Each scale also consists of a subscale for engagement and action in that particular scale. The scale consists of a 10-point Likert scale ranging from "Never" to "Always". The Cronbach's alphas for each scale are as follows: self-compassion – engagement = 0.77, self-compassion – action = 0.90, compassion for others – engagement = 0.90, compassion for others – action = 0.94, compassion from others – engagement = 0.89, compassion from others – action = 0.91. This scale also allows the items from both the engagement and action scale to be combined to produce a total score which was done for this study. The Cronbach's alphas for the total score of the self-compassion scale was 0.84 and 0.91 for the total score of the compassion from others scale in this study. The test-retest reliability of the scales was 0.72 for compassion to others, 0.59 for compassion from others, and 0.75 for self-compassion. Confirmatory factor analysis of each of the subscales displayed models with good model fit. The CEAS had good construct validity when examining its correlations to other validated measures of compassion. These scales were used to measure the participant's compassion at the beginning, middle, and end of the study.

Physiological Measures

Participants' respiration and HRV were measured via a NEXUS 4 biofeedback device. This device uses a three lead ECG configuration and a strain gauge respiration belt to measure

physiology continuously. This device collects the raw data of interbeat intervals between heart beats in milliseconds. There are many errors or artifacts that can appear in the raw data. These artifacts account for less than 0.1 percent of the data but can significantly skew the data (Begum et al., 2011). Artifacts can occur because of excessive movement (e.g., sneezing, itching, shaking) that can interfere with a device's ability to collect clear and clean data. Because of different artifacts, the raw data were cleaned through the Kubios HRV software. This software addresses the artifacts in the data in a standardized way to obtain a more accurate view of HRV (Tarvainen et al., 2014). The Kubios software uses a threshold-based beat correction algorithm that compares every interbeat interval against the average interval in the sample. If an interbeat interval differs from the average more than a specified threshold value, then the interval is marked and corrected by interpolating the values using a cubic spline interpolation that is based off of the mean value of the individual (Tarvainen et al., 2014). Researchers believe that the interpolation method is a better way to correct artifacts as deleting them from the data can interrupt the continuity of the raw data (Begum et al., 2011).

HRV is a vast construct that can be broken up into two facets: frequency domain measures and time domain measures. The frequency domain measures of HRV estimate the distribution of absolute power into four frequency bands. The very low frequency (VLF) band (0.0033 – 0.04 Hz) is more strongly associated with all-cause mortality than LF or HF power (Tsuji et al., 1994). The heart's intrinsic nervous system appears to contribute to the VLF rhythm and the SNS influences the amplitude and frequency of its oscillations (Shaffer et al., 2014). The heart intrinsically generates the VLF rhythm and efferent SNS activity due to physical activity and stress responses modulates its amplitude and frequency (Shaffer & Ginsberg, 2017). The LF band (0.04 – 0.15 Hz) was previously called the baroreceptor range because it mainly reflects

baroreceptor activity during resting conditions (McCraty & Shaffer, 2015). LF power may be produced by both the parasympathetic nervous system (PNS) and blood pressure regulation via baroreceptors (Camm et al., 1996). Lastly, the HF band (0.15 – 0.4 Hz) reflects PNS activity and is called the respiratory band because it corresponds to the heart rate variations related to the respiratory cycle (Shaffer & Ginsberg, 2017).

Time domain measures of HRV examine the amount of variability in the IBI during a specific time period. The SDNN is one of the most common measures of HRV. Both SNS and PNS activity contribute to SDNN, and it is correlated highly with VLF, LF and total power measures of HRV in the frequency domain facet of HRV (Umetani et al., 1998). When the VLF and LF bands have greater power than the HF band, they contribute more to SDNN (Shaffer & Ginsberg, 2017). SDNN is the gold standard for medical stratification of cardiac risk when recorded over a 24-hour period and it predicts both morbidity and mortality (Camm et al., 1996; Shaffer & Ginsberg, 2017). Another common time domain measure of HRV is RMSSD (Shaffer & Ginsberg, 2017). This reflects the beat-to-beat variance in heart rate and is the primary time domain measure used to estimate the vagally mediated changes reflected in HRV (Shaffer et al., 2014). RMSSD is correlated with HF power, and RMSSD is more influenced by the PNS than SDNN (Bigger et al., 1989; DeGiorgio et al., 2010).

There are important age and gender differences that have been addressed in the HRV literature. Low HRV is considered a large predictor of mortality, however HRV lowers as age increases, which may limit the predictive power of HRV (Umetani et al., 1998). Researchers observed that SDNN decreased linearly with age while RMSSD decreased rapidly in the first five decades, then stabilized after the sixth decade (Umetani et al., 1998). Women under the age of 30 had lower measures of HRV in all measurements of HRV. Gender differences decreased

after the age of 30 and disappeared after age 50 (Umetani et al., 1998). These factors are important variables that need to be addressed and controlled for.

Statistical Analysis

The data were analyzed using Mplus version 8 (Muthén, & Muthén, 2017). Baseline characteristics were analyzed using descriptive statistics and univariate general linear model analyses. I used Structural Equation Modeling (SEM) to analyze the data which has many assumptions that need to be met before analyzing the data. These assumptions are normality, linearity, no systematic missing data, and correct model specification. To address normality, the residuals of the data were analyzed, and appropriate transformations were applied to the data to help the data be as normal as possible. There were outliers in the HRV data, and the most effective and commonly used technique to address this is to take the natural log of the data to create a more normal distribution (Shaffer & Ginsberg, 2017). The rules of thumb for skewness and kurtosis created by Kline (2015) suggest that the absolute value of skewness greater than three and kurtosis greater than ten is problematic. All the variables had an absolute value of skewness lower than three and kurtosis value lower than ten.

The assumption of linearity was tested by observing scatterplots and the variables were sufficiently linear for the SEM models. Because there was significant attrition, mostly from the control group, I analyzed the data to see if the missingness was related to any of the dependent variables at baseline. None of the dependent variables were significantly correlated with the participants' missingness.

The first hypothesis for this study is that psychotherapy administered in the classroom settings led to increases in measures of eudaimonia and gratitude and decrease symptoms of depression, anxiety, and stress. To answer this research question, longitudinal SEM models were

used to assess differences in of eudaimonia, gratitude, compassion, depression, anxiety, and stress across time between participants in the applied mental health classes and those not in those classes. The SEM model is shown in Figure 1. The models are described in the following section. Gender was added to the analysis as a covariate.

The second hypothesis is that HRV significantly improved due to the class. To address this question another longitudinal SEM model was used to measure change in HRV over time. These analyses examined RMSSD, and HF HRV. An important factor that was controlled for is age and gender as these can lead to group differences in HRV. The SEM model is shown in figure 2 and is described in the following section.

The last hypothesis for this study, given that there is significant change across time, is that eudaimonia and compassion, mediated change in depression, anxiety, stress and HRV (RMSSD, HF-HRV). To test this hypothesis, a structural equation model utilizing the A, B, C, and C' mediation approach was used. The model should be identified as there are more than two indicators for each latent variable and there are no feedback loops in the model. The direct path in this model was the influence of the classes on depression, anxiety, stress, and HRV (HF-HRV) at post-test measures and the indirect path was measures of eudaimonia (e.g., autonomy, personal growth, self-acceptance, positive relationships, purpose in life, environmental mastery, gratitude) and compassion (e.g., self-compassion, compassion from others) included in a single model. There are also no correlated error terms in the model. Model fit was tested for, and the steps outlined by Shrout and Bolger were used to see if change in depression, anxiety, stress, and HRV are mediated by eudaimonia and compassion (Shrout & Bolger, 2002). The SEM model is provided below in Figure 3. Recommended steps for moderated mediation models and longitudinal mediation models by Geiser and Hayes were followed (Geiser, 2020; Hayes, 2017).

Model Description

Multiple indices were used to evaluate model fit. The root mean square error of approximation (RMSEA) measures discrepancy per degree of freedom, imposing a penalty for adding complexity to a model without substantially improving model fit. Smaller RMSEA values indicate better model fit, with values less than 0.05 indicating a "close fit," between 0.05 and 0.08 corresponding to an "acceptable" fit, and RMSEA values larger than 0.10 suggesting a "poor fit." The comparative fit index (CFI) is a goodness-of-fit statistic where CFI values greater than 0.90 have been considered an indication of an acceptable fit of the model to the observed data. The standardized root mean square residual (SRMR) is another fit index that measures badness-of-fit, where values greater than 0.10 indicate poor fit. The chi-squared (χ^2) test whether the predicted model and observed data are equal. Chi-squared tests that have a nonsignificant p value indicate good model fit (Kline, 2015).

To examine whether psychotherapy applied in the classroom setting would lead to increases in eudaimonia and decreases in depression, anxiety, and stress, I fit a longitudinal SEM model depicted in Figure 2. This model is known as the curve of factors (CUFFS) latent growth model (McArdle, 1988). The CUFFS model assesses change in a construct over time. Factor analysis was used to determine a factor structure given the consideration of a smaller sample size for the experimental group. For the analysis of change in depression, anxiety, and stress, the sum scores were used as observed variables for a latent variable called distress rather than the individual items. Using the summed scores of the scales significantly reduced the number of indicators in the model which greatly reduces the risk of convergences issues/ improper solutions or impossible parameter estimates common in small sample sizes with many indicators (Wolf et al., 2013). This structure was repeated across three time points. I assumed strong measurement

equivalence across time such that the loadings and intercepts of the observed variables were

constrained to be time-invariant (i.e., set equal across time for the same indicator). The loadings

of the distress latent variable on the intercept latent variable were fixed to one across three time

points. The loadings of the distress latent variable on the slope latent variable were fixed to zero

for the first time point, one for the second time point, and two for the third time point to measure

a linear change in distress across time. To observe the impact of group identity and sex on slope

and intercept, these observed variables were regressed on the latent variables of slope and

intercept. A mean structure was added to the model for the slope and intercept latent variables.

Measurement error influences were also taken into account for each variable in the model. Each

of the observed variables were allowed to covary with the same variable across time (e.g.,

depression at time one was allowed to covary with depression at time two and time three). The

intercept and slope latent variables were allowed to covary as well. Given that the three items

across three time points were approximately normally distributed, I obtained model fit statistics

and parameter estimates through maximum likelihood estimation in Mplus version 8.

Figure 2. CUFFS Model for Distress
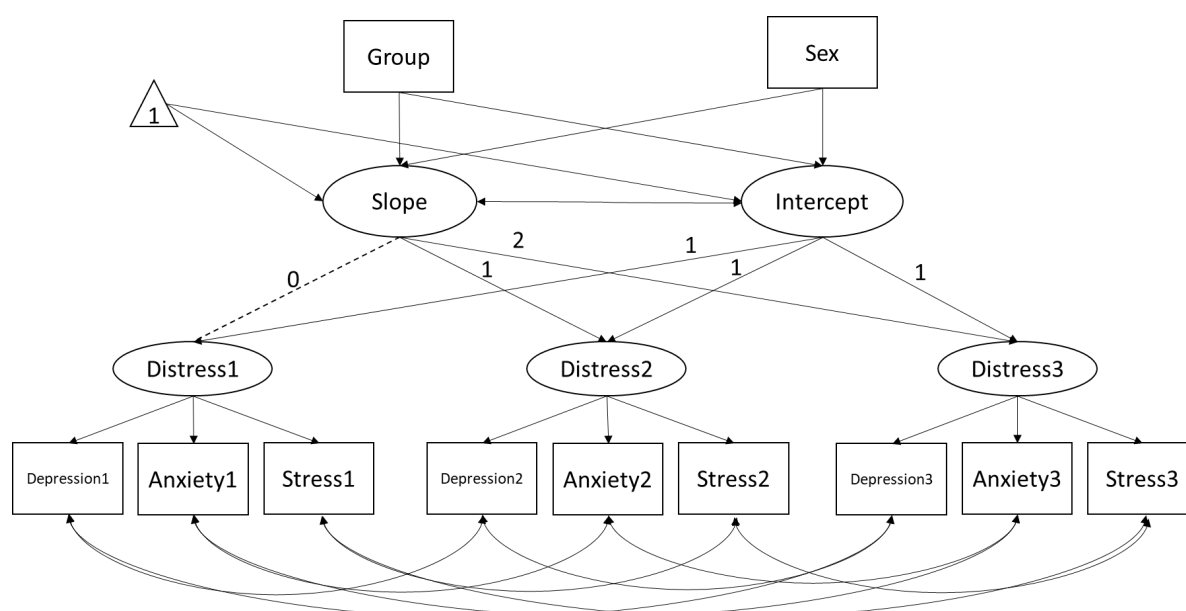
Note. This figure shows the CUFFS model for the latent variable distress. Distress at each time point consisted of measures of depression, anxiety, and stress. The relationship between the slope and distress variables was fixed as well as the relationship between the intercept and distress variables. The group and sex observed variables were then regressed to both the slope and intercept latent variables.

Parallel models were also used for the analyses of eudaimonia, gratitude, compassion from others, and self-compassion. In the next model instead of a distress latent factor, a eudaimonia factor was used that consisted of six observed variables that consisted of the summed scores of autonomy, environmental mastery, personal growth, positive relationships, purpose in life, and self-acceptance from the scale of psychological well-being. In the model of gratitude, because there were only six items in the gratitude questionnaire, the six items were loaded onto a latent variable of gratitude. In the compassion from others model, because all of the items significantly loaded onto a single factor in factor analysis, a single latent variable was used that was comprised of the ten items that make up the summed score. With the self-compassion model, the ten items produced two factors with eigenvalues greater than one in factor analysis, comprising of an engagement with self-compassion factor and a self-compassionate action factor. This factor structure was similar to the structure presented in the initial psychometric article by Gilbert et al., (2017) and thus I used the original scoring procedure to produce two sum scores of engagement and action within self-compassion. These sum scores were then loaded to a single latent variable of self-compassion and included in the CUFFS model.

To observe changes in HRV, I used a difference between occasion factors model. This is also a second order SEM model that allowed us to observe changes in HRV with just two time points. This model is presented in Figure 3. The observed variables RMSSD and HF-log were

loaded to a single HRV latent variable for each time point. The regression from HRV at time one to HRV at time two was fixed to one. A difference latent variable also had a regression to HRV at time two that was fixed to one. The variables of group, sex, and age were then each regressed to HRV at time one and the difference latent variable. HRV at time one was allowed to covary with the difference latent variable and HF-log at time one was allowed to covary with HF-log at time two. A mean structure was added to the model for HRV at time 1 and difference latent variables. Measurement error influences were also taken into account for each variable in the model. Given that the two items across two time points were approximately normally distributed, I obtained model fit statistics and parameter estimates through maximum likelihood estimation in Mplus version 8.

Figure 3. The Difference Between Occasion Model for HRV
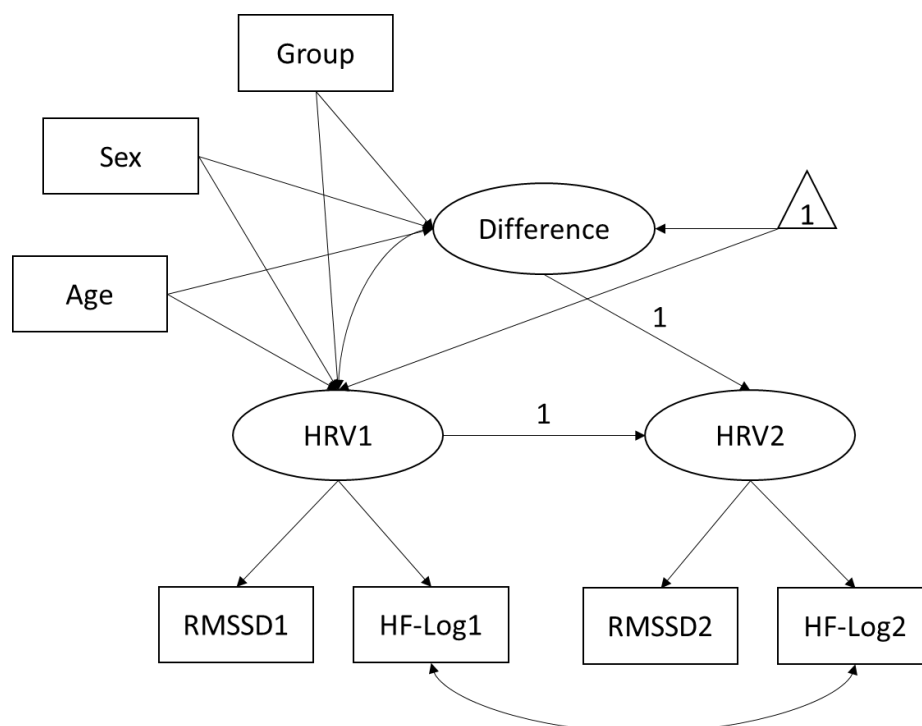
Note. This model shows the difference between occasion model using HRV. HRV at time one and two consisted of RMSSD and HF-Log. The relationship between HRV1 and HRV2 was

fixed to one as well as the relationship between the difference latent variable and HRV2. The observed variables group, sex, and age were regressed to both HRV1 and the difference latent variable.

Results

Baseline Characteristics by Group

The baseline characteristics of the participants by group are presented in Table 1. The participants only significantly differed on baseline measures of self-compassion with those in the class being significantly lower on self-compassion in comparison to the control group. The participants in the two groups did not significantly differ by age, gender, race, depression, anxiety, stress, eudaimonia, and compassion from others at baseline. Measures of HRV (RMSSD and HF HRV) were equivalent at baseline. I also examined correlations among the measures of depression, anxiety, stress, eudaimonia, gratitude, compassion and HRV at baseline. The correlations are reported in table 2.

Table 1. Descriptive Statistics by Group at Baseline

Variables	Class	Control	p
	M (SD) or % (n = 43)	M (SD) or % (n = 191)	
Age	19.79(2.21)	20.05(2.07)	0.460
Gender (% Female)	86%	62%	
Ethnicity (% White)	88%	96%	
Depression Symptoms	10.56(9.55)	10.18(8.6)	0.792
Anxiety Symptoms	11.12(10.34)	8.53(8.2)	0.078
Stress Symptoms	14.56(10.11)	13.42(8.43)	0.444
Self-Acceptance	26.1(6.92)	28.25(7.44)	0.091
Autonomy	25.81(5.72)	26.56(6.75)	0.508
Positive Relationships	29.51(6.49)	31.27(6.07)	0.099
Purpose in Life	30.68(5.95)	32.19(5.51)	0.117
Environmental Mastery	26.29(5.66)	27.48(6.14)	0.256
Personal Growth	32.68(5.22)	33.52(4.79)	0.317
Gratitude	35.98(5.12)	37.04(4.7)	0.194

Self-Compassion	58.3(12.7)	63.03(13.3)	0.041*
Compassion for Others	59.43(15.27)	63.7(16.37)	0.130
RMSSD	67.99(34.88)	59.37(30.65)	0.114
HF HRV	7.26(1.01)	6.96(0.96)	0.066

Note. Depression, anxiety, stress, self-acceptance, autonomy, positive relationships, purpose in life, environmental mastery, personal growth, and gratitude have a maximum score of 42. Self-compassion and compassion for others have a maximum score of 100. $*p < 0.05$

Table 2. Correlations for Study Variables at Baseline

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Depression Symptoms	-													
2. Anxiety Symptoms	0.49***	-												
3. Stress symptoms	0.59***	0.71***	-											
4. Autonomy	-0.28***	-0.27***	-0.28***	-										
5.Environmental Mastery	-0.59***	-0.46***	-0.54***	0.52***	-									
6. Personal Growth	-0.39***	-0.17**	-0.21**	0.40***	0.55***	-								
7. Positive Relationships	-0.46***	-0.33***	-0.39***	0.29***	0.53***	0.44***	-							
8. Purpose in Life	-0.48***	-0.26***	-0.29***	0.43***	0.66***	0.53***	0.46***	-						
9. Self-Acceptance	-0.62***	-0.39***	-0.39***	0.47***	0.70***	0.59***	0.57***	0.62***	-					
10. Gratitude	-0.34***	-0.11	-0.18**	0.21**	0.42***	0.46***	0.51***	0.48***	0.52***	-				
11. Self-Compassion	-0.41***	-0.23***	-0.28***	0.36***	0.49***	0.49***	0.36***	0.42***	0.60***	0.33***	-			
12. Compassion from Others	-0.22***	-0.05	-0.06	0.05	0.24***	0.23***	0.54***	0.29***	0.30***	0.32***	0.23***	-		
13. RMSSD	0.00	-0.09	-0.04	0.06	0.08	0.01	0.03	0.09	-0.01	0.15*	-0.04	0.09	-	
14. HF-Log	0.00	-0.06	-0.01	0.04	0.10	0.04	0.00	0.09	0.00	0.16*	-0.06	0.05	0.91***	-

Note. *p < 0.05, **p < 0.01, ***p < 0.001

Hypothesis 1: Impact of the Applied Mental Health Class on Psychological Measures

The distress model that included depression, anxiety, and stress, fit reasonably well, χ^2 (40, N = 234) = 89.765, p = 0.000, RMSEA = 0.073, CFI = 0.951, SRMR = 0.061. The summed scores of depression, anxiety, and stress significantly and strongly loaded to the latent variable of distress for each time point. The regression of group identity on the intercept and slope latent variables were not significant with p = 0.813 and p = 0.933, respectively. Sex did have a significant relationship with the intercept latent variable such that males had a -3.698 difference at baseline (p = 0.000). The regression of sex on slope did not have a significant relationship (p = 0.351). The parameter estimates are presented in Table 3.

Table 3. Parameter Estimates and Standard Errors for the DASS

Parameter	Estimate	SE	p	Standardized estimate
Measurement Model				
Depression	1.000[a]	-	-	0.668, 0.642, 0.615[c]
Anxiety	1.033[b]	0.087	0.000***	0.737, 0.778, 0.804[c]
Stress	1.339[b]	0.109	0.000***	0.918, 0.851, 0.870[c]
Structural Model				
Group -> Intercept	0.247	1.046	0.813	0.018
Group -> Slope	0.042	0.499	0.933	0.020
Sex -> Intercept	-3.698	0.888	0.000***	-0.331
Sex -> Slope	0.412	0.442	0.351	-0.242

Note. [a]Parameter fixed a priori for model identification or theoretical reasons; [b]parameter set equal across time; [c]standardized factor loadings are reported in the following order: Time1, Time 2, Time3. Dashes (-) indicate that a standard error was not computed due to a parameter being fixed rather than freely estimated. *p<0.05 **p<0.01 ***p<0.001

The eudaimonia model that included autonomy, environmental mastery, personal growth, positive relationships, purpose in life, and self-acceptance fit well, χ^2 (167, N = 234) = 222.370,

$p = 0.003$, RMSEA = 0.038, CFI = 0.982, SRMR = 0.063. The summed scores of included

autonomy, environmental mastery, personal growth, positive relationships, purpose in life, and

self-acceptance significantly and strongly loaded to the latent variable of eudaimonia for each

time point. The regression of group identity on the intercept and slope latent variables were not

significant with $p = 0.105$ and $p = 0.785$, respectively. Sex did have a significant relationship

with the slope latent variable such that males had a -0.448 difference across time ($p = 0.021$).

The regression of sex on intercept did not have a significant relationship ($p = 0.134$). The

parameter estimates are presented in Table 4.

Table 4. Parameter Estimates and Standard Errors for the PWB

Parameter	Estimate	SE	p	Standardized estimate
Measurement Model				
Autonomy	1.000[a]	-	-	0.498, 0.537, 0.536[c]
Environmental Mastery	1.627[b]	0.159	0.000***	0.847, 0.844, 0.866[c]
Personal Growth	1.117[b]	0.122	0.000***	0.701, 0.695, 0.698[c]
Positive Relationships	1.326[b]	0.144	0.000***	0.655, 0.720, 0.728[c]
Purpose in Life	1.441[b]	0.145	0.000***	0.787, 0.816, 0.846[c]
Self-Acceptance	1.861[b]	0.183	0.000***	0.817, 0.852, 0.891[c]
Structural Model				
Group -> Intercept	-0.923	0.569	0.105	-0.119
Group -> Slope	-0.058	0.213	0.785	-0.029
Sex -> Intercept	0.705	0.470	0.134	0.110
Sex -> Slope	-0.448	0.193	0.021*	-0.267

Note. [a]Parameter fixed a priori for model identification or theoretical reasons;
[b]parameter set equal across time; [c]standardized factor loadings are reported in the
following order: Time1, Time 2, Time3. Dashes (-) indicate that a standard error
was not computed due to a parameter being fixed rather than freely estimated.
*$p<0.05$ **$p<0.01$ ***$p<0.001$

The gratitude model that included the questionnaires individual items had acceptable fit,

$\chi^2 (167, N = 234) = 350.674$, $p = 0.000$, RMSEA = 0.069, CFI = 0.891, SRMR = 0.098. The

individual items significantly and strongly loaded to the latent variable of gratitude for each time

point. The regression of group identity on the intercept and slope latent variables were not

significant with $p = 0.120$ and $p = 0.657$, respectively. Sex did have a significant relationship

with the intercept latent variable such that males had a -0.207 at baseline ($p = 0.035$). The

regression of sex on slope did not have a significant relationship ($p = 0.726$). The parameter

estimates are presented in Table 5.

Table 5. Parameter Estimates and Standard Errors for the Gratitude Questionnaire

Parameter	Estimate	SE	p	Standardized estimate
Measurement Model				
Item 1	1.000[a]	-	-	0.806, 0.817, 0.720[c]
Item 2	1.125[b]	0.068	0.000***	0.806, 0.780, 0.876[c]
Item 3	1.104[b]	0.100	0.000***	0.559, 0.623, 0.559[c]
Item 4	1.050[b]	0.089	0.000***	0.628, 0.677, 0.666[c]
Item 5	0.941[b]	0.069	0.000***	0.732, 0.674, 0.648[c]
Item 6	1.284[b]	0.136	0.000***	0.496, 0.528, 0.519[c]
Structural Model				
Group -> Intercept	-0.184	0.119	0.120	-0.116
Group -> Slope	0.024	0.054	0.657	0.047
Sex -> Intercept	-0.207	0.098	0.035*	-0.159
Sex -> Slope	-0.017	0.048	0.726	-0.041

Note. [a]Parameter fixed a priori for model identification or theoretical reasons; [b]parameter set equal across time; [c]standardized factor loadings are reported in the following order: Time1, Time 2, Time3. Dashes (-) indicate that a standard error was not computed due to a parameter being fixed rather than freely estimated. *$p<0.05$ **$p<0.01$ ***$p<0.001$

The compassion from others model that included the questionnaires individual items had

generally acceptable fit, χ^2 (465, N = 234) = 856.031, $p = 0.000$, RMSEA = 0.060, CFI = 0.896,

SRMR = 0.064. The individual items significantly and strongly loaded to the latent variable of

compassion from others for each time point. The regression of group identity on the intercept and

slope latent variables were not significant with $p = 0.093$ and $p = 0.337$, respectively. Sex did not

have a significant relationship with the intercept and slope latent variable with $p = 0.234$ and $p = 0.487$, respectively. The parameter estimates are presented in Table 6.

Table 6. Parameter Estimates and Standard Errors for the Compassion from Others Scale

Parameter	Estimate	SE	p	Standardized estimate
Measurement Model				
Engagement Item 1	1.000[a]	-	-	0.760, 0.808, 0.809[c]
Engagement Item 2	1.006[b]	0.058	0.000***	0.722, 0.784, 0.765[c]
Engagement Item 4	0.661[b]	0.061	0.000***	0.519, 0.529, 0.486[c]
Engagement Item 5	0.654[b]	0.050	0.000***	0.593, 0.641, 0.587[c]
Engagement Item 6	0.981[b]	0.056	0.000***	0.753, 0.810, 0.717[c]
Engagement Item 8	0.766[b]	0.056	0.000***	0.593, 0.692, 0.609[c]
Action Item 1	1.000[b]	0.049	0.000***	0.885, 0.894, 0.822[c]
Action Item 2	1.010[b]	0.051	0.000***	0.826, 0.893, 0.824[c]
Action Item 4	0.899[b]	0.051	0.000***	0.729, 0.818, 0.750[c]
Action Item 5	0.867[b]	0.047	0.000***	0.764, 0.823, 0.802[c]
Structural Model				
Group -> Intercept	-0.524	0.312	0.093	-0.128
Group -> Slope	0.149	0.156	0.337	0.075
Sex -> Intercept	-0.301	0.253	0.234	-0.089
Sex -> Slope	0.095	0.136	0.487	0.058

Note. [a]Parameter fixed a priori for model identification or theoretical reasons; [b]parameter set equal across time; [c]standardized factor loadings are reported in the following order: Time1, Time 2, Time3. Dashes (-) indicate that a standard error was not computed due to a parameter being fixed rather than freely estimated. *$p<0.05$ **$p<0.01$ ***$p<0.001$

The self-compassion model that included engagement with self-compassion and self-compassionate action fit very well, χ^2 (13, N = 234) = 13.521, $p = 0.408$, RMSEA = 0.013, CFI = 0.999, SRMR = 0.029. The summed scores of engagement with self-compassion and self-compassionate action significantly and strongly loaded to the latent variable of self-compassion

for each time point. The regression of group identity on the intercept and slope latent variables were not significant with $p = 0.240$ and $p = 0.331$, respectively. Sex did not have a significant relationship with the intercept and slope latent variable with $p = 0.54$ and $p = 0.513$, respectively. The parameter estimates are presented in Table 7.

Table 7. Parameter Estimates and Standard Errors for the Self-Compassion Scale

Parameter	Estimate	SE	p	Standardized estimate
Measurement Model				
Engagement	1.000[a]	-	-	0.766, 0.765, 0.764[c]
Action	0.849[b]	0.388	0.029*	0.779, 0.801, 0.816[c]
Structural Model				
Group -> Intercept	-2.100	1.788	0.240	-0.153
Group -> Slope	0.656	0.674	0.331	0.127
Sex -> Intercept	1.902	0.988	0.054	0.169
Sex -> Slope	-0.383	0.586	0.513	-0.090

Note. [a]Parameter fixed a priori for model identification or theoretical reasons; [b]parameter set equal across time; [c]standardized factor loadings are reported in the following order: Time1, Time 2, Time3. Dashes (-) indicate that a standard error was not computed due to a parameter being fixed rather than freely estimated. *$p<0.05$ **$p<0.01$ ***$p<0.001$

Hypothesis 2: Impact of the Applied Mental Health Class on HRV

The HRV model that included RMSSD and HF-log fit very well, χ^2 (6, N = 206) = 7.256, $p = 0.298$, RMSEA = 0.032, CFI = 0.999, SRMR = 0.030. The RMSSD and HF-log significantly and strongly loaded to the latent variable of HRV for each time point. The regression of group identity on the HRV at time 1 and difference latent variables were not significant with $p = 0.281$ and $p = 0.635$, respectively. Sex did not have a significant relationship with HRV at time 1 and difference latent variables with $p = 0.192$ and $p = 0.778$, respectively. Lastly, age did not have a significant relationship with HRV at time 1 and difference latent variables with $p = 0.159$ and $p = 0.747$, respectively. The parameter estimates are presented in Table 8.

Table 8. Parameter Estimates and Standard Errors for HRV

Parameter	Estimate	SE	*p*	Standardized estimate
Measurement Model				
RMSSD	1.000[a]	-	-	0.955, 0.966[c]
HF-Log	2.045[b]	0.087	0.000***	1.008, 0.987[c]
Structural Model				
Group -> HRV at Time 1	0.089	0.082	0.281	0.075
Group -> Difference	0.042	0.088	0.635	0.038
Sex -> HRV at Time 1	-0.098	0.075	0.192	-0.099
Sex -> Difference	-0.025	0.089	0.778	-0.027
Age -> HRV at Time 1	-0.024	0.017	0.159	-0.104
Age -> Difference	-0.007	0.021	0.747	-0.031

Note. [a]Parameter fixed a priori for model identification or theoretical reasons;
[b]parameter set equal across time; [c]standardized factor loadings are reported in the
following order: Time1, Time 2, Time3. Dashes (-) indicate that a standard error
was not computed due to a parameter being fixed rather than freely estimated.
*p<0.05 **p<0.01 ***p<0.001

Hypothesis 3: Mediation of Positive Psychology on the Relationship between Psychological Measures and HRV

Because there were not significant changes across time in distress, eudaimonia, gratitude, self-compassion, compassion from others, or HRV, a mediation was not done as this hypothesis was conditional on observing significant change across time.

Discussion

This study sought to assess the impact of applied mental health classes on both psychological (e.g., distress and eudaimonia) and physiological (e.g., HRV) functioning in college students. Mental health disorders are becoming increasingly prevalent, especially among college age students and college counseling centers are often not able to keep up with the growing demand for psychological treatment (Kessler & Zhao, 2010; Vostanis & Bell, 2020).

Applied mental health classes are a novel treatment approach that teaches therapeutic principles in a classroom setting. These classes were created with hopes of reaching distressed students and providing psychological support to address the large need for psychological services. Although this specific treatment model has not been empirically tested, studies from related approaches (e.g., personal practice in psychotherapy classes) observed significant beneficial impacts on mental health outcomes (Bennett-Levy & Finlay-Jones, 2018; Pakenham & Viskovich, 2019). Additionally, there are many studies showing significant relationships between psychological health and HRV that suggested that these classes could positively impact both psychological and physical health outcomes (Chien et al., 2015; Kim et al., 2009; Mankus et al., 2013; Steffen et al., 2021b).

My first hypothesis was that participants in the experimental group would have significant decreases in symptoms of distress (i.e., depression, anxiety, and stress) and increases in eudaimonia (i.e., autonomy, environmental mastery, personal growth, positive relationships, purpose in life, and self-acceptance), gratitude, and facets of compassion (self-compassion, compassion from others) in comparison to the control group. Across all of the psychological measures, there were no significant changes over time in either the experimental group or the control group. There were significant sex differences that arose in the analyses. Males had significantly lower levels of distress and gratitude at baseline. Additionally, males' report of eudaimonia significantly decreased compared to females across time. The second hypothesis was that HRV would significantly increase for the participants in the experimental group in comparison to the control group. HRV (i.e., RMSSD, HF-HRV) did not significantly change across time and there were no significant relationships with sex or age at baseline or across time.

The findings of the present study differ from the literature on the outcomes of treatments for depression, anxiety, and stress (Cuijpers et al., 2008; Ferrari et al., 2019). Traditional therapy models (e.g., CBT, ACT, compassion focused therapy, individual therapy, group therapy) lead to significant decreases in depression, anxiety, and stress (Bandelow et al., 2015; Cuijpers et al., 2013; Millard et al., 2023). Across different therapy modalities, the personal practice of therapy skills on their own plays a key role in decreasing symptoms in samples with clinical diagnoses and significant distress (Pakenham & Viskovich, 2019). Although the intervention in the present study was similar with traditional therapy approaches, there are notable differences. Some of the similarities include similar theoretical orientation, exercises, examples, and practice assignments. Some of the differences include the therapeutic setting, number of people in the group, class format, and the assignment of a grade based on participation and engagement with coursework. Comparisons with traditional therapy models can be informative, but because of key differences in the therapeutic setting and how the class was administered, these comparisons may not be analogous.

There are few studies that have implemented psychotherapy in classroom settings and initial studies also observed significant changes as participants practiced on their own (Browning et al., 2022; Danitz & Orsillo, 2014; Danitz et al., 2016; Pistorello et al., 2013). One explanation for the lack of findings in my sample was the presence of a floor effect. When looking at the baseline characteristics, the mean scores on measures of depression, anxiety, and stress were quite low. In fact, when looking at the severity descriptors based off the sum score ranges, all of the participants' means were in either in the normal or mild range. There was little room for improvement as many of the participants' scores were already low to begin with. The participants' baseline levels in the present study were surprising given the current prevalence

rates of mental health disorders in college. In one study, prevalence rates for mental health disorders for those ages 18 to 29 were estimated to be 52.4% (Kessler & Zhao, 2010). Another study of 1628 young adults found that the 12-month prevalence of any mental disorder was 19.8% in men and 32.4% in women (Gustavson et al., 2018). Despite current prevalence rates for psychological disorders, my sample was psychologically healthier than was anticipated.

Gratitude has been a topic of study for decades now and gratitude interventions benefit well-being, happiness, life satisfaction, positive affect and decrease depressive symptoms (Dickens, 2017; Lambert et al., 2012; Wood et al., 2008; Wood et al., 2010). Few studies have examined changes in gratitude from therapy, but one study by Pearce and colleagues (2016) observed significant improvement in gratitude from both religiously integrated and conventional CBT. The CBT intervention in the study by Pearce and colleagues (2016) consisted of guided discovery, Socratic questioning, behavioral activation, identifying and challenging automatic thoughts, gratitude assignments, and mindfulness meditation. Although only one session of the ten was focused on gratitude, participants experienced a significant improvement in gratitude at the end of treatment and those gains were maintained at a 12-week follow-up. A randomized controlled trial that examined the effectiveness of CFT through a guided self-help format also examined significant changes in gratitude (Sommers-Spijkerman et al., 2018). This study mailed a CFT focused self-help book to participants that consisted of psychoeducation and exercises that encouraged self-reflection, mindful breathing, and self-compassion. They also emailed participants each week with personalized guidance based off their email correspondence. Even though gratitude was not a specific focus, significant improvements occurred. Despite these encouraging studies, the present study did not observe significant improvements in gratitude. A possible explanation could be a ceiling effect. This was observed for gratitude as 16% of the

participants maxed out the scale and another 50 % were within five points of the maximum score. This left little room for improvement on measures of gratitude.

Eudaimonia focuses on human flourishing and principles that encourage living well (Waterman, 1993). In a systematic review of eudaimonia and psychological distress, researchers observed that as eudaimonia increases, psychological distress decreases (Ruini & Cesetti, 2019). The individual aspects of eudaimonia (i.e., self-acceptance, purpose in life, environmental mastery, positive relationships, personal growth, autonomy) also lead to decreases in depression, anxiety, and stress as these facets improve (Costanza et al., 2019; Erzen & Çikrikci, 2018; Garcia et al., 2014; Popov, 2019; Wood & Joseph, 2010). Eudaimonia also improves significantly in treatment studies using ACT, CBT, or positive psychotherapy (Ruini & Cesetti, 2019). Sommers-Spijkerman and colleagues (2018) also observed increases in measures of eudaimonia in their study of guided self-help from a CFT modality. As other studies have observed increases in eudaimonia from CBT, ACT, CFT, and positive psychotherapy, I believed that this study would also observe significant improvements (Ruini & Cesetti, 2019). Despite the findings in the literature, this study did not observe significant improvements in measures of eudaimonia. It is notable that there was not a ceiling effect with measures of eudaimonia. All the baseline means of eudaimonia were close to the middle of the scale with ample room for improvement. There are not any studies that have looked at this class structure specifically, but studies with similar structures in psychotherapy training courses have found significant improvements (Bennett-Levy & Finlay-Jones, 2018; Pakenham & Viskovich, 2019; Pistorello, 2013; Pistorello et al., 2013). Many of these studies measured personal practice and found that personal practice meditated the significant change in outcomes due to the class (Pakenham & Viskovich, 2019). Our study did not have a measure of treatment adherence or personal practice,

and it is possible that one explanation for a lack of improvement is a lack of personal practice or application of the material learned in class.

Another explanation for a lack of change could be low motivation to change. The transtheoretical model proposes distinct stages of change that predict treatment success (Prochaska & DiClemente, 1994). Readiness for change has been shown to be a significant moderate of treatment outcomes in many studies (Boswell et al., 2012; Tsoh & Hall, 2004; Li et al., 2020). These stages include a precontemplation, contemplation, preparation, action, and maintenance stage with those in the action stage taking overt action towards change (Prochaska et al., 1997). It is possible those in our sample were in the earlier stages of change where there is more ambivalence towards change and less change behavior. This hypothesis may be plausible as taking an educational class about compassion can be indicative of the preparation stage (Prochaska et al., 1997). If many of the participants were in earlier stages of change than the action stage during the treatment, then this may be an explanation for a lack of improvement.

Self-compassion has been a focus in recent lines of research with strong relationships to both psychological and physical health (Breines et al., 2014; Dryden, 2013; Di Bello et al., 2020; Ferrari et al., 2019; Pinto-Gouveia et al., 2014). Self-compassion is a strong predictor of depression, anxiety, and life satisfaction (Dryden, 2013; Mehr & Adams, 2016). A meta-analysis of randomized controlled trials on self-compassion found large effect sizes for rumination and moderate effect sizes for stress, depression, and anxiety (Ferrari et al., 2019). CFT and mindfulness based cognitive therapy also significantly improves self-compassion and decreases depression, anxiety, and stress in a wait-list controlled study (Frostadottir & Dorjee, 2019). Although CFT administered in individual therapy and group therapy are effective, compassion focused therapy administered in the classroom setting did not lead to significant improvements in

either self-compassion or compassion from others. There may be important environmental differences present in individual therapy and group therapy that may not be present in a classroom. One example may be the therapeutic relationship. The therapeutic relationship, when present, provides patients with a safe and secure environment to engage with new and often challenging practices (Matos et al., 2022). The therapeutic relationship can be easily created in smaller settings like individual therapy and group therapy where patients and group members are active participants in their treatment and relationship with the clinician and other group members. A classroom setting may not have the same level of safety and security to explore and experiment with new therapeutic techniques, not due to the inexperience of the instructor, but because of the size of the class. The ideal number of group members is approximately seven or eight members (Yalom & Leszcz, 2020). Groups that are too large begin to lose effectiveness and cohesion as subgrouping can occur, it is easier for group members to be passive participants, and less time is allowed for individual focus (Yalom & Leszcz, 2020). The classes in our sample had around 25 students which is much larger than the recommended amount and may have resulted in the participants not feeling safe or secure enough to explore and experiment with new behaviors and ways of thinking.

HRV, a measure of autonomic flexibility and strong predictor of cardiac mortality, has relationships with psychological distress and can be increased with focused interventions (Alvares et al., 2016; Chen et al., 2022; Dimitriev et al., 2016). A study by Kemp and colleagues (2012) observed that HRV was significantly lower in physically health individuals with major depressive disorder and generalized anxiety disorder compared to a control group. Psychological disorders like depression and anxiety significantly impact both mental health and physical health. Traditional treatments for depression and anxiety (e.g., CBT) do not improve HRV although the

participant's symptoms decrease (Caldwell & Steffen, 2018; Euteneuer et al., 2023; Wheeler et al., 2014). Individuals that recover from a depressive episode still carry a significant health risk despite successful psychological treatment. Newer psychological treatments that involve forms of compassion, mindfulness, and breathing techniques can significantly improve HRV (Di Bello et al., 2020; Mankus et al., 2013). The applied mental health classes in this study used CFT, a psychological treatment that improves HRV, but the participants did not significantly improve in HRV. Some key things to note was that this study was in young college students that had healthy measures of HRV at baseline. There was a ceiling effect, and the participants had little room for improvement. Other studies that observed significant improvements had a sample that were high on psychological distress and low in measures of HRV while the sample in the present study did not have either.

Limitations and Future Directions

There are significant limitations that should be considered. One limitation is the generalizability of this study's findings. The sample of this study consisted of young college students that were already psychologically and physically healthy at baseline. This is a significant limitation that impacted our ability to assess the effectiveness of the applied mental health classes. It is possible that in a more distressed sample, this class would have been effective in improving psychological well-being and decreasing psychological distress. A young and healthy sample can also be problematic for HRV as significant differences in HRV are more pronounced in older age, people diagnosed with depression, and in those experiencing significant stress (Umetani et al., 1998; Kemp et al., 2012). Another limitation was the non-randomized design of the study. A design that includes random assignment to either a control group or a

treatment group could have more power to assess the impact of the applied mental health classes while controlling for potential confounding variables that can arise in non-randomized studies.

An important next step in assessing the effectiveness of the applied mental health classes is to test these classes in a population with increased distress or diagnosed psychological disorders. The floor effect that I observed would not be a challenge in a population with increased distress. Another consideration in studying these classes would be to include measures of motivation and treatment adherence as moderating variables in observing change. Because these variables were not included in this study, I was not able assess the impact that these could have on the participants' outcome. Lastly, this class focused on compassion focused therapy. Other studies could address the impact of other treatment modalities like cognitive behavioral therapy or acceptance and commitment therapy and see if alternative treatment modalities are effective in the class setting.

Although this study did not observe significant decreases in symptoms, these classes still have the potential to aid distressed students. One significant challenge was that the students in my sample were not significantly distressed at baseline. Because the class was open enrollment, students that were not distressed registered for the class. To avoid the floor and ceiling effect that was observed in the present study, an alternative approach to class recruitment would be warranted. Many college counseling centers have long waitlists and while students wait, these applied mental health classes could be recommended in the interim (Thomas et al., 2020). Additionally, the classes could be advertised in the counseling center and academic and career counselors could be informed of these classes and recommend the class to distressed students they meet with. The applied mental health classes observed in this study could be beneficial if delivered to a distressed population.

Conclusion

Overall, I did not observe significant changes in measures of distress (depression, anxiety, and stress), eudaimonia, gratitude, or compassion due to the applied mental health classes. I also did not observe significant changes in measures of HRV as a result of the classes. It is important to note that I observed a floor effect and ceiling effect in our particular sample which could cloud our findings that the applied mental health classes did not lead to improvement. More specifically, measures of depression, anxiety, and stress were in the normal to mild ranges for both the experimental and control group. Measures of HRV were high at baseline and gratitude scores were close to the highest possible score on the scale. There was not a floor or ceiling effect for measures of eudaimonia, self-compassion, and compassion from others, but there were no improvements in any of these measures. Some potential explanations for this finding could be poor adherence to the treatment, low motivation for change, or environmental differences present in the class that could diminish the effectiveness of the treatment. It is possible that in a more distressed sample, significant changes could be observed because of the classes. Future studies could continue to investigate these classes as this treatment approach could be a cost-effective way to provide treatment in light of current challenges mental health disparities.

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