Inner Engineering: A Multiphase Mixed Methods Study Evaluating the Utility of Mindfulness Training to Cultivate Intrapersonal and Interpersonal Skills among First-year Engineering Students

by

Mark V. Huerta

A Dissertation Presented in Partial Fulfillment
of the requirements for the Degree
Doctor of Philosophy

Approved June 2019 by the
Graduate Supervisory Committee

Ann McKenna, Chair
Teri Pipe
Adam Carberry

ARIZONA STATE UNIVERSITY

August 2019

ABSTRACT

Background – Among influential education reports, there is clear consensus that an expansive range of intrapersonal (e.g. self-regulation) and interpersonal competencies (e.g. empathy) highly influence educational and career success. Research on teaching and learning these competencies is limited in engineering education.

Purpose/Hypothesis – This dissertation study explores the impacts of a mindfulness training program on first-year engineering students and aims to understand potential impacts on the development of intrapersonal and interpersonal competencies.

Design/Method – A four-session mindfulness-based training program was designed, developed, and facilitated to cultivate intrapersonal and interpersonal competencies. This study employed a multiphase mixed method design in which quantitative and qualitative data was collected from a total of 35 different students through a post survey (n=31), 3-month follow-up survey (n=29), and interviews (n=18). t-tests were used to evaluate the statistical significance of the program and a rigorous thematic analysis process was utilized to help explain the quantitative data.

Results – The results suggest that the majority of students became more mindful, which led to improved intrapersonal competencies (i.e. self-management, critical-thinking, focus, resilience, and well-being) and interpersonal competencies (i.e. empathy, communication, teamwork, and leadership).

Discussion / Conclusions – The study provides compelling evidence that mindfulness training can support the development of intrapersonal and interpersonal skills among engineering students, which can support their overall academic experience, as well as

personal and professional development. Future design and development work will be needed to evaluate the integration and scalability potential of mindfulness training within engineering programs.

DEDICATION

This dissertation paper is dedicated to my fiancé, Susan Sajadi. She believed in me and the value of obtaining my PhD from the very beginning and provided me with the encouragement I needed to continue progressing especially through the difficult times. I especially appreciate her willingness to listen and help me think through and evolve my ideas. I am so blessed to have her in my life!

ACKNOWLEDGMENTS

There are so many other people that have provided me with strength and guidance during my PhD journey. This has been the most intellectually-demanding yet rewarding experience of my life. I would like to acknowledge my parents who have been so incredibly supportive of my desire to pursue my PhD and have always been eager to hear about my progress.

Thank you to all the faculty at ASU who have enabled me to have an outstanding PhD experience. Firstly, I would like to thank my advisor, Ann McKenna, for guiding me throughout the PhD process, always providing timely advice, and being an advocate for me. From Ann I learned the value of mentorship and how to be a composed leader in all situations. I am especially grateful I never once had to worry about a lack of funding.

I would also like to acknowledge the efforts of my other two committee members, Adam Carberry and Teri Pipe. Thank you, Adam for also being a great mentor for me and taking time to meticulously read through my work. Your thoughtful feedback and edits have shown me how to become a better researcher and writer. Thank you, Teri for your feedback throughout the process and providing me with the opportunities to further enhance my personal mindfulness practice through the various trainings the Center for Mindfulness, Compassion, & Resilience has sponsored. These experiences and your personal feedback helped instill in me the confidence that I could effectively facilitate these mindfulness trainings on engineering students.

I would also like to thank the EESD faculty for doing such an incredible job designing the program. Special thanks to Jeremi London for teaching the Mixed Methods course

that enabled me to draft an initial proposal for my dissertation comprehensive exam. Thank you to Jennifer Bekki, Samantha Brunhaver, and Adam Carberry for training me as a quantitative, social sciences researcher. Thank you to Nadia Kellam, Shawn Jordan, and Samantha Brunhaver for training me as a qualitative social sciences researcher.

I would also like to acknowledge Ann Sebren for teaching a graduate course on mindfulness. This class provided me with a rich foundation of knowledge on mindfulness research and awareness of the most influential papers in the field.

In addition to the faculty, I would like to acknowledge two of my PhD peers - Eunsil Lee and Steven Weiner - for their support throughout my PhD experience. Our coffee and lunch meetings were inspiring and were the catalyst for many great ideas. I am very grateful I was able to share the PhD journey with them.

The final two people I would like to thank are Scott Shrake and Mark Henderson for sharing the EESD program to me and encouraging me in the first place to pursue this PhD program.

Finally, I would like to acknowledge the generosity of the Kern Family Foundation for funding my research position for all three years and generally the great work they do supporting entrepreneurial mindset across ASU and the KEEN network.

TABLE OF CONTENTS

Page

APPENDIX Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER 1: INTRODUCTION

There is a growing recognition that intrapersonal and interpersonal competencies play an important role in the future success of engineering students. Several influential reports have suggested that efforts must be made to develop these competencies (Prince, Saveri, & Swanson, 2017; Lucas, Hanson, & Claxton, 2014; Clough, 2004; NRC, 2013). For example, *The Future of Learning* report highlights that social-emotional skills like empathy, self-awareness, metacognition, and emotional regulation, are essential to building collaborative, resilient, and adaptable workplaces (Prince, Saveri, & Swanson, 2017). The *Thinking Like an Engineer: Implications for the Education System* report discusses that, although habits of mind like resilience, reflection, and collaboration are not unique to engineering, they nonetheless are instrumental to becoming a good engineer (Lucas, Hanson, & Claxton, 2014). The National Academy of Engineering's *The Engineer of 2020: Visions of Engineering in the New Century* report shares that in addition to engineers possessing strong analytical skills and practical ingenuity, other attributes are increasingly becoming more important to the future success of engineering students, including strong communication skills, professionalism, dynamism, agility, resilience, flexibility, a desire for life-long learning, and leadership (Clough, 2004). Additionally, the National Research Council (NRC) of the National Academies report on *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century* identifies the Big Five Personality trait of conscientiousness as a "highly correlated with desirable educational, career, and health outcomes" (NRC, 2013, p. 4). Each of these reports speaks to the importance of interpersonal and intrapersonal

competencies, but requires a deeper understanding of how these competencies impact success.

The NRC report examined the role of these competencies for success in the 21st century within education, work, health, and life contexts (NRC, 2013). The report generated a taxonomy of three broad domains – cognitive, intrapersonal, and interpersonal – and provided a brief definition for each domain:

> The cognitive domain involves reasoning and memory; the intrapersonal domain involves the capacity to manage one's behavior and emotions to achieve one's goals (including learning goals); and the interpersonal domain involves expressing ideas and interpreting and responding to the message from others (p. 3).

The current body of research examining these domains indicates intrapersonal and interpersonal competencies support deeper learning of school subjects; yet, cognitive competencies – such as problem-solving, critical-thinking, information literacy, creativity – have been studied more extensively than intrapersonal and interpersonal competencies. There is a clear need for new research efforts on how to develop intrapersonal and interpersonal competencies in formal settings, particularly as technological advancements lead a shift in the skills necessary to contribute to the future workplace. These skills include problem-solving, teamwork, communication, planning and time management, taking initiative, thinking creatively, and focusing on goals, which were identified by Passow and Passow's (2017) recent meta-analysis based on ratings from practicing engineers, engineering faculty, and engineering graduates. The data reviewed also suggested that engineers spend about 55% to 60% of their day communicating as part of collaborative efforts. The major conclusion of this analysis is that "technical competence is inseparably intertwined with effective collaboration" (p. 491).

Others have also advocated for the importance of intrapersonal competencies among engineering students such as emotional intelligence (Riemer, 2003), emotional resilience (Jesiek et al., 2014), adaptability (Ahn, Annie, & Kwon, 2012), emotional awareness (Bish, Newton, Browning, O'Connor, & Anibaldi, 2014), working under pressure (Walther et al., 2011), empathy (Hess, Strobel, Pan, & Morris, 2016, Walther et al., 2017), mindfulness (Goldberg and Somerville, 2014), and reflective behaviors (Knight, 2014). The sum of these efforts suggests an emerging consensus within the engineering ecosystem that intrapersonal and interpersonal skills are important engineering professional competencies.

NEED FOR INTERPERSONAL COMPETENCIES

Engineering education has historically focused on developing cognitive competencies, but recent attention and emphasis has been placed on developing a wider range of interpersonal competencies through the integration of active-learning pedagogies. Active learning pedagogies have largely been successful in promoting deeper-learning, transfer, motivation, and engagement, while having students practice teamwork, communication, and leadership skills, and exposing students to more social and global issues (Lattuca, Terenzeni, and Volkwein, 2006; Mills & Treagust, 2003; Frank, Lavy, & Elata; Smith, Sheppard, Johnson, & Johnson, 2005; Lehmann et al., 2008; Hadim & Esche, 2002; Yadav et al., 2011; Lima et al., 2007; Jones, Epler, Mokri, Bryant, & Paretti et al., 2013; Savage, Chen, & Vanasupa, 2007). The proliferation of active, experiential learning pedagogies in engineering education has supported the development of interpersonal skills, but additional evidence has indicated there is still room for improvement (Markes, 2006; Meier, Williams, & Humphreys, 2000; Nair, Patil,

& Mertova, 2009; Nguyen, Yoshinari, & Shigeji, 2005). In particular, engineering students have been found to be less empathetic—an important interpersonal skill—than students from other disciplines like social work and psychology (Rasoal, Danielsson, and Jungert, 2012). Hess and colleagues (2016) found that engineering professionals did not feel like they become more empathetic or caring during college, but thought that fostering these skills in engineering education would enhance engineering practice.

Empathy has been recently gaining recognition as an important interpersonal competency to focus more on developing among engineering students because of its wide range of benefits, including supporting teamwork and communication skills (Baron-Cohen, 2011), making ethical decisions (Hoffman, 2000; Hess, Beever, Strobel, & Brightman, 2017), and the design process (Vallero, 2006; Zoltowski, Oates, and Cordella, 2012) from understanding stakeholder needs (Leonard & Rayport, 1997; Hey et al., 2007) to idea generation (Gray et al., 2015). Despite this awareness of the benefits of empathy, the current literature provides little guidance on how to foster empathy in undergraduate engineering programs (Walter, Miller, & Sochacka, 2017; Hess, Strobel, & Brightman, 2017; Hess, Strobel, Pan, Wachter Morris, 2016). Walther and colleagues (2017) note that engineering educators possess an implicit assumption that these skills can be classified more as fixed traits and are therefore not teachable or learnable skills. Currently, engineering students are mostly expected to learn interpersonal competencies like empathy incidentally on their own with little to no guidance coming from their engineering education.

NEED FOR INTRAPERSONAL COMPETENCIES

There has also been limited research that has been conducted to promote and understand intrapersonal competencies; the research thus far in engineering education has primarily focused on topics such as incremental beliefs about intelligence (e.g. Synder et al., 2018, Stump et al., 2014), self-regulated learning (e.g. Nelson et al., 2015), reflection (e.g. Turns et al., 2014), and metacognition (e.g. Cunningham et al., 2015). Despite these efforts, many students, not just in engineering, struggle to find mental balance. In the National College Health (NCHA) assessment of 88,178 students, 52.4% of felt overwhelmed by all they had to do in the last two weeks, 27.6% had felt overwhelming anxiety, 15.1% felt so depressed it was difficult to function, and 33.2% reported stress negatively affecting their individual academic performance (American College Health Association, 2018). The rate of mental disorders such as anxiety and depression appear to actually be increasing. In a 2015 survey, 95% of college counselors reported noticing more students are experiencing severe psychological problems than in previous years (Center for Collegiate Mental Health, 2017). This growth can likely be at least partially attributed to growing awareness and treatment options but is still notable that so many students consistently feel stressed and anxious. It is well-known that stress and anxiety are strongly linked with poor academic performance beyond the many negative health ramifications. For example, stress and anxiety are correlated with having poorer relationships with other students and faculty members, lower levels of engagement in campus clubs and activities, lower grade averages, and lower rates of graduation than students not suffering from mental health problems (Felsten and Wilcox, 1992; Pritchard and Wilson, 2003; Struthers, Perry, and Menec, 2000; Byrd and McKinney, 2012; Keyes et al., 2012; Salzer, 2012; Storrie et al., 2010).

Engineering is well-known to be a rigorous major with considerable perceived stress among students (Schneider, 2007; Janson, 2018). Students must be able to develop intrapersonal competencies, like self-regulation, to cope with stress in productive ways as well as achieving success in school. Zimmerman describes self-regulation as "the self-directive processes by which learners transform their mental skills into academic skills" (Zimmerman, 2002, p. 65). He considers self-regulation to be essential in developing life-long learning skills. There is also evidence indicating it is a teachable skill that an increase student achievement and motivation (Schunk & Zimmerman, 1998). A concerted effort is needed to continue to identify approaches to instill the value of intrapersonal and interpersonal skills as well as equip engineering students with tools and best practices for developing these skills. This is especially vital in the first year when many students are making a major transition and may have added responsibilities and stressors (e.g. academic pressure, financial concerns, and relationship difficulties). Potential stress can lead to a feeling of being overwhelmed, which can drive students to migrate to other disciplines; Ohland and colleagues (2008) report that 43% of entering first-year engineering students migrate to other disciplines.

PURPOSE

Supporting the processes within the psyche that promote autonomous regulation may provide an approach to assist the development of intrapersonal, while enhancing interpersonal skills. One method that has been demonstrated to promote one's autonomous regulation is intentionally orienting one's attention to the present moment, or what is happening on a moment-to-moment basis. The capacity for someone to focus their attention on the events transpiring in the present moment is known as mindfulness.

There is an exponentially growing body of literature within psychology that has explored the benefits of mindfulness training, especially among college students (Creswell, 2017; Brown, Creswell, & Ryan, 2015). Much of the initial explorations has centered around improving health outcomes (e.g. treating mental illness, chronic pain, etc.) (Creswell, 2017; Kabat-Zinn, 1982). Recent literature has begun to investigate mindfulness training as a tool to promote the development of intrapersonal and interpersonal skills among college students (Bamber and Schneider, 2016). No such studies have been conducted exploring the potential benefits of mindfulness training for engineering students. The purpose of this study is to investigate the potential utility of mindfulness to support the development of intrapersonal and interpersonal competencies among freshmen engineering students.

CHAPTER 2: THEORETICAL PERSPECTIVES

The concept of mindfulness is firmly rooted in Buddhist psychology and has origins that can be traced back over 2,500 years. It was only in the 1980-1990's that it became secularized and adopted by western researchers (Brown, Creswell, & Ryan, 2015). Although mindfulness has now been studied for several decades, no consensus conceptualization has emerged (Analayo, 2014). Mindfulness is a complex phenomenon to understand because it is rooted in consciousness itself. Perhaps the most influential definition of mindfulness is "paying attention in a particular way, on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994, p. 4). Most operational definitions of mindfulness include the capacity of being attentive or aware of the immediate, present moment or experience and the adoption of an orientation marked by acceptance, non-judgment, curiosity, and openness (e.g. Bishop et al., 2004; Baer et al., 2006; Feldman et al., 2007; Cardaciotto et al., 2008; Davis et al., 2009). These attitudes support the capacity for one to maintain a clear awareness on their salient internal and external realities in any given moment. This is why mindfulness has been associated with having a "pure" or "lucid" awareness (Sogyal, 1992; Das, 1997; Gunaratana, 2002). A common misconception is that mindfulness is antithetical to thought. Mindfulness instead fosters a different relationship to thought (Brown & Ryan, 2007). One can more objectively evaluate their thoughts, which can elicit insight into one's own biases and emotional response tendencies (Brown & Ryan, 2007). The rest of this section focuses on the mechanisms of the mindfulness relevant to this study. Figure 1 provides an overview of these mechanisms.

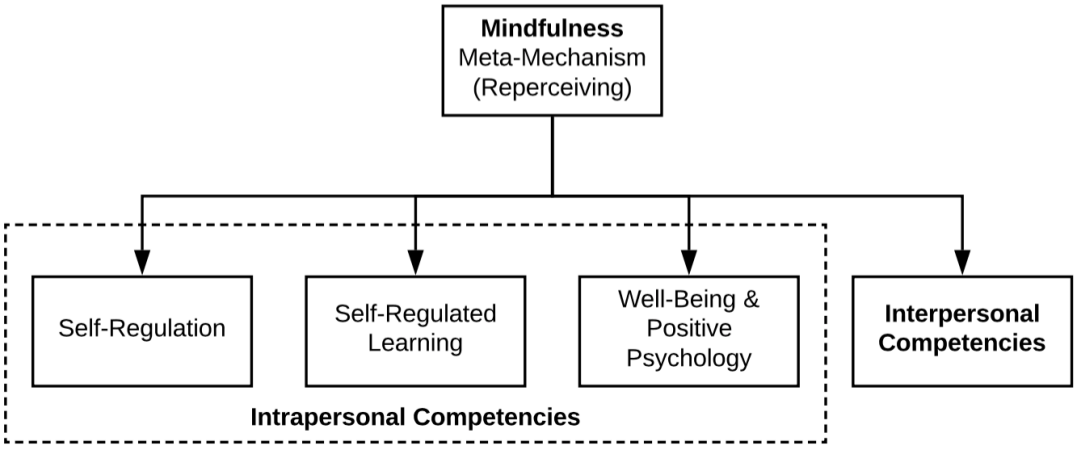
REPERCEIVING

Shapiro and colleagues (2006) identified the meta-mechanism of mindfulness as reperceiving, which is analogous to other psychological constructs such as decentering (Kabat-Zinn, 1990; Safran & Segal, 1990; Fresco, Segal, Buis, & Kennedy, 2007). Reperceiving describes the fundamental shift in perspective that occurs when one develops their capacity to orient themselves to the present moment and dispassionately (or objectively) observe the contents of their consciousness (i.e. one's thoughts, emotions, self-concepts, etc.). That is, one perceives the contents of their consciousness (i.e. thoughts and emotions) as "objects" within their field of awareness because they have "separated" themselves from these contents. There is a realization that one is in a transient state of awareness that observes the contents of his or her consciousness rather than being identified (or defined, determined, or controlled) by his or her own personal narrative (Kabat-Zinn, 1990). The "self" is deconstructed as identity shifts from the contents of awareness to awareness itself (Hayes et al., 1999).

It is important to note that reperceiving is not the same as numbing one's experience or becoming apathetic or disinterested (Shapiro et al., 2006). The opposite is true in that one can observe the present moment or experience exactly how it is with intimacy, versus identifying oneself with the mind's subjective commentary of what is happening. Reperceiving is a natural process, but mindfulness practice is believed to accelerate this shift in perspective (Shapiro et al., 2006). Reperceiving enables the other mechanisms of mindfulness to manifest. The mechanisms this paper will focus on are self-regulation, self-regulated learning, well-being and other positive psychology

mechanisms, and interpersonal competencies. Figure 1 provides an overview of the mechanisms featured in the paper.

Figure 1: Mechanisms of Mindfulness



SELF-REGULATION

Reperceiving can enhance self-regulation processes that promote stress management, resilience, and flexibility. Lazarus and Folkman's (1984) influential transactional model of stress and coping helps provide an explanation. The model suggests that there are two processors that act as mediators between the individual-environment transaction: cognitive appraisal and coping. When an individual is exposed to a stressor, they appraise the stressor, or evaluate how much of a threat they perceive it to be. An individual will almost instantly or automatically assess coping options, or the resources required to minimize, tolerate, or eradicate the stressor (Ohman, Carlsson, Lundqvist, & Ingvar, 2007). The appraisal and coping strategy are influenced by an individual's motivation, beliefs about themselves and the world, and recognition of personal resources for coping (Lazarus and Folkman, 1988). A stimulus in the

environment may be perceived as a stressor to some, but not all. Stress is almost always the result of this cognitive mediation process (Lazarus, 1974).

Reperceiving can help support an individual's ability to mediate this automatic stress response because it promotes the access and use of more objective, reliable information (Sayers, Creswell, Taren, 2015). One can "expose" themselves to information that was previously too difficult to carefully examine (Holzel et al., 2011; Treanor, 2011; Baer, 2003). There is more tolerance to metacognitively observe unpleasant internal states instead of avoiding or denying them because they are too overwhelming or frightening (Linehan, 1993; Hayes et al., 2006; Farb, Anderson, & Segal, 2012). The insight gained from observing unpleasant internal states can be used to interrupt conditioned, maladaptive habits and behaviors (Bishop et al., 2004).

The ability to disengage from automatic mental processes is known as 'deautomatization' (Deikman, 1982, p. 137). For example, mindfulness is known to interrupt rumination or repetitive, obtrusive, unproductive thought patterns (Trapnell and Campbell, 1999; Baer, 2009; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). The interruption of default, conditioned reactions, provides an opportunity to reappraise a situation and instead choose a different, potentially adaptive response. Mindfulness therefore offers a buffer against immediate, automatic reactivity and allows psychological space to metacognitively reflect, which leads to the broadening of attention, and allows for a more flexible selection of appraisals (Schwabe & Wolf, 2009; Garland et al., 2010; Gable & Harmon-Jones, 2010; Teasdale & Chaskalson, 2011). Mindfulness therefore promotes cognitive, emotional, and behavioral flexibility, while providing the space for

one to reflect and clarify his or her values and behave in ways that are congruent with those values (Brown & Ryan, 2003; Shapiro et al., 2016).

SELF-REGULATED LEARNING

Mindfulness also may have a connection with self-regulated learning. Self-regulation in this context refers to self-generated thoughts, feelings, and behaviors that are oriented to attaining goals (Zimmerman, 2000). Self-regulated learners are proactive in their efforts to learn because they are guided by goals and task-related strategies. They use metacognitive awareness, i.e., awareness and knowledge of one's own thinking, to actively monitor and control their performance and self-reflect on the effectiveness of their approach (Zimmerman, 2002). This feedback can then be used to make adjustments to future learning efforts. Self-regulated learning overall involves self-awareness, self-motivation, i.e., perceived efficacy and intrinsic interest, and behavioral skill (Zimmerman, 2002). Self-regulated learning is affected by one's self-beliefs and affective reactions, such as fears or doubts about one's ability (Zimmerman, 1995). Mindfulness, therefore, may be able to support self-regulated learning by enhancing the quality of metacognitive awareness and supporting attitudes such as curiosity, while minimizing negative self-judgments that can adversely affect self-efficacy.

WELL-BEING & POSITIVE PSYCHOLOGY

Mindfulness, overall, has been found to support well-being and a number of constructs within positive psychology. Mindfulness increases the capacity to tolerate, regulate, and recover from negative emotions triggered by stressors, and can eventually even lead to the extinguishment of previous stressors, attentional biases, and associated maladaptive habits (Vago & Nakamura, 2011; Farb, Anderson, & Segal, 2012; Garland &

Howard, 2013; Sayers, Creswell, Taren, 2015; Roemer, Willison, & Rollins, 2015; Arch & Landy, 2015). Stressful events can be reconstructed over time as meaningful and even growth promoting (Lazarus & Folkman, 1984; Garland, Baylord, & Frederickson, 2011). An overall enhanced ability to self-regulate one's thoughts and emotions can lead to increased resilience, equanimity, and well-being (Brown and Ryan, 2003; Walsh & Shapiro, 2006; Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Gross & Thompson, 2007; Sahdra et al., 2010; Garland, Farb, Goldin, and Frederickson, 2015).

Mindfulness is closely linked and influences other mechanisms cited in positive psychology literature including hope, meaning, savoring, gratitude, self-acceptance, autonomy, and body awareness (Young, 2016; Garland, Farb, Goldin, & Frederickson, 2015; Parks & Biswas-Diener, 2013). One is more inclined to accept their circumstance, the flow of events, and act in ways that support their well-being by creating a resonant, self-perpetuating cycle of growth and positive change. Mindfulness has a strong relationship with "flow" or being fully immersed in what is occurring. Flow leads to a sense of enjoyment and vitality (Csikszentmihalyi, 1990). Even being immersed in seemingly mundane activities (e.g. driving, washing dishes) can bring one immense joy and bliss (Kornfield, 2006).

INTERPERSONAL COMPETENCIES

Mindfulness also generally supports the development of interpersonal competencies. An improved capacity to sustain attention all transfers to focusing more on the internal states of others with kindness and compassion (Siegel, 2012). This improved receptivity or being fully aware of the resonance of fully being present with someone can then lead to expressing this resonance to another person (Geller & Greenberg, 2002).

Listening with increased awareness and less judgment of others can promote the ability to obtain information from interactions and respond more constructively (Parker et al., 2015). This can lead to greater relationship satisfaction and manifest into teamwork and leadership skills (Good et al., 2015). Mindful listening can also be used to mitigate misunderstandings or conflicts through enhanced perspective-taking (Barnes et al., 2007), and exhibiting less hostility or anger (Saavedra et al., 2010; Wascsh & Cordova, 2007).

SUMMARY

The theorized mechanisms of mindfulness provide insight into how mindfulness can support the development of intrapersonal and interpersonal competencies. The next section provides a literature review on mindfulness and evidence that these trainings have been found to foster competencies that may transfer to an engineering education context.

CHAPTER 3: LITERATURE REVIEW

There is a growing body of evidence demonstrating the efficacy of mindfulness to support a range of cognitive, affective, and interpersonal benefits (Brown et al., 2015). Mindfulness is typically measured as a trait or one's general mindfulness level over an extended period. It can also be measured as a state or one's mindfulness level within a narrow bandwidth of time (e.g. the last five minutes). Levels of mindfulness are measured in populations through psychometric instruments. Several scales (e.g. the Mindfulness Attention Awareness Scale [MAAS]: Brown & Ryan, 2003; the Five Facet Mindful Attention Scale [FFMQ]: Baer et al., 2006) have demonstrated reliability and validity with different subsets of populations, including college students (e.g. Baer et al., 2006), adults (e.g. Brown & Ryan, 2003), clinical populations (e.g. Baer, Smith, & Allen, 2004), and experienced meditators (e.g. Chadwich et al., 2008). The use of these scales in mindfulness interventions have established that mindfulness can be cultivated through regular meditation and other contemplative practices, hence the term *mindfulness meditation* (Quaglia et al., 2015, Creswell, 2017).

Higher levels of mindfulness have been found to positively correlate with enhanced self-regulated functioning (Deci & Ryan, 1985; Roemer, Willison, & Rollins, 2015), higher levels of life satisfaction (Brown & Ryan, 2003), eudaimonic well-being (Hanley, Warner, & Garland, 2014), conscientiousness (Giluk, 2009; Thompson & Waltz, 2007), autonomy (Brown & Ryan, 2003), optimism (Brown & Ryan, 2003), self-compassion (Chiesa, Anselmi, & Serreti, 2014), empathy (Dekeyser et al., 2008; Birnie et al., 2010; Shapiro et al., 1998), perspective taking (Schutte, Malouff, & Bobik, 2001), relationship satisfaction (Carson, Carson, Gil, and Baucom, 2004), and agreeableness

(Thompson & Waltz, 2007). Mindfulness has also been found to negatively correlate with depression (Cash & Whittingham, 2010), neuroticism (Giluk, 2009), cognitive reactivity (Raes et al, 2009), social anxiety (Rasmussen & Pedgeon, 2011), rumination (Nolen-Hoeksema, 2000), difficulties in emotional regulation (Baer et al., 2006), experiential avoidance (Baer et al., 2004), and unpleasant emotional experiences (Brown & Ryan, 2003; Baer et al., 2006; Broderick, 2005). The next section provides an overview of the literature that have studied the effects of mindfulness interventions.

OVERVIEW OF MINDFULNESS INTERVENTIONS

The first generation of mindfulness intervention studies primarily focused on treating adult patients in clinical settings. For example, the well-known Mindfulness-Based Stress Reduction (MSBR) program, was designed and developed to help adults alleviate chronic pain (Kabat-Zinn, 1982). Mindfulness interventions have been applied to treat many clinical symptoms such as anxiety, depression, chronic pain, immune system function, heart disease, substance abuse, and eating disorders (Ludwig and Kabat-Zinn, 2008; Creswell, 2017). The success of the MSBR program has led to the development of other mindfulness interventions with different areas of focus ranging from cognitive therapy to relapse prevention to relationship enhancement (e.g. Teasdale et al. 2000, Bowen et al. 2014, Carson et al. 2004). Over the past ten years, mindfulness interventions have been integrated into a variety of institutional settings, including the workplace (Good et al., 2016) and schools (Sibinga et al., 2016). Many organizations (e.g. Aetna, Google, Nike, Target, the U.S. Army, Goldman Sachs) offer mindfulness training to their employees to positively influence goal-directed behavior and buffer against stressors that disrupt productivity (Good et al., 2016). Mindfulness is theorized to

enhance workplace functioning, such as enhanced workplace performance, relationships, and well-being (Hunter, 2013; Jha et al., 2015; Tan, 2012; West et al., 2014; Wolever et al., 2012; Good et al., 2016).

There is now an abundance of meta-analyses that have analyzed numerous studies and have concluded mindfulness interventions designed to increase mindfulness levels and psychological benefits (e.g. Keng, Smoski, & Robins, 2011; Chiesa, Anselmi, & Serreti, 2014; Gotink, et al., 2015, Creswell, 2017). The rigor of research on these interventions has vastly improved, making quality evidence available for reference (Creswell, 2017). The use of randomized control trial (RCT) studies that use wait-list (and even active-control groups) has increased substantially; however, many of these studies still are limited to small sample sizes (Davidson & Kaszniak, 2015; Creswell, 2017). For example, Jain and colleagues (2017) found that mindfulness meditation and somatic relaxation activities decreased self-reported psychological distress, but only mindfulness meditation reduced rumination. Improvements in brain imaging has also provided evidence of the neurobiological pathways and mechanisms involved in mindfulness (Tang et al., 2015). Brain-imaging studies of mindfulness studies have shown more activity in the prefrontal cortex, anterior cingulate cortex, and insular cortex and less activity in the amygdala of participants, which leads to greater attentional control and ability to modulate the emotional regulation network (Holzel, 2011; Fox et al., 2014; Wheeler, et al., 2017). The findings support that among meditators, attention takes less effort (Tang et al., 2015) and fewer attentional resources are used to process distractions (Cahn & Polich).

MINDFULNESS INTERVENTIONS AND COLLEGE STUDENTS

Mindfulness interventions have now been studied extensively among healthy college students. Bamber and Schneider (2016) recently completed a narrative synthesis of 57 mindfulness intervention studies on college students. Most of the studies revealed that students' stress, anxiety, and depression decreased following participation in a mindfulness intervention. Additionally, many of these studies also demonstrated significant effects on well-being (e.g. Shapiro, Schwartz, & Bonner, 1998; Brown & Ryan, 2003), empathy (e.g. Birnie et al, Beddoe & Murphy, 2004) and compassion (e.g. Greeson et al., 2014). The most common program used by these studies was the 8-week MSBR program. There was also evidence that shorter mindfulness interventions are also effective, although it is unclear how many sessions are needed to increase mindfulness at this point among college students (Bamber and Schneider, 2016). Most studies focused on general college student populations, but several studies focused on specific groups like law students (Danitz & Orsillo, 2014), nursing students (Song & Lindquist, 2015; Beddoe & Murphy, 2004), and student athletes (Goodman et al., 2014). Creswell's (2017) meta-analysis concluded that RCT studies among healthy young adult samples demonstrate that mindfulness improves attention-related outcomes (e.g. sustained attention, working memory, problem-solving performance), and affective outcomes (e.g. reduced rumination). Mindfulness meditation has been shown to improve academic performance among students (Jha et al., 2007; Mrazek et al., 2013) and dispositional mindfulness has been found to be correlated with their adjustment to the university (Mettler et al., 2017).

MINDFULNESS & ENGINEERING EDUCATION

This brief overview of the theory and literature provides evidence that mindfulness can support a wide range of benefits among healthy students, including the cultivation of intrapersonal and interpersonal skills (e.g., self-regulation, resilience, well-being, and empathy). These types of skills would undoubtedly be useful for engineering students to develop and use, especially when navigating the design process. Real world engineering design projects take place in complex situations and the problems are often ill-defined. They force engineers to think critically about a problem and gather the information needed to design a solution that meets the user's needs. The solution generated by a team is as good as how well they are able to understand their customer needs, apply their technical skills, work together, communicate effectively with each other and their clients, manage their time, deal with uncertainty, and adapt. For an engineering team to function at its highest level, team members must possess the intrapersonal and interpersonal skills that mindfulness may be able to support.

Despite this, little has been done to explore the potential links between mindfulness and engineering. Rieken and colleagues (2017) explored the relationship between dispositional mindfulness and innovation in engineering and found that mindfulness significantly correlated with innovation self-efficacy. Another paper demonstrated mindfulness correlated with business skills self-efficacy (including interpersonal skills), and the intent to pursue a career in a start-up or as an entrepreneur (Rieken, Schar, and Sheppard, 2016). There has yet to be a study that has evaluated the potential benefits of mindfulness training in engineering education. This study sought to further investigate

the connection between mindfulness training and the development of intrapersonal and interpersonal skills that support students' engineering education experience.

RESEARCH QUESTIONS

The overarching research questions for this study are:

1. To what extent does mindfulness training influence the development of intrapersonal and interpersonal skills among engineering students?
    a. Does the mindfulness training influence specific intrapersonal skills (mindfulness, resilience, self-management, critical-thinking) and interpersonal skills (empathy, teamwork, and leadership)? (Quantitative)
    b. Which do students self-report being the primary intra/interpersonal competencies they develop from the mindfulness training? (Qualitative)
2. How does the development of these intra/interpersonal competencies transfer to supporting students' engineering education experience? (Qualitative)
3. Does a response shift bias influence the quantitative data? (Quantitative)
4. What are students' overall experience learning mindfulness? (Qualitative)
5. How does the qualitative data help explain the quantitative data? (Mixed Methods)

The research questions are quantitative, qualitative, and mixed in nature. Question 1 in particular is further partitioned into a quantitative and qualitative research question. Questions 1b, 2, and 4 were the primary focus of the qualitative study. Question 3 was added to the longitudinal quantitative component of this study. This question, along with the concept of response shift bias, will be further elaborated in the Methods section.

Question 5 highlights an important aspect of the study, in that both strands of data were mixed to mitigate the weaknesses of using each type of methodology on their own. The methodology is discussed in detail in the next Chapter.

CHAPTER 4: METHODS

There are many existing mindfulness-based interventions (MBI) that have been applied in different settings with different intended purposes. No MBIs were identified in the literature to have been specifically tailored toward a freshmen engineering student population. A mindfulness program was designed and developed with the intention of promoting the cultivation of intrapersonal and interpersonal skills and conveying the importance of these skills to engineering academic and career success. The program was named the "Inner Engineering Leadership Program" and was marketed at Arizona State University as an extracurricular program consisting of four workshops. The number of students treated for anxiety at this institution more than doubled from 2010 to 2018, going from 9.2% to 22.1% of students (American College Health Association, 2010; 2018).

The overarching study to evaluate the utility of the mindfulness program adopted a pragmatic worldview. Pragmatism is a practical research philosophy that focuses on a "what works" approach to collecting and analyzing data that addresses the research questions (Creswell & Clark, 2017). It supports the use of both quantitative and qualitative methods by embracing both singular and multiple realities. Pragmatism aligns closely with critical realism. Maxwell and Mittapalli (2010) discuss critical realism as acknowledging there is a singular, objective world that exists independently of our perceptions, theories, and constructions of it, but there are multiple understandings of the world constructed from each individual's experiences. Pragmatism therefore has the flexibility to use a realist ontology with a constructivist epistemology. Tashakkori and

Teddle (2003) suggest that there are a number of authors that support the notion of pragmatism being the primary worldview for mixed methods research.

This study uses a multiphase mixed methods approach to answer the research questions. Mixed methods research can be defined as research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches (Tashakkori & Creswell, 2007, p.4). It is also characterized by the emphasis of priority of one or both forms of data; the use of two forms of data in a single study or a sustained line of research inquiry; the use of a philosophical or theoretical orientation that informs all aspects of the study; and the use of a specific type of mixed methods design for procedures (Creswell, 2011). In the *SAGE Handbook of Mixed Methods in Social & Behavioral Research*, Tashakkori and Teddle (2003) write "mixed methods has evolved to the point where it is a separate methodological orientation with its own worldview, vocabulary, and techniques (Tashakkori & Teddle, 2003aa, p. 10). Mixed methods research provides strengths that offset the limitations of using a quantitative or qualitative approach alone. The mixed methods approach of this study is well aligned with the pragmatist worldview as it gathers both objective data through psychometric surveys and subjective data through interviews.

A challenge to using mixed methods designs is the lengthy amount of time it requires. Another challenge to using mixed methods designs is the researcher needs to be well-versed in both quantitative and qualitative methods. Finally, mixing the data can also be challenging. The researcher needs to make difficult decisions after the initial round of collecting quantitative and qualitative data on what phenomena should be

investigated further. There are a number of studies in engineering education that have used mixed methods research (e.g. Brawner et al., 2012; Allendoerfer et al., 2012; Lichtenstein, 2009; Trytten et al., 2012; Trenor et al., 2008).

The rest of the methods section provides details on the: 1) researcher qualifications, 2) curricular influences, 3) program curriculum, including major design and development decisions, 4) participant information, 5) overall research design, 6) quantitative data collection and analysis processes, and 7) qualitative data collection and analysis processes. Validity evidence is integrated throughout these sub-sections. It should be noted that some of the qualitative sections are written in first-person intentionally to provide the researcher with "voice".

RESEARCHER QUALIFICATIONS

Prior to creating and facilitating the program, I had seven years of personal experience integrating formal and informal mindfulness techniques to induce state mindfulness. I had acquired tacit knowledge on both western and eastern conceptualizations of mindfulness through reading best-selling books written by Jon Kabat Zinn, Thich Naht Hanh, Sadhguru, Michael Singer, David Hawkins, and Alan Watts. I have also spent considerable time contemplating and practicing mindfulness. To further aid the creation and facilitation of the workshop, I completed the Mindfulness-Based Stress Reduction (MSBR) program, a local Mindfulness Leadership Certificate Training program, and the Koru mindfulness teacher training.

I also took a graduate level course that discussed mindfulness research and read through many notable mindfulness publications. Through the graduate course, I also

participated in an 8-week Mindfulness-Based Stress Reduction (MBSR) program. Finally, I consulted with a local Center for Mindfulness in developing the curriculum. All of these experiences helped prepare me to undertake the complex task of designing, developing, and facilitating this mindfulness program tailored toward engineering students. I was able to reflect considerably on the topic in the weeks prior to designing the program and learned first-hand the how all kinds of different people experience and express mindfulness. I was therefore very familiar with the best practices on how to convey and discuss mindfulness.

CURRICULAR INFLUENCES

From a curricular perspective, the Search Inside Yourself (SIY) and the Koru programs had the most influence on the design of the program. Lecture content and discussions were also influenced by the mindfulness literature and the researchers' personal experience.

SEARCH INSIDE YOURSELF

The SIY program was developed by Chade-Meng Tan, a former google engineer. Content for SIY is openly shared and discussed in his book titled "Search Inside Yourself: The Unexpected Path to Achieving Success, Happiness (and World Peace)". The SIY program is a mindfulness leadership program designed from the perspective of an engineer. It has been delivered to 20,000+ individuals. The SIY book establishes a connection between mindfulness and emotional intelligence and also includes active-listening and journal reflection activities. This content in particular was integrated into the lectures and activities of the program. The Search Inside Yourself Leadership Institute (SIYLI) website claims participants of the program report a 10% reduction in

emotional drain, a 28% increase in ability to focus, and a 21% increase in ability to remain calm and poised during challenges.

KORU

The Koru program was developed and iterated at Duke University by two psychiatrists, Dr. Holly Rogers and Margaret Maytan. Koru is designed to teach mindfulness, meditation, and stress management to college students and other young adults. There are currently 300+ certified Koru instructors who have applied the program to 50,000+ students. The facilitator was trained as a Koru mindfulness facilitator prior to designing the workshops. Greeson and colleagues (2014) evaluated the effectiveness of Koru in a randomized controlled trial (RCT) featuring 90 students (66% female and 71% graduate students). The students in the experimental group exhibited statistically significant improvements in mindfulness, perceived stress, sleep problems, and self-compassion, while the waitlist control group did not show statistically significant improvements. The effect sizes (Cohen's d) were large for changes in mindfulness and moderate for perceived stress, sleep problems, and self-compassion.

The structure of the program and meditations integrated in the program were largely influenced by Koru's program. There are three components of the curriculum: Koru Basic, Koru 2.0, and the Koru Retreat. Koru Basic consists of four, 75-minute classes. The program teaches certain mind-body skills, such as diaphragmatic breathing (i.e. belly breathing) and guided imagery, as well as insight meditation. Students are asked to log their 10-minute mindfulness practices via the Koru mobile application. The Koru manual has scripts for all training and meditations and even includes responses to frequently asked student questions. Similar to other mindfulness programs, Koru employs

an active learning pedagogy to engage young adults and integrates stories and metaphors that are relevant to young adults. Koru recommends limiting class sizes to around 12 to 15 students to increase accountability and social intimacy.

PROGRAM CURRICULUM

Based on evidence on MBIs covered in the Literature Review section, several key design decisions were made in developing the program. I decided early that the program would be offered as a four-week extracurricular program composed of one-hour workshops. At least four sessions have been considered the minimum time period to begin observing effects in MBIs (Broderick 2005, Papies et al. 2015, Westbrook et al. 2013, Zeidan et al. 2011), although eight weeks has been considered the standard for most programs (Baer 2003, Goyal et al. 2014). Lecture, experiential, and active-based learning pedagogies were used to deliver the workshop content. Starting with lecture, mindfulness theory and research evidence was introduced. Explicit connections were made on how mindfulness can be used to cultivate intrapersonal skills (e.g., self-awareness and self-management) and interpersonal skills (e.g., empathy, active-listening, communication, teamwork, and leadership). A variety of activities were integrated throughout the four workshops to encourage active participation and practice. These activities, including different guided meditations designed to induce state mindfulness, facilitated discussions (e.g. think-pair-shares and active-listening exercises), and journal reflections. An average workshop typically lasted 60 minutes and consisted of 20 minutes of lecture, 15 minutes of meditation and discussion, and 25 minutes of discussion activities. Students were also encouraged to practice mindfulness on their own and gradually increase their practice over time.

The content of the four workshops were segmented and titled: 1) Mindfulness and Self-Awareness, 2) Mindfulness and Self-Management, 3) Mindfulness and Empathy, 4) Mindfulness and Habit-Building. Table 1 provides an overview of the focus of each workshop. The first two workshops provided an overview of the program and focused on intrapersonal skills. Students were introduced to mindfulness, self-awareness, self-management, and meditation. Research on mindfulness was shared to inform students that mindfulness can be used to cultivate emotional intelligence, which is critical to one's future success. A major emphasis of the first two workshops was encouraging students to practice cultivating state mindfulness more frequently on their own by taking a few minutes or moments each day to briefly focus their attention on internal phenomena (i.e. thoughts, emotions, and sensations). Students were encouraged to monitor their daily habits and objectively observe their everyday stressors. An explicit connection was made to metacognitive monitoring and controlling of thoughts. Several think-pair-share activities were integrated in the first two workshops for students to begin thinking critically about the ideas of mindfulness, self-awareness, and the relationship to self-management in school and life. In the first workshop, students were also introduced to a 3-minute, guided meditation designed to cultivate state mindfulness. I, the facilitator, guided the students on focusing their attention on their breath, performing a quick body scan, and noticing one's thoughts and feelings. This three-minute meditation was then used to start each workshop. The first workshop also includes a brief, deep-breathing exercise, while the second workshop includes a body scan.

The objectives of the third and fourth workshop are to demonstrate the value of focusing one's attention externally, especially toward others. The third workshop focused

on the importance of empathy and mindful (active) listening and how these skills can be applied within the context of engineering design work. Students were encouraged to try perspective-taking and to minimize judgment of others. An exercise with integrated think-pair-share discussions was included to allow students to practice empathy and active-listening. A discussion followed regarding the exercise's utility in their life, especially in developing teamwork and leadership skills. Students were encouraged to be conscientious in their daily interactions and to notice the influence they have on others. The fourth workshop was dedicated to how mindfulness can be used to cultivate positive habits. I guided the students on several activities (e.g. think-pair-shares and journal reflections) designed to have them reflect on their goals and daily habits. The group discussed how mindfulness can support self-regulated learning through goal-setting, minimizing procrastination, approaching school with a growth mindset, and practicing gratitude. Students were also encouraged to immerse themselves fully with daily actions, such as walking and eating. Students practiced this idea in the fourth workshop through an activity called "mindful eating", which is designed to have students immerse themselves fully in the process of eating.

Table 1: Overview of Workshops

Topic	Content
1. Mindfulness & Self-Awareness 2. Mindfulness & Self-Management	Focus on intrapersonal competencies including mindfulness and connection to self-awareness, self-management, and meditation
3. Mindfulness & Empathy	Focus on interpersonal competencies including empathy, communication, teamwork, and leadership, and connection to mindfulness

4. Mindfulness & Habit-Building	Focus on how mindfulness relates to habits of mind including goal-setting, growth mindset, and gratitude

RECRUITMENT & OVERALL STUDY POPULATION

The MBI was offered as an extracurricular program to freshmen engineering students at Arizona State University with the name "Inner Engineering Leadership Program". Four different workshop sessions were offered at different times; two workshops were each offered at the Tempe and Polytechnic campuses, respectively. A variety of strategies were implemented to make freshmen students aware of the program. Approximately 2,500 flyers were distributed in the freshmen engineering residence halls. An electronic version of the flyer was also disseminated through multiple listservs including Inner Circle, Barrett Honors Digest, and the Poly Sunrise. These listservs are respectively sent to all engineering students, Barrett honors students, and students at the Polytechnic campus. The electronic flyers were also shared with engineering faculty teaching freshmen courses at ASU including ASU 101, FSE 100, and EPICS 194. These faculty were asked to share the flyer through either the Blackboard or Canvas learning management software. I also presented an overview of the program at the beginning of 18 different freshmen engineering classes for approximately five minutes.

The flyer can be seen in Figure 2. Details on the program are provided along with a link to register. The description of the program in the flyer is intentionally ambiguous and does not explicitly use the term "mindfulness". This was done on purpose to draw interest from students who are generally interested in personal development, not just mindfulness. In order to register for the program, students had to provide their consent to participate, select the date of the program(s) they could attend, and then complete the

quantitative survey. This process was implemented in order to draw students committed to the program.

Figure 2: Program Flyer

A total of 148 students opened the registration link and provided their consent to participate in the study. A subset of 73 completed the survey, which suggests that the survey itself may have been a barrier to entry. A sample of 45 students who completed the survey attended at least one workshop; 35 students participated in the data collection efforts. A subset of 29 students completed three or more workshops. Almost all the students who participated in the data collection efforts were between the ages of 18 and 19. Half of the participants (15 out of the 35) that participated in the data collection efforts were female (~43%). Students identified themselves as White (21), Asian (9),

Hispanic or Latino (9), and African American (1); five students identified themselves with multiple racial or ethnic identities. A summary of the overall demographic information collected for the participants can be seen in Table 2.

Table 2: Demographic Information

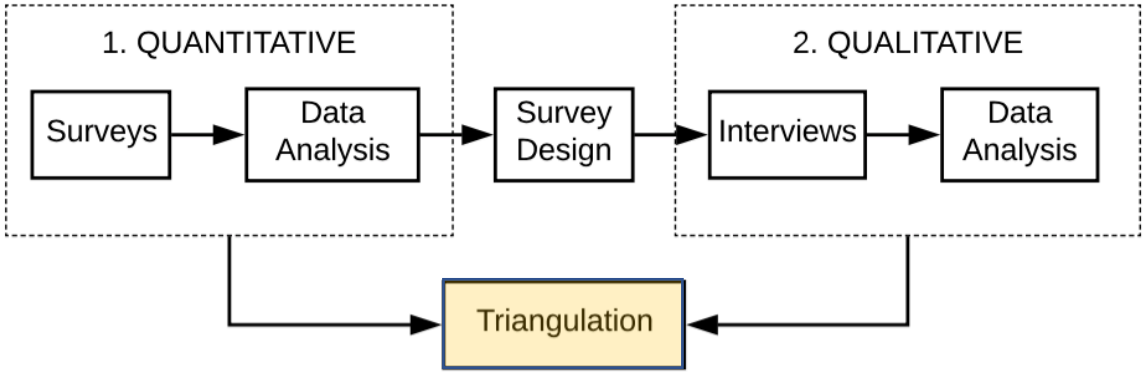
Characteristic	Number of students
Age	
18-19	34
20+	1
Gender	
Female	15
Male	20
Racial Identification	
White	21
Asian	9
Hispanic or Latino	9
African American	1

OVERVIEW OF DATA COLLECTION & ANALYSIS

This study evolved into a multi-phase mixed methods study. The overall data collection occurred in two main phases: immediately after the program and approximately three-months later (delayed data collection). Both the initial and delayed phases of this study specifically fit the mold of an explanatory mixed method design (QUANT→QUAL), because quantitative and qualitative data were collected sequentially, and the qualitative data strand was then used to help explain the quantitative results (Creswell, Plano Clark, et al., 2003). The data was "mixed" or "triangulated" when I interpreted how the qualitative results explained the quantitative results. This

design type is therefore very useful for being able to investigate the mechanism or reasons behind the quantitative results. Creswell and Clark (2017) discuss how it is more common in explanatory mixed methods designs for the quantitative phase to be prioritized (Creswell & Clark, 2017). In this study, however, the quantitative and qualitative strands were equally prioritized. Figure 3 provides a visual of an explanatory mixed methods design.

Figure 3: Explanatory Mixed Methods Design

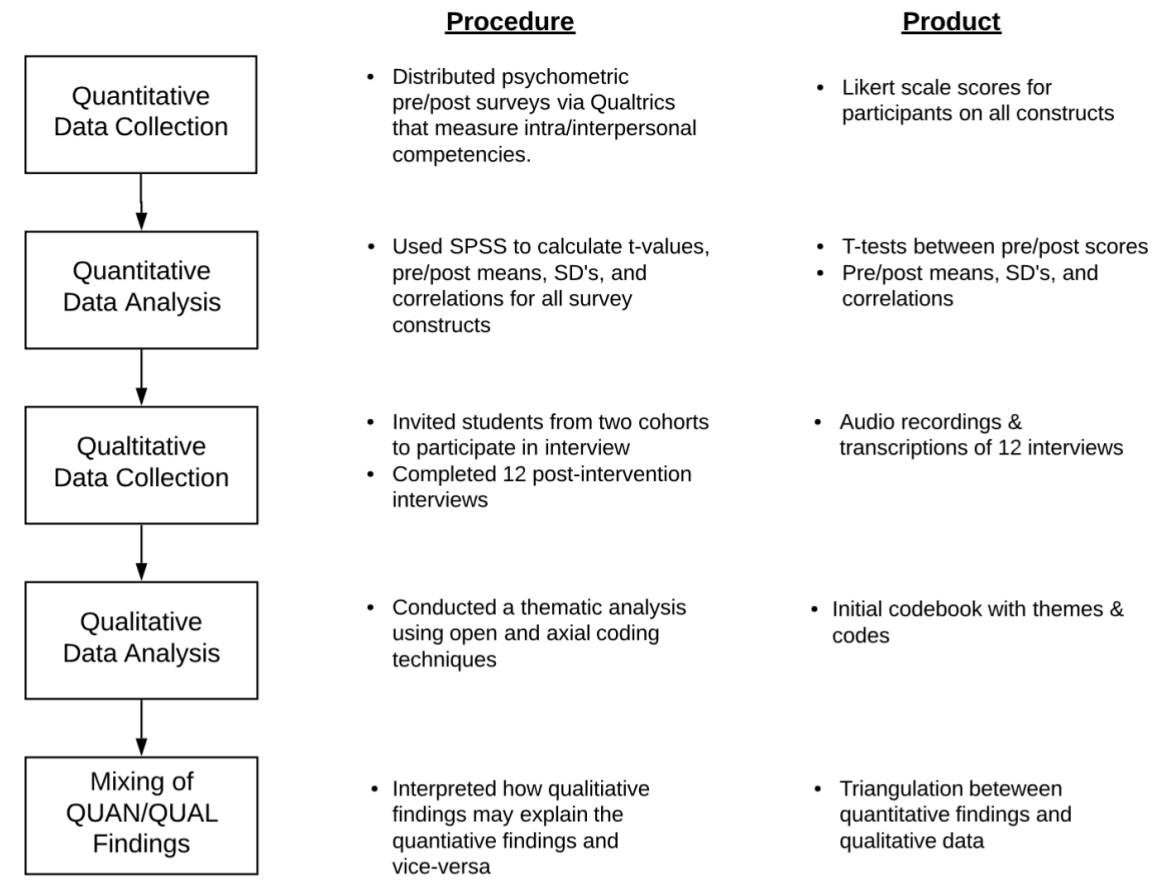


PHASE 1

In the first phase, quantitative data was collected from students through a survey both before and after the mindfulness training. The survey combined several psychometric instruments designed to measure intrapersonal skills (mindfulness, resilience, self-management, and critical-thinking), and interpersonal skills (empathy, teamwork, and leadership). These constructs were selected based on the mindfulness literature and professional skills highlighted in engineering education. The second, qualitative phase was conducted as a follow up to the quantitative results to further explore the impacts of the mindfulness training and to help explain the quantitative results. After the data was collected and analyzed, the data strands were triangulated.

Figure 4 contains a procedural diagram that provides an overview of the data collection and analysis procedures and products used in the initial phase of the study.

Figure 4: Procedural Diagram for Initial Phase of Multiphase Mixed Methods Study



PHASE 2

After the initial data collection and analysis efforts, a second component was added to the study to help provide clarification on discrepancies that emerged after the data strands were mixed. It was theorized that a response shift may have occurred in the initial quantitative phase. A quantitative component that featured a "retrospective pre-test" was added to further capture the longitudinal effects of the students and determine whether a response shift bias occurred in the initial quantitative phase. An additional

qualitative phase was also added to the study through open-ended survey questions and delayed interviews. The final stage of the research design involved mixing all of the data (two quantitative strands and two qualitative strands). Figure 5 features a procedural diagram that provides an overview of the delayed quantitative and qualitative phases. Figure 6 provides an illustration of the mixing of all four data strands. Table 3 provides an overview of the overall student participation and the level of participation in the different data collection efforts.

Figure 5: Phase 2, Procedural Diagram

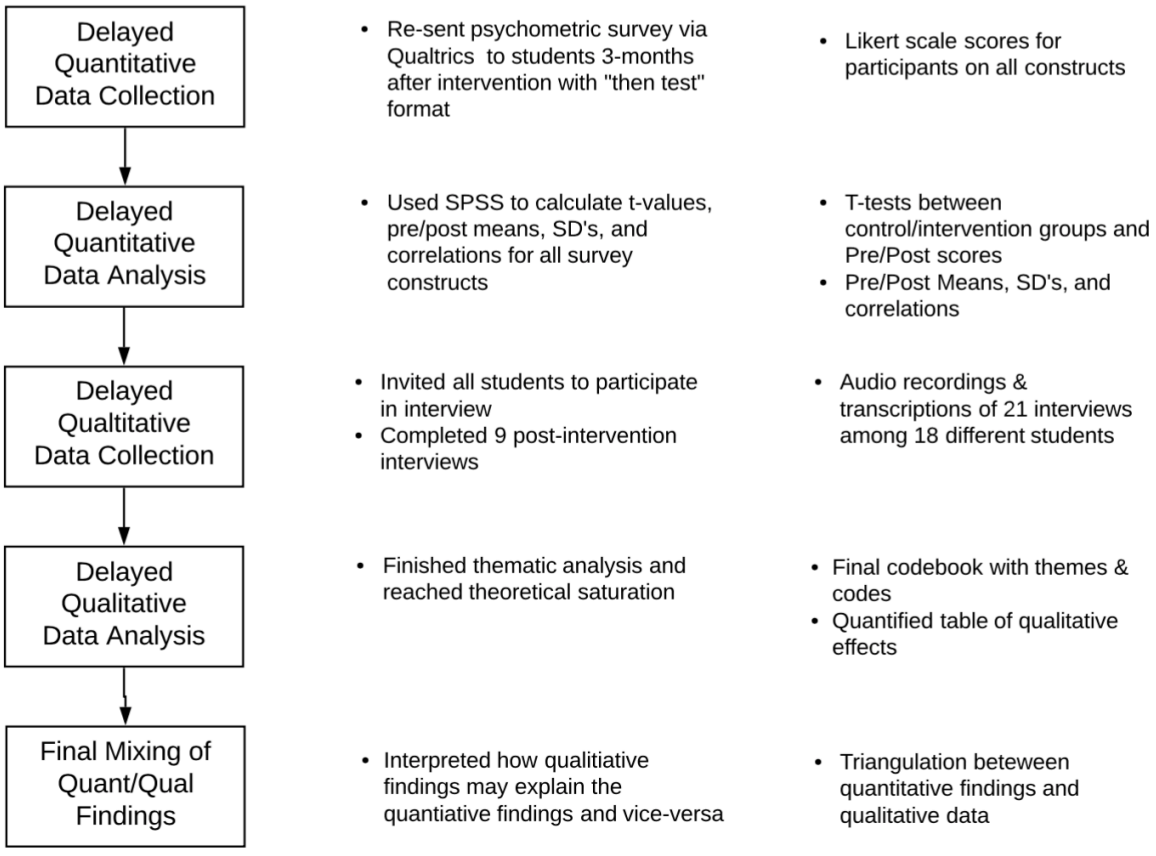


Figure 6: Mixing of all Four Data Strands

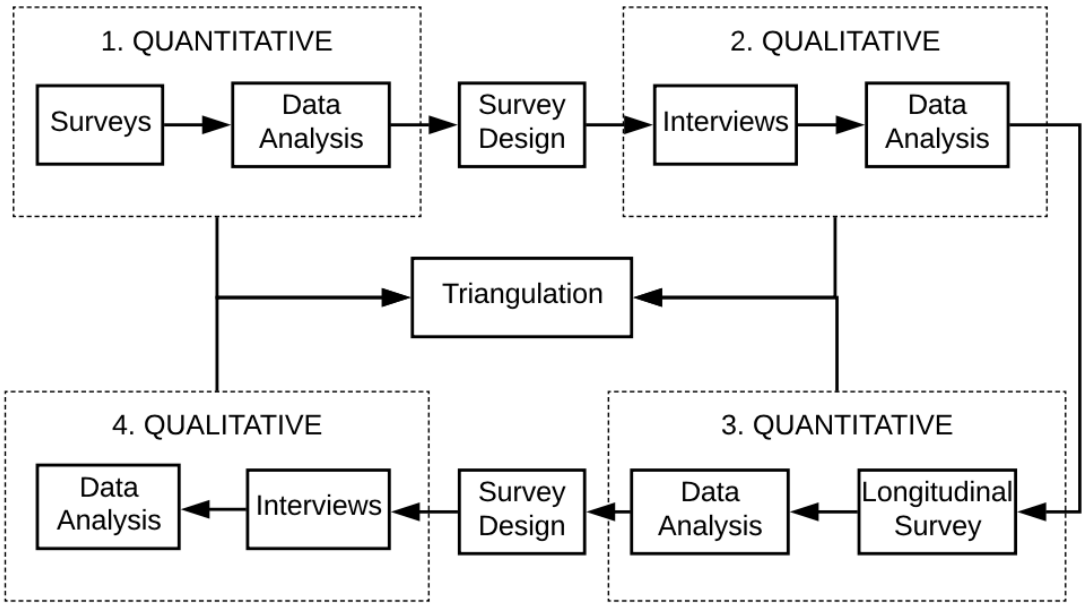


Table 3: Level of Participation

Level of Participation	Number of students
Pre-Survey Participation	
Opened registration link	148
Completed pre-survey	73 of 148 (49%)
Workshop Participation	
Attended 1+ workshop	45
Attended 2+ workshops	35 of 45 (78%)
Attended 3+ workshops	30 of 45 (67%)
Attended 4 workshops	18 of 45 (40%)
Data Collection Participation	
Completed pre-post survey	31
Completed delayed follow-up survey	29
Participated in interview	18*
Total	35

*Note: There were 21 interviews across 18 students

QUANTITATIVE DATA COLLECTION

In the first quantitative phase, data was collected from students who participated in the program via a survey, which was completed before and after the intervention. All 45 students that participated in a workshop were invited to participate, however only 31 students completed the survey. The survey combined several psychometric instruments to measure intrapersonal skills (mindfulness, resilience, self-management, and critical-thinking) and interpersonal skills (empathy, teamwork, and leadership). These constructs were selected based on the mindfulness literature and professional skills highlighted in engineering education. The total item count was 44 items.

The delayed quantitative survey featured the same 44 items. A modification was made to the delayed quantitative instrument because it was theorized that a response shift may have occurred. A response shift can occur when a participant understands the scale differently after an intervention than they did when completing the pre-survey because their internal standards of interpretation have changed. This is specifically known as a "recalibration response shift". For example, participants may retrospectively rate themselves higher or lower than in the pre-survey. This indicates a response shift may have occurred as participants overrated or underrated themselves initially. A bias introduced from response shift has been cited as a challenge for mindfulness instruments (Grossman, 2008). For example, a non-meditator may take a mindfulness survey before an intervention, go through mindfulness training, and then re-take the mindfulness survey. However, their interpretations of the scales may be different because they have a different understanding of what it means to "pay attention", "maintain awareness",

"practice acceptance", or "be in the present moment". They may recalibrate the scales, which, for example, may cause themselves to underrate themselves in the post-survey.

The delayed quantitative instrument added a retrospective pre-test (also known as "thentest"), which is the most common method used to help capture the extent to which a "response shift" may have occurred (Schwartz & Sprangers, 2010; Hill, 2005). In a retrospective pre-test, participants retrospectively rate themselves before an intervention (time 1) in addition to their current state (time 2). The main limitation of using a retrospective pre-test is that a "recall bias" may be introduced to the study, which is participants may not accurately remember their former state. All 45 students who attended at least one workshop were invited to participate in a survey featuring the same items with the addition of a retrospective pretest in which students rated themselves before and after the program. A total of 29 students completed the delayed survey including 6 students that did not complete the post-survey.

The rest of this section provides a description of the four instruments (mindfulness, resilience, empathy, and generic engineering skills) used in this study to capture intra/interpersonal skills. Table 4 provides an overview of these four instruments, while Table 5 maps out the constructs used within these instruments to intrapersonal and interpersonal skills. All quantitative data collection efforts were IRB-approved.

Table 4: Overview of Four Instruments Used

Construct	Scale	Year	Items	Google Citations*	Factors	Response Options	Cronbach's Alpha
Mindfulness	CAMS-R	2007	12	1035	Attention, awareness, present moment, acceptance	4	0.74-0.85
Resilience	CD-RISC-10	2007	10	1041	Unidimensional	5	0.85
Empathy	EQ	2004	40	3015	Unidimensional	5	0.92
Engineering Generic Skills	GSPQ	2017	16	15	Self-management, interpersonal, critical-thinking, leadership	5	0.65-0.82

*Note: Citations are as of 5/7/19

Table 5: Categorization of Quantitative Constructs

Intrapersonal Skills	Interpersonal Skills
Mindfulness	Empathy
Resilience	Interpersonal / Teamwork
Self-Management	Leadership
Critical-Thinking	

MINDFULNESS INSTRUMENT

There are two different types of mindfulness scales: state mindfulness and trait mindfulness. *State mindfulness* is focused on measuring mindfulness at a given moment, or within a narrow range (e.g. the past 5 minutes). *Trait mindfulness* is focused on measuring the general frequency of mindfulness states over time (Quaglia et al., 2015, Ch.9, p 156). This study investigates trait mindfulness. There are several well-known trait mindfulness scales including the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R; Feldman et al., 2007), the Five Factor Mindfulness Questionnaire (FFMQ; Baer et al., 2006), the Freiburg Mindfulness Inventory (FMI; Walach et al., 2006), the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004), the Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003), and the Philadelphia Mindfulness Scale (PHLMS; Cardaciotto et al., 2008). There is some diversity within these scales including differing conceptual origins, factor structures, and intended uses. For example, the KIMS and FFMQ, were developed from dialectical behavior theory (DBT) model for individuals with personality disorder (Quaglia et al., 2015, Ch.9, p 160).

The CAMS-R was selected as the mindfulness instrument for this study. CAMS-R was designed to offer certain advantages including capturing a comprehensive conceptualization of mindfulness, being relatively brief, and using jargon-free language that is easy to understand regardless of previous mindfulness experience. CAMS-R operationalizes Kabat-Zinn's (2003) definition, "awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment to moment." It includes four constructs: (1) the ability to regulate **attention**, (2) an orientation to **present** or immediate experience, (3) **awareness** of

experience, and (4) an attitude of **acceptance** or **non-judgment** to the experience. CAMS-R consists of just 12 items in which participants are asked to rate themselves on a series of statements using a 4-point Likert scale with the following options: 1 (Rarely/not at all), 2 (Sometimes), 3 (Often), and 4 (Almost always). Higher scores indicate more trait mindfulness. Example items include: "I am able to focus on the present moment" and "I am able to accept the thoughts and feelings I have". The full list of CAMS-R items can be seen in Appendix A.

The scale a researcher uses is dependent on research context and purpose (Sauer et al., 2013). The CAMS-R was selected for this study for its brevity, comprehensive definition aligning well with the intervention, and its strong psychometric properties. The instrument gathered validity evidence using undergraduate students. Higher mindfulness scores on CAMS-R were positively correlated with validated instruments designed to measure well-being, adaptive emotional regulation (clarity of feelings, mood repair, attention to feelings, and distraction), and adaptive mental problem-solving strategies (cognitive flexibility, problem analysis, and plan rehearsal). Meanwhile, higher mindfulness scores were negatively correlated with distress, maladaptive emotional regulation (experiential avoidance, thought suppression, worry, rumination, and overgeneralization), and maladaptive problem-solving strategies (stagnant deliberation and outcome fantasy). CAMS-R also correlated with other well-regarded mindfulness instruments including MAAS, FMI, KIMS, and SMQ (r's = 0.51 to 0.67; Baer, Smith, Hopkins, Krietemeyer, Toney, 2006; Feldman et al., 2007). These results for CAMS-R are consistent with findings from other researchers indicating construct, convergent, and

discriminant validity. CAMS-R has also demonstrated strong reliability (Cronbach's α: 0.74 - 0.85; Feldman et al., 2007).

Resilience Instrument

As part of the Resilience and Healthy Aging Network, Windle and others (2010) conducted a systematic review of the literature on resilience research involving over 270 research articles to develop the following definition of resilience:

> The process of negotiating, managing, and adapting to significant sources of stress or trauma. Assets and resources within the individual, their life and environment facilitate this capacity for adaptation and 'bouncing back' in the face of adversity. Across the life course, the experience of resilience will vary.

Windle, Bennett, & Noyes (2011) conduct a methodological systematic review of resilience measurement scales using a comprehensive set of criteria to evaluate the psychometric properties including content validity, internal consistency, construct validity, reproducibility, responsiveness, floor and ceiling effects, and interpretability. Their findings highlight that there is currently no gold-standard scale to measure resilience (Windle, Bennett, & Noyes, 2011); however three scales received the best psychometric ratings: the Connor-Davidson Resilience Scale (CD-RISC), the Resilience Scale for Adults and the Brief Resilience Scale.

This study selected the 10-item version of the Connor-Davidson Resilience Scale (CD-RISC). The original scale developed by Connor and Davidson (2003) consisted of 25 items, however, it was later condensed to just 10 items by Campbell-Sills and Stein (2007). This scale conceptualizes resilience as the ability to bounce back from the variety of challenges that can arise in life. The original CD-RISC contained five factors representing: (1) personal competence, high standards, and tenacity, (2) trust in one's

instincts, tolerance of negative effects, and strengthening effects of stress, (3) positive acceptance of change and secure relationships, (4) control, and (5) spiritual influences. The scale was tested for internal consistency, test-retest reliability, convergent validity, and divergent validity in the general population in addition to other samples. When Campbell and Stein (2007) modified the scale, they conducted and EFA and found the original factor structure to be unstable. They then conducted an additional EFA and a CFA to modify the instrument. This resulted in the creation of a unidimensional, shorter version of the CD-RISC. The final 10 items still reflect the definition of resilience by covering ability to tolerate experiences such as change, personal problems, illness, pressure, failure, and painful feelings. The CD-RISC-10 demonstrated excellent internal consistency with a Cronbach's alpha value of 0.85. Additionally, it highly correlates with the original instrument (r=.92)

The reason for selecting the CD-RISC are threefold: (1) it exhibits robust psychometric properties relative to other resilience measures, (2) it offers a unidimensional definition of resilience, and (3) the brevity of the scale. Participants are asked to rate themselves on a series of statements using a 5-point Likert scale with the following options: 1 (Not true at all), 2 (Rarely true), 3 (Sometimes true), 4 (Often true), and 5 (True nearly all the time). Sample items include "able to adapt to change", "can stay focused under pressure", and "not easily discouraged by failure". The list of items for the CD-RISC-10 can be seen in Appendix B.

EMPATHY INSTRUMENT

The Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004) was used in this study to capture the construct of empathy. The authors of the EQ define empathy as "the drive or ability to attribute mental states to another person/animal and entails an appropriate affective response in the observer to another person's mental state." They therefore take the stance that empathy includes both affective and cognitive dimensions. They define the affective component of empathy as "feeling an appropriate emotion triggered by seeing and/or learning of another's emotion and the cognitive component as "predicting what someone else might think, feel, or do". In their paper, they argue that these components cannot be easily disentangled and that their instrument was designed to be unidimensional. The original instrument contains 40 empathy items and 20 filler or control items. Participants are asked to rate themselves on a series of statements using a 4-point Likert scale with the following options: 1 (Strongly disagree), 2 (Disagree), 3 (Agree), and 4 (Strongly agree). Participants received a 0 for a 'non-empathetic' response, regardless of the magnitude, while participants receive a 1 or 2 for an 'empathetic response'. The original paper demonstrated a high reliability score (Cronbach's alpha = 0.92). It also included test-re-test reliability (r=0.97), convergent, and divergent validity

The psychometric properties of the EQ were evaluated soon after by Lawrence et al., (2004) and Muncer and Ling (2005). Lawrence and co-authors (2004) conducted an exploratory principal components analysis and identified a three-factor scale containing 28 items. They were able to disentangle the cognitive and affective dimensions of empathy revealing three factors as 'cognitive empathy', 'emotional reactivity', and 'social skills'. Cognitive empathy includes items that "measure the appreciation of

affective states". Emotional reactivity includes items that "reflect the tendency to have an emotional reaction in response to others' mental states." Social skills include items that "tap the spontaneous use of such skills and/or a lack of intuitive social understanding." The authors acknowledge that these social skills are reliant on cognitive empathy. Muncer and Ling (2005) confirmed the findings of Lawrence and co-authors (2004) that a three-factor solution was a better fit. They then condensed the EQ instrument to just 15 items and provided both reliability (Cronbach's alpha = 0.84) and validity evidence. Eight of these items were included in this study and can be seen in Appendix C.

Engineering Generic Skills Instrument

The Generic Skills Perception Questionnaire developed by Chan, Lao, and Luk (2017) was the final instrument included. The authors refer to generic skills as skills and competencies that extend beyond disciplinary knowledge and can be applied broadly across different contexts. They highlight how other synonymous terms have been used including "transferable skills", "21st century" skills, "employability skills", and "key competencies". In their paper, Chan, Lao, and Luk (2017) conceptualize these generic skills with an engineering disciplinary context and operationalize this into an instrument to evaluate the perception and development of these skills. The instrument was administered to 1,241 first-year engineering students in Hong Kong. The final instrument that emerged from EFA and CFAs consisted of 38 generic skills across 8 domains.

Although there are eight domains of generic skills, in this study only four domains were used: interpersonal, teamwork, leadership, and self-management. The interpersonal domain (includes 8 items) is defined as "the ability to engage in the building and maintenance of relationships". The interpersonal domain includes items originally created

for teamwork, which is defined by the authors as “the ability to work with others, particularly in multidisciplinary teams, which are common in the engineering working environment.” The leadership domain (includes 3 items) is defined as “the ability to play multiple roles of a leader in coordination and planning, motivating and supervising team members, and building team cohesion.” The critical-thinking domain (includes 3 items) is defined as “the ability to think critically and independently, as well as creatively.” Finally, the self-management domain (includes 4 items) is defined as “the ability to self-reflect, organize things, and manage time.” A total of 18 out of the 38 generic skills items were used in this study. The items from the four domains used can be seen in Appendix D.

The original survey asks students to rate their perceived importance and their current level of competency for each generic skill item. This study only captures students’ perceived competency level using a 5-point Likert scale ranging from very poor (1) to very good (5). Since this instrument was recently developed, there are limitations in the validity evidence gathered to date. It was developed using a rigorous instrument development process that involved having a psychometrician, engineering students, and other experts evaluate the face and content validity of the items. Furthermore, the instrument factors were created through objective EFA and CFA analyses. The instrument also displays moderate to high reliability as exemplified by its Cronbach’s alpha values ranging from 0.65 to 0.84. However, the authors do acknowledge that more evidence of convergent and discriminant evidence by correlating the instrument to other measures is needed.

QUANTITATIVE DATA ANALYSIS

Pre-Post Survey

All of the quantitative data was organized and primarily analyzed on IBM's SPSS Statistics 25. The data was reviewed to ensure there was no patterns indicating the student may not have taken the survey seriously (i.e. providing the same response for each item). No such patterns were found. Only one of the 31 students that completed the pre and post-program surveys missed a survey item. Mean imputation based on the respondent's other items scores within the construct was used to fill in the missing data point so the respondent's data could be used for all of the analyses.

Two-sided, paired samples t-tests were run on SPSS to determine whether a statistically significant change occurred across all of the constructs. A paired samples t-test is a statistical procedure used to determine whether the mean difference between two sets of observations is zero. Each subject is measured twice, resulting in pairs of observations. Common applications of the paired samples t-test include repeated-measures designs as was the case in this study. G*Power Version 3.1.9.3 was used to calculate the effect sizes and conduct a post hoc power analysis.

Delayed Survey

For the delayed survey, a similar data analysis process was applied. Two-sided, paired t-tests were run on SPSS between the self-reported retrospective pre-program and the delayed survey scores. Only two students missed a survey item. Mean imputation based on the respondent's other items scores within the construct was used to fill in the missing data point so the respondent's data could be used for all of the analyses.

To further investigate whether a response shift bias occurred, two paired t-tests were run. The first was between the students' retrospective scores from before the

program and their original pre-test scores. The second was between students' delayed post scores and the immediate post-program results. Only data from 23 students was used for this step since six of the 29 students that participated in the delayed survey had not completed the post-survey. Once again, G*Power Version 3.1.9.3 was used to calculate the effect sizes and complete a post hoc power analysis. Table 6 provides an overview of all of the paired-samples t-tests that were run for the study.

Table 6: Paired Samples T-Tests

Paired Samples T-Test	Number of students
Pre-Survey and Post Survey	31
Retrospective Pre-Survey and Delayed Post Survey	29
Pre-Survey and Retrospective Pre-Survey	29
Post-Survey and Delayed Post-Survey	23

QUALITATIVE DATA COLLECTION

Qualitative data was collected from a total of 35 different students who participated in the program using post surveys (n=31), three-month delayed follow-up surveys (n=29), and semi-structured interviews (n=18). Student participation in the data collection efforts varied. All of the students were invited to participate in the post-survey and delayed-post survey. Only students that had participated in three-plus workshops were invited to participate in interviews. A total of twenty-one interviews were completed with 18 different students. Twelve of these interviews were completed within the subsequent two weeks after the last workshop; nine of the interviews were conducted

three months after the last workshop. Appendix A provides a list of pseudonyms with associated workshop and data collection participation information. All qualitative data collection efforts were IRB-approved.

The post-surveys included four open-ended response questions. The primary objectives were to learn about: 1) students' overall impression of the program, 2) how and to what extent students practiced mindfulness, 3) any effects students noticed as a result of the training, and 4) what students learned (i.e. main takeaways). The delayed post-survey questions were designed largely with the intent to support a quantitative data set. The open-ended questions for this survey asked students to describe whether they think they have experienced any changes since the beginning of the program on the following competencies: resilience, empathy, mindfulness, and generic skills (e.g. teamwork, leadership, and self-management). The open-ended questions for the post-survey and delayed post-survey are shared in Appendix B. All students were strongly encouraged to provide candid, objective feedback (good or bad) at the end of the last workshop to minimize bias in the data collection.

The post-program and delayed interviews are presented in Appendix C. These interviews ranged from ten to thirty minutes (M ~ 18 minutes). All of the interviews were audio-recorded and transcribed. The interview protocol objectives were the same as the post-survey. The interviews started by reminding the students of the importance of being honest and candid. The first question asked students about their overall impressions of the program. The interviews were semi-structured; the researcher asked follow-up questions throughout to elicit more rich, nuanced information than what could be conveyed through the written-responses. The interviewer proceeded with the next question once the first

question was sufficiently covered. The second question asked the students whether they maintained either a formal or informal mindfulness practice. If the students said yes, the researcher asked additional questions to learn more about how and the extent of the practice. If they answered no, the interviewer continued to the next question. The next stage of the interview protocol involved asking questions to learn more about what the student learned and any effects they experienced as a result of the mindfulness training. The researcher was intentional about asking students how their main takeaways or effects experienced from the workshops transferred over to both their personal life and engineering education contexts. The delayed interview protocol was almost identical to the post-program interview, but several questions were rephrased to reflect that the data was being collected three months later.

Table 7: Level of Participation for Each Student

Name	Gender	Age	Major	Days Attended	Data Collection Participation		
					Pre -Post Survey	Delayed Survey	Interview
Charles	M	18	Mechanical Engineering	4	1	1	1
Amy	F	18	Mechanical Engineering	4	1	1	1
Stephen	M	18	Civil Engineering	4	1		
Ysmael	M	18	Robotic Engineering	4	1	1	1
Carla	F	18	General Engineering	4	1	1	1
Rodrigo	M	19	Automotive Systems Engineering	4	1		1
Sarah	F	18	Computer Science	4	1	1	1
Tanya	F	18	Mechanical Engineering	4	1		
Eve	F	19	Biomedical Engineering	4	1	1	
Greg	M	18	Software Engineering	4	1		1
Arthur	M	18	General Engineering	4	1	1	1
Shannon	F	18	General Engineering	4	1	1	1

Maria	F	18	Computer Systems Engineering	4	1	1	1
Roy	M	18	Aerospace Engineering	4	1	1	1
Mary	F	18	Civil Engineering	4	1	1	1
George	M	18	Mechanical Engineering	4	1		
Courtney	F	18	Biomedical Engineering	4	1	1	1
Natalie	F	19	Human Systems Engineering	4	1	1	1
Sharon	F	18	Chemical Engineering	3	1	1	1
James	M	18	Aerospace Engineering	3	1		
Tanya	F	18	Mechanical Engineering	3	1	1	1
Jose	M	18	Mechanical Engineering	3	1	1	1
Naresh	M	18	Electrical Engineering	3	1		
Joseph	M	18	Computer Systems Engineering	3	1	1	
David	M	18	Computer Science	3	1	1	
Asaf	M	18	Engineering Management	3	1		
Ravi	M	19	Materials Science Engineering	3	1	1	
Jane	F	18	Computer Systems Engineering	3	1		1
Harry	M	27	Computer Science	3	1	1	
Joan	F	18	Computer Science	2	1		
Wade	M	18	Computer Science	2	1	1	
Vishal	M	18	Automotive Systems Engineering	2	1		
Robert	M	18	Industrial Engineering	2		1	
Samantha	F	18	General Engineering	2		1	
Gabriel	M	18	Computer Science	1		1	
					32	24	18

QUALITATIVE DATA ANALYSIS

The interviews were transcribed through REV's transcription service. A thematic analysis was used to identify patterns within the data. The process followed the best practices for conducting a rigorous thematic analysis recommended by Braun and Clarke (2006) and Creswell (2016). The thematic analysis began after gathering the first round of written and interview qualitative data collected immediately following the workshops. Several passes were made through all of the written and transcribed data to become familiar with the data. Open-coding of all student excerpts with post-it notes was then done within three main categories: 1) effects/learning outcomes, 2) mindfulness practice, and 3) general workshop experience. These categories aligned closely with the four stated objectives of the data collection, except the effects and learning outcomes were combined due to considerable overlap. Axial-coding was also applied in the early stages; written memos were used to help the researcher track relationships between certain codes. The first iteration of the codebook contained 26 codes; 19 distinguishable codes for effects/learning outcomes, two broad codes for mindfulness practice, and five codes for general workshop experience. Considerable variance in students' mindfulness practice led to the creation of a continuum rather than distinguishable codes. All of the excerpts were coded using the initial codebook to preliminarily organize the data.

The second stage of the data analysis was conducted upon the completion of the delayed data collection. Several passes were again undertaken with the new data to become familiar with the data. No new codes emerged during coding of the second stage data, indicating theoretical saturation had been reached during the first stage. A second round of axial coding was performed to condense the codebook where possible. Several strategies from Saldaña's (2005) *The Coding Manual for Qualitative Researchers* were

used to minimize redundancies and overlap of the codes. The original 19 effects/learning outcomes codes were merged into four themes. Commonality of codes and variance across students was illuminated by quantifying the different effects across each of the 35 participants. The visualization for this can be seen in Appenix I – pseudonyms are used for all of the students to maintain anonymity.

The quantified, qualitative results were mixed with the quantitative data in two main phases. First, the results were compared with the paired samples t-test between the pre and post-survey scores. These results helped inform the second phase of data collection. The qualitative data collected from the second phase helped provide enough data to quantify the qualitative data. These results were then compared with the paired samples t-test between the retrospective pre and delayed post scores.

CHAPTER 5: RESULTS

QUANTITATIVE RESULTS

PRE-POST SURVEY RESULTS

As seen in research question one, the primary focus of the quantitative data collection and analysis process was to determine whether mindfulness training influenced the development of specific intrapersonal skills (mindfulness, resilience, self-management, and critical-thinking) and interpersonal skills (empathy, teamwork, and leadership). The results for the paired samples t-test between the pre-survey and post-survey are summarized in Table 7:

Table 8: Paired-Samples T-Test Results for Pre vs Post Program Survey

	Intrapersonal Skills				Interpersonal Skills		
Statistic	Mindfulness	Resilience	Self-Management	Critical-Thinking	Empathy	Interpersonal / Teamwork	Leadership
Scale	1-4	1-5	1-5	1-5	1-2	1-5	1-5
Pre-Survey Mean	2.68	3.95	3.85	3.88	1.19	3.91	3.61
Post-Survey Mean	2.85	4.02	3.94	4.06	1.26	4.06	3.89
p-value (two-sided)	0.10**	0.39	0.50	0.13***	0.15***	0.11***	0.06**
Effect Size (dz)	0.31	0.16	0.12	0.28	0.27	0.30	0.36
Power	0.39	0.13	0.10	0.33	0.31	0.37	0.49

Note: * $p < 0.05$, ** $p < 0.10$, *** $p < 0.15$

Although all of the scores across each construct did increase from pre to post, none of the changes were statistically significant at an alpha of 0.05, the typical cutoff for significance. The constructs of mindfulness and leadership were statistically significant at an alpha of 0.10, while critical-thinking, empathy and interpersonal/teamwork were statistically significant at 0.15. No close significant changes were observed for resilience and self-management. Cohen suggested that d=0.2 be considered a 'small' effect size, d=0.5 be a 'medium' effect size, and d=0.8 to be a 'large' effect size. The largest effect sizes were for mindfulness (d=0.31) and leadership (d=0.36) and these would be considered to be small to medium. Due to the small sample sizes (n=31), the power achieved for mindfulness was just 0.39 and for leadership it was 0.45. Generally, the desired power for quantitative data is 0.80. Therefore, the power achieved for this data-set was well below the desired threshold. Overall, the post-program survey data provided very little conclusive evidence that mindfulness influenced the development of any intrapersonal and interpersonal skills.

Delayed Survey Results

The delayed survey results also elicited findings that could help answer the primary research question on whether the mindfulness training supported the development of intrapersonal and interpersonal skills. The results for the paired samples t-test between the retrospective pre-survey and delayed post-survey are summarized in Table 8. Despite also having a relatively small sample size for the delayed survey (n=29), the retrospective pre-survey format produced very different results. All of the constructs exhibited statistically significant results (p=0.00) with large effect sizes ranging from 0.91 (empathy) to 1.42 (mindfulness). The power achieved was 1 for all of the constructs

as well. These findings are somewhat inconsistent with the preliminary findings from the pre-post t-test. Unlike the pre-post survey, the delayed survey provided evidence that the mindfulness training did influence the development of intrapersonal and interpersonal skills among the students.

Table 9: Paired-Samples T-Test Results for Retrospective vs Delayed Post Survey

	Intrapersonal Skills				Interpersonal Skills		
Statistic	Mindfulness	Resilience	Self-Management	Critical-Thinking	Empathy	Interpersonal / Teamwork	Leadership
Scale	1-4	1-5	1-5	1-5	1-2	1-5	1-5
Retrospective Pre-Survey	2.45	3.62	3.66	3.87	1.12	3.80	3.68
Delayed Post-Survey	3.04	4.18	4.23	4.33	1.37	4.36	4.17
p-value (two-sided)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Effect Size	1.42	1.18	1.17	0.99	0.91	1.36	0.99
Power	1	1	1	1	1	1	1

Note: * $p < 0.05$, ** $p < 0.10$, *** $p < 0.15$

Response Shift Bias Results

As seen in research question four, an additional focus of the quantitative strand was to determine whether these results were affected by a directional response shift. This was done by conducting two paired samples t-test between: (1) the original pre-survey vs the retrospective survey, and (2) the post-survey vs the delayed post-survey.

The results for the two-sided paired samples t-test between the original pre-survey and the retrospective pre-survey are summarized in Table 9. With the exception of critical-thinking, the students self-reported lower scores when they retrospectively rated

themselves before the program across all of the constructs in comparison to their original pre-survey scores. However, only self-management and resilience exhibited a statistically significant change at an alpha of 0.05. The effect size for self-management and resilience were 0.55 and 0.53 respectively indicating a medium effect. The achieved power for self-management and resilience was 0.72 and 0.68, which is close to the desired power of 0.80. Mindfulness had a p-value of 0.06 and an effect size of 0.41, but a power of just 0.46. Comparing the retrospective survey with the pre-survey, therefore elicited evidence indicating a response shift bias occurred in that students may have overrated their initial levels of resilience, self-management, and perhaps mindfulness prior to the program.

Table 10: Paired-Samples T-Test Results for Pre vs Retrospective Pre-Survey

	Intrapersonal Skills				Interpersonal Skills		
Statistic	Mindfulness	Resilience	Self-Management	Critical-Thinking	Empathy	Interpersonal / Teamwork	Leadership
Pre-Survey	2.73	4.03	4.00	3.97	1.24	4.01	3.77
Retrospective Pre-Survey	2.47	3.68	3.63	3.99	1.13	3.84	3.68
Delta	0.26	0.36	0.37	-0.01	0.11	0.17	0.09
p-value (two-sided)	0.06**	0.02*	0.02*	0.93	0.11***	0.25	0.63
Effect Size	0.41	0.53	0.55	0.02	0.34	0.25	0.10
Power	0.46	0.68	0.72	0.05	0.35	0.20	0.08

Note: * $p < 0.05$, ** $p < 0.10$, *** $p < 0.15$

The results for the two-sided paired samples t-test between the post-survey and the delayed post-survey are summarized in Table 10. The mean scores across all of the constructs was higher for the delayed post-survey than the immediate post-program

survey. These differences were however only statistically significant at an alpha of 0.05 for the interpersonal / teamwork construct. Empathy was statistically significant at an alpha of 0.10. These results indicate that an opposite response shift may have occurred for empathy and interpersonal / teamwork skills in that students may have underrated these self-reported scores after the program. For interpersonal / teamwork skills, this was at a moderate effect size at 0.48 and a power of 0.60, while empathy had a small-medium effect size at 0.39 with a power of 0.43.

Table 11: Paired-Samples T-Test Results for Post vs Delayed Post-Survey

	Intrapersonal Skills				Interpersonal Skills		
Statistic	Mindfulness	Resilience	Self-Management	Critical-Thinking	Empathy	Interpersonal / Teamwork	Leadership
Post-Survey	2.97	4.14	4.16	4.25	1.29	4.22	4.06
Delayed Post-Survey	3.06	4.25	4.25	4.38	1.39	4.42	4.16
Delta	0.09	0.11	0.09	0.13	0.10	0.20	0.10
p-value (two-sided)	0.30	0.16	0.46	0.22	0.07**	0.03*	0.38
Effect Size	0.22	0.30	0.16	0.27	0.39	0.48	0.19
Power	0.18	0.29	0.11	0.23	0.43	0.60	0.14

Note: * $p < 0.05$, ** $p < 0.10$, *** $p < 0.15$

QUALITATIVE RESULTS

The qualitative results were designed to answer three primary research questions: (1) to determine the primary intrapersonal and interpersonal skills students developed from the mindfulness training, (2) how the development of these skills transferred to

students' engineering education experience, and (3) learn about students' overall experience learning mindfulness.

There was considerable variation in the depth of qualitative data collected per student. For example, there may only be four, short (i.e. one sentence) responses for students that participated in one of the surveys, while a student that participated in both surveys and an interview would have several pages worth of data. The overall data provided was sufficient to reach theoretical saturation and quantify the commonality of the effects with some limitations. No new insights emerged in the data analysis about the first phase of interviews. The primary effects or skills were categorized into mindfulness, intrapersonal skills, and interpersonal skills. The fourth and final theme identified was students' experience of the program including learning mindfulness. Table 12 summarizes the quantification of the three main effects experienced. See Appendix I for a more detailed breakdown of the effects experienced across each student.

Table 12: Quantification of Qualitative Results

Effect	Number of Students
Intrapersonal Skills	33
Mindfulness	29
Self-Awareness	15
Manage Stress / Resilience	27
Well-Being	17
Self-Regulated Learning	18
Interpersonal Skills	25
Empathy	19

Communication / Listening	20
Leadership / Teamwork	18

THEME 1: MINDFULNESS

There was evidence in the qualitative data indicating 29 of the 35 students exhibited improvements in their level of mindfulness. The students touched on all facets of mindfulness including an enhanced ability to regulate their attention/awareness, being more present focused, and developing attitudes associated with mindfulness such as acceptance. A general comment is provided by Amy who wrote, “I pay closer attention to the things happening around me and I am more in tune with my thoughts.” A nuanced examination of many of the mindfulness-related quotes revealed students developed an enhanced ability to orient their attention both internally and externally. The students who improved their ability to direct their attention internally were able to develop more self-awareness of their everyday thoughts, feelings, and body sensations within different situations. Fifteen students had quotes that were classified as experiencing an improvement in self-awareness. Robert simply states this by writing, “I am more aware of what my thoughts are, and I listen to what I am thinking.”

Other students described that they noticed an improvement in their ability to orient or focus their attention externally including becoming more aware of their environment or surroundings. For example, Carla wrote, “I've noticed that I've become more oriented with the world around me and that I was able to control myself better in times of stress.” Directing one’s attention externally allowed students to focus their attention more on others. There was also evidence indicating that a student who experienced an increase in self-awareness did not come at the expense of focusing on others. Many students developed both self-awareness and awareness of others jointly. For

example, Jose wrote, “This program helped me learn and be more aware of myself and others.” The increased awareness of others is elaborated in the third theme, interpersonal skills. Many students also began to pay attention more to routine activities they perform regularly including walking, eating, driving, and biking. This will be discussed more in the fourth theme, mindfulness practice. In general, an enhanced ability to regulate one’s attention was associated with improved focus as highlighted by Shannon, “I thought it was super helpful for me in terms of focus. The meditations really helped me realize what I needed to do to get my mind to focus.”

A significant number of students described being more present-oriented in their daily experiences. Several students described how they feel like they “live in the moment” more or “focus more on what is happening now.” For example, David writes, “Slowing down, taking deep breaths, realizing what's going on, setting goals was really nice to focus in on myself and realize my current situation.” Several students also discussed how they feel like life had “slowed down” for them and that they “take life as it comes” or “moment-by-moment.” An exemplar of this phenomena is provided by Arthur when he shared, “It also seems that my life has slowed down, and I can think better about what I am doing in my everyday life, instead of being swept away by the flow of life.” Several students also indicated they are now more reflective in certain situations and take time to “pause” every so often and evaluate their situation instead of immediately reacting. Several students describe that they noticed more often when they are on “autopilot” mode or are “less reactive”. Rodrigo conveys this idea when he said, “Meditation and mindfulness are really training our brains to act the way we’d like it to instead of reacting to what’s around us.”

A number of students also noted changes in attitudes associated with mindfulness. Most prominently featured was acceptance, or students describing how they are more "accepting of challenges". Several students also described that they are less judgmental of others and are more likely to give others the benefits of the doubt. A notable example comes from Sarah who said, "I used to completely overthink things, just sit their wondering if I am going to fail until I fail. I realized that if I just breathe and accept the reality, it's fine."

Theme 2: Other Intrapersonal Skills

Overall, 33 out of the 35 students improved an intrapersonal skill. All 29 students who described an improvement in mindfulness also experienced an improvement in at least one intrapersonal skill. The intrapersonal skills developed by the students were grouped into four main categories: (1) an enhanced ability to manage or bounce back from stress, i.e., resilience, (2) an improvement in well-being, (3) a greater focus on personal development, and (4) an improved ability to focus on school related tasks and/or greater productivity.

Twenty-seven of the 35 students described an enhanced ability to manage their thoughts/emotions, stress, and/or anxiety. As a result, these students have seen a reduction in (or relief of) stress, anxiety, or feeling overwhelmed, and rumination. A noteworthy comment comes from Jose who shared:

> A big effect it had was decreasing the frequency and severity of my anxiety. Coming to this program, one of my goals was not to improve or get help with my anxiety but it made a big difference. Since I have been practicing mediation every morning, I have noticed that I am less anxious and don't have as many anxiety attacks, which helps me enjoy my time and days more.

The students largely attribute these improvements to changes in their mindfulness. David for example mentioned, “I've also felt calmer in stressful situations actually, without overreacting or overthinking. I don't exactly know what is helping me do that, but I figured it's a part of practicing mindfulness that has helped me center in more at times I need to.” Becoming more aware of and managing everyday thoughts, emotions, stressors, has greatly alleviated much of the stress or anxiety students had and has led to improvements in resilience, or the ability to bounce back from stress. For example, Rodigro simply states, “I feel like my tolerance is slowly getting better towards stress.” Carla concisely writes, “I think I've grown in my ability to overcome obstacles and hardships.” Courtney elaborates on the idea that she is less negatively affected by stress by saying, “I still get stressed and everything from school and whenever life. But I feel like it doesn't affect me as much. I know it's there, but in my mind, I know it's okay. It's just what it is and I can get through it.” A number of students describe being able to more readily recognize, tolerate or accept, and identify ways to overcome stress. This is also represented well by the following quote from Samantha who said, “I think I have grown better self-awareness for recognizing when I am stressed and evaluating what I need to do to overcome that stress and take care of myself.”

About half (or 17 out of the 35 students) explicitly mention that their life has improved in some capacity since the culmination of the program due to improvements in intrapersonal skills. Common adjectives used among the students, including feeling more at peace, content, calm, at ease, and/or clear-minded. For example, James writes, “I have noticed that I seem more mindful in general, I appreciate little things in life more often. I also feel a lot less stressed and more relaxed.” Others described feeling more confident,

curious, optimistic, and energetic such as Mary who writes, “I have noticed a strong increase in interest and optimism in my life.” Some students generally noted that they feel like life is more enjoyable. A few students mentioned that they are more appreciative of positive things in their life and less focused on negative occurrences. For example, Rodrigo divulged, “The more you do practice mindfulness, you start picking out the more positive things that happen during your day unconsciously. Your negative thoughts start to drain out of your mind.” Arthur also noticed that being more mindful or self-aware of his thoughts helped him identify negative thought-patterns. He comments, “It's kind of made me a more positive person and I identify negativity in my own thinking and in others thinking, and I try to do my best to reduce it because nobody wants negativity.” There were 17 students that explicitly mentioned a positive life outcome and were classified as experiencing improvements in well-being. These improvements often went hand-in-hand with improvements in self-regulation and/or mindfulness. This is exemplified perfectly by Courtney who became considerably more aware of her rumination and now is able to manage her thoughts more effectively:

> I felt that I was more present in my actions and was also more aware of my surroundings. When I felt stressed throughout the week, I found that it was easier to calm myself down and put everything into a better perspective. Overall, I feel that the program has heightened my general mood and has given me a sense of peace. It amazes me how even much I would (and still do at times) get wrapped up in my thoughts and let them cycle around in my head throughout the day. Now that I am more aware of this, I feel as though I have more control over my thoughts and do not let them consume me quite as much.

Many students noticed improvements in their ability to prioritize their time more effectively on a daily basis. Several students shared that they are more scheduled, structured, and or organized now especially in relation to personal and school-related work and goals. For example, David wrote, “I have noticed that I have been able to

organize my schedule a little bit more effectively, prioritizing." Meanwhile, Carla felt like she was more prepared and focused each day: "I was more prepared schedule-wise. I was able to remember when I had a meeting or class whereas before I struggled to remember what classes I had each day. I felt more focused in what I was doing each day." Other students developed a habit of tracking the tasks they need to complete such as Jose who shared, "I now keep a to-do list on my phone with all of the due dates and today what I am going to do." This increased organization has consequently led to students being less prone to procrastination. For example, Tanya alleges, "The program motivated me to procrastinate less to make things easier". George affirms this statement by stating, "The course encouraged me to take incremental steps in accomplishing my goals and tasks, especially homework, rather than become a procrastinator."

Mindfulness also transferred to students' mindset toward learning and completing school-work in that students felt less overwhelmed by their overall workload and were more focused on just completing one task at a time. A salient example that highlights an increased resilience toward school-related work comes from Jose who articulates a shift in perspective in how he approaches his assignments:

> Let's say I get assigned a bunch of assignments. That's what usually would start some stress or feed into my anxiety. I am able to calm myself down in a way and tell myself it's not that bad. It's just assignments – take it step-by-step. You can only do one thing at a time. I've had anxiety for a long time. It's hard to explain that it is helping my day overall. Things that would usually stress me out don't affect me as much.

Multiple students also shared they were "more focused in class" and "could focus more on their homework". Harry for example wrote, "I listen more and intake more information the more that I focus on stopping and breathing instead of just trying to focus

more on the instructor." A few students even began to touch on the idea of developing more of a positive outlook or growth mindset toward school. Mary specifically noticed adopting a growth mindset toward her chemistry class, while Jose remarks, "I learned some skills to deal with school and life as it comes at me and to have a positive outlook on stuff and think of them as learning experiences."

Another noteworthy phenomenon was that several students noted that improving their mindfulness or level of focus, resulted in achieving more productivity. Ravi for example wrote, "Meditation really helped me center my mind in a task. My mind tends to wander a lot and it really helped me focus. I did try it on my own time and it increased my productivity."

A significant number of students indicated they are now more focused on their personal or self-improvement goals. Gabriel for example succinctly states, "After the program, I found that I'm able to focus on my goals and whatever would benefit me as a person." A few students shared that they are intentional about making time for their personal hobbies and taking care of themselves. Several students also shared that they now allocate more time to reflect on ways to improve themselves. A strong example of this comes from Mary who shares how she has integrated reflection as a daily habit: "I have also done a form of debrief at the end of each day by reflecting on what stressed me out or upset me, how to fix this, and the things I think I did well and could improve on." Tanya mentions now that she already had a habit of reflecting on self-improvement but now does it "in a more productive and positive way now".

THEME 3: INTERPERSONAL SKILLS

Twenty-five of the 35 students described an improvement in their interpersonal skills. These changes were organized into three main categories: empathy, communication, and leadership/teamwork. Nineteen students discussed empathy as one of the main skills they learned from the program. Collectively the students describe both the cognitive and affective dimensions of empathy, and an increased desire to understand the perspective of others. A greater example of this comes from Rodrigo who describes cultivating empathy from the program:

> I feel like I have more empathy for people. Feeling what they are feeling more. And then you realize what they are going through as well and you start seeing everything from a different perspective. For example, before the program, I would judge people a lot but now after this program, I try to see things from their perspective more.

Many of the students that noted a change in empathy have observed the benefits from practicing empathy more including understanding others more, being less judgmental, and generally having more positive interactions. Yasmael notes that "empathy is the most major thing I feel I will take away" and that his "conversations with others are more elaborative". He attributes this to mindfulness and specifically "not really in a rush anymore." Another prominent example of the benefits of empathy comes from Mary who shares:

> When I'm interacting with other people too, I really try and understand their side and I think that's helped me give people the benefit of the doubt a lot more. This has therefore increased my intrapersonal skills, because I am not as quick to come to conclusions about others, my own feelings, and other people's feelings/actions. I think this has increased my awareness of how to display good intentions and genuinely.

Twenty students also described improvements in communication skills. One common theme was students feeling more open and confident. This has led to different

benefits such as making it easier to connect with others, being more relatable, and being able to share ideas more effectively. For example, Carla shared that she "feels more open to making friends and making connections" and that "the program showed me I can be more open to other people." Maria describes herself as introverted and writes, "I communicate more with others without making it too uncomfortable for myself. Jose says that he is now "more comfortable presenting [his] ideas."

Within communication, students are now more focused on listening to others. Stephen for example shared, "I think that I also pay attention more to what people are saying in a conversation," while Jane wrote, "I did try to be more mindful and listen to conversations more attentively." A number of students noticed becoming more aware of internal distractions that previously hindered their listening skills such as thinking about what they were going to say next instead of actually listening. Courtney describes this phenomenon well: "I feel like I've always listened to people, but now I feel like I'm more focused on listening to what they have to say versus how I'm going to respond." Active-listening has helped improve some student's ability to understand the perspective of others also. David for example noted that he "still remembers the listening activity" and that "it helps understand people's statements." Wade shared, "Through listening to what others were talking about and focusing on what they were saying in my head, I was able to understand them more emotionally."

Eighteen students discussed improvements in their teamwork and/or leadership skills. Many of these students noticed how empathy and active-listening have enhanced their teamwork skills. These students described being less controlling, more open to new ideas, having a greater desire to seek the input of their team members and ensuring the

perspectives of others are heard. These students share that this has enhanced their group experience, supported conflict-resolution, and overall led to improvements in productivity and outcomes. A good example of this comes from Shannon who acknowledges that "the importance of empathy in engineering stuck with [her]" and how she was able to transfer the ideas of empathy to an engineering group project. She observes and remarks, "It's allowed me to listen to the team better instead of taking control, which is what I used to do. It's made it easier because I am not trying to do everything myself." Jared describes empathy also as a major takeaway and as a way "to make teamwork more efficient". He elaborates on this by explaining, "It's related to conflict-resolution. It can help you detect when a teammate feels like their voice isn't being heard and ask them "well what do you think about this?"

Many students also observed how empathy and active-listening has enhanced their leadership skills. Several of the more introverted students noticed that they now feel more confident in their ability to step up in a leadership role as a result of integrating empathy and active-listening skills in their group work. Two particularly notable examples of this are shared by two students. In an interview Carla articulates her maturation as a leader:

> I feel like I have been listening more to others instead of focusing on making a remark to what they said. Or saying, "me too". It's more focusing on what they mean and supporting them instead of bringing myself into it. I would relay the messages between everyone, which was really interesting because I usually don't take a leadership role within my groups. There were some points where I was the only one available but other times it felt like I was stepping up to bring all of the ideas together or bring back up points that others left behind. I felt very comfortable with taking the leadership role over time. At first it felt really weird but over time I felt more comfortable with it and felt prepared to take on a leadership role.

Carla describes becoming more comfortable being a leader and an ability to seek out and integrate the ideas of the other team members. Gabriel describes that before the program he had difficulties working with others and was "hesitant to provide input on certain things." Since the culmination of the program, Gabriel describes:

> I've learned to break out of my shell one step at a time and take a leadership role every now and then. I used to be more behind the scenes as far as organization and time management, but I've found that I'm slowly becoming more all around. I've grown to be more flexible and adapt to change while trying my best to avoid over-analyzing things

Theme 4: Mindfulness Practice

There was considerable granularity in how and to what extent the students practiced cultivating mindfulness on their own. There was evidence that 12 students integrated a formal meditation practice into their lives. This ranged from just a few minutes a week to an extensive daily practice. Perhaps the most extensive change came from Carla who integrated a 30-minute meditation into her daily routine. Amy, Rodrigo, Jose, Yasmael, Courtney, Tanya, Shannon, Arthur, James, Sarah, and Roy integrated various forms of self-guided and guided meditations into their lives such as body scans, deep breathing, active breathing, and guided mediations. A few of these students discussed incrementally building their practice over time. Courtney for example started with a 2-minute daily practice and gradually increased her meditations to 10-15 minutes a day. Some students chose to focus on one technique that resonated with them, while others found mixing different techniques to be effective. A few students discussed that meditating in the morning was more effective, while others preferred the evening. A few students (e.g. David and Tanya) found journaling to be effective in cultivating self-awareness.

Meditation did not resonate with all students. Amy, Maria, and Eve for example discussed how meditation would just make them fall asleep. The majority of students did not integrate a formal meditation practice. There was evidence indicating 11 of these students preferred to integrate an informal mindfulness practice or have "mindful moments." This group included Ravi, Charles, Joseph, Maria, Mary, Eve, Sharon, Stephen, Naresh, Adi, and Jane. Many of the students that practiced formal meditation also cited having more mindful moments. This often times took the form of connecting with their physical body in some capacity, such as taking deep breaths or focusing on their movement or what they were doing in that moment (e.g. walking, eating, biking, or eating). Some of these students also cited just becoming more aware of what was going on around them. A concise example comes from Roy who mentioned, "Randomly throughout the day I would just take a moment to recognize what was going on around me and just live in the moment." Many students found the informal mindful moments especially helpful to support paying attention in class and dealing with stress while working on homework. Mary and Amy for example found that focusing on their breaths for a few seconds helped them listen or engage with other students more in classes. James, Adi, Sarah, and Tanya discussed how just taking a few breaths when they felt stressed working on their homework helped them refocus. Sarah also shared that focusing on her breath helped alleviate her anxiety before tests.

Theme 5: General Workshop Impression

The workshop was well-received with all 35 students having a positive impression of the workshop. Only one student described experiencing no tangible benefit from the program but did share she found aspects interesting. Another student explicitly

described experiencing no changes in mindfulness but did find the empathy component to be helpful. The common adjectives students used to describe the workshop were enjoyable, rewarding, interesting, informative, useful, and engaging. A significant number of students noted that they had different expectations for the workshop. There was also considerable variation in students' impression of the in-workshop meditations. A few students also did provide some constructive feedback that the workshops should be more interactive. Several students also generally noted that they learned important habits and how to "live life better." Others noted that the "calm" or "safe" environment made it easier to connect with others on a deeper level. Charles notes that learning more about the struggles of others was "humanizing."

Most students appeared to enjoy all aspects of the program and struggled to come up with any constructive feedback. Some students noted they "looked forward to the workshop each week" and that they are interested in continuing to learn more about mindfulness. A few students expressed they appreciated how "engaging" the program was and that the small class sizes might have played a role in creating a "comfortable environment." Other students noted that they had different expectations of the program based on the flyer description but were "pleasantly surprised" by the program content. Two students shared they would not have signed up if they knew exactly what the program was about, which suggests that the program flyer did draw students who would otherwise not be interested in mindfulness. There were considerable differences in students' experience of the in-workshop meditations. Some students thought it was odd initially or had negative perceptions of meditation such as "it was a waste of time" but became receptive to it over time. Some students found the in-class meditations to be

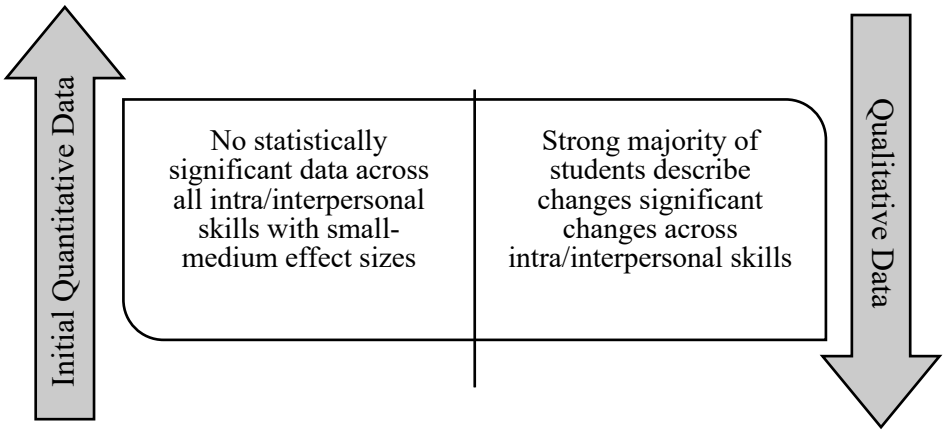
challenging, and found it easier to do at home, while others found it easier to meditate in class versus on their own. A few students mentioned they thought the in-workshop meditations were their favorite part.

MIXED RESULTS COMPARISON

As seen in research question five, a major component of the study is to mix the quantitative data with the qualitative data. The qualitative results did not align well with the quantitative results from the pre-post survey. The qualitative results indicated a strong majority of the students exhibited improvements across both intrapersonal and interpersonal skills. Within intrapersonal skills, a strong majority of students describe experiencing improvements in their overall mindfulness and ability to manage and/or become more resilient to stress. In contrast, the quantitative data indicated no statistically significant changes using an alpha of 0.05. The students also mentioned other intrapersonal skills they further developed that were not featured in the quantitative data including self-awareness, well-being, and self-regulated learning.

Within interpersonal skills, the qualitative data indicated a slight majority of students described improvements in empathy, communication, listening, teamwork, and leadership. These changes were however not observed in the quantitative data, which produced no statistically significant changes across empathy, teamwork, and leadership using an alpha of 0.05. Figure 7 provides an illustration of the incongruency present between the qualitative and initial quantitative findings. The discrepancy between the results influenced the addition of the second (delayed) data collection component to the dissertation study, which served to gather additional information to help provide clarification.

Figure 7: Visualization of Incongruence Between Initial Quantitative Results & Qualitative Results

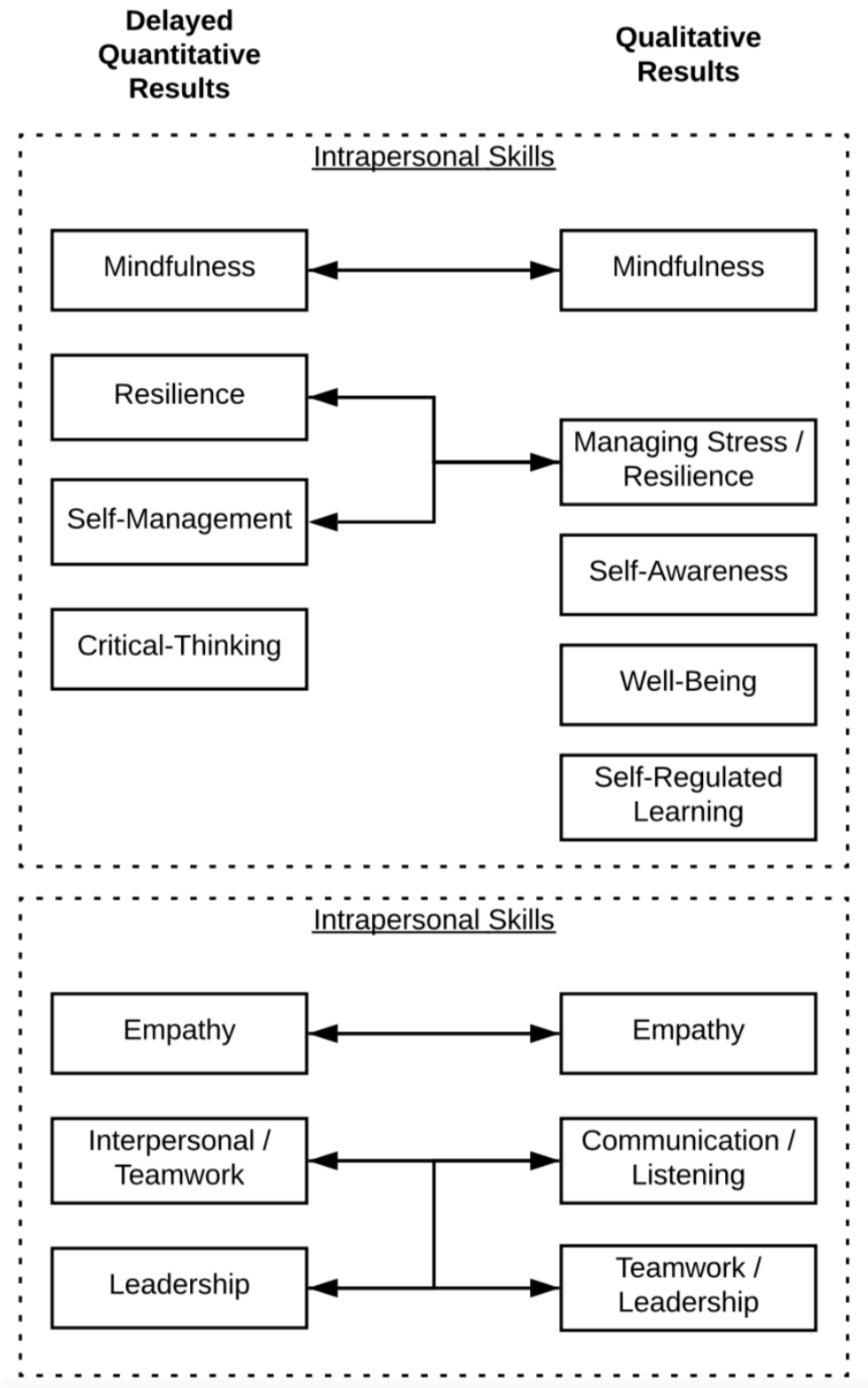


The quantitative data collected from the delayed survey using a retrospective pre-test format produced statistically significant results across all of the intrapersonal and interpersonal skills with very large effect sizes. These results seemingly aligned more closely with the qualitative data. Figure 8 provides a visualization of how the qualitative and delayed quantitative strands help explain each other. There were slight differences in the constructs analyzed in the quantitative data and the constructs that emerged in the qualitative data. For example, the quantitative data analyzed critical-thinking, however, this did not emerge as a major intrapersonal skill in the qualitative data. Instead, self-awareness, well-being, and self-regulated learning skills were discussed by many students.

Overall, many of the quantitative constructs aligned with the themes that emerged from the qualitative data. Mindfulness was the intrapersonal skill discussed by the most students in the qualitative data and was also the construct with the largest effect size in the delayed quantitative data. In the qualitative data, managing stress and resilience were

merged because of the considerable overlap between these two constructs. These two intrapersonal skills were discussed the second most in the qualitative data and align with the resilience and self-management constructs in the quantitative data, which had the third and fourth largest effect sizes with the quantitative data. Within interpersonal skills, empathy matched up perfectly between the quantitative and qualitative data. Within the qualitative data the constructs leadership and teamwork, as well as communication and listening, were combined into two different codes within the theme of interpersonal skills because of the considerable overlap. These constructs align with the quantitative constructs of interpersonal/teamwork and leadership. The overall findings are discussed in greater detail in the following Discussion section.

Figure 8: Visualization of Congruence Between Delayed Quantitative Results & Qualitative Results



CHAPTER 6: DISCUSSION

The overall findings for this multiphase mixed methods study indicated that mindfulness training can indeed support the development of intrapersonal and interpersonal skills among first-year engineering students. While the initial quantitative data indicated that students did not exhibit any statistically significant changes using an alpha of 0.05, the delayed quantitative data provided evidence that students experienced very large effects across intrapersonal skills (mindfulness, resilience, self-management, and critical-thinking) and interpersonal skills (empathy, interpersonal/teamwork, and leadership).

Comparing the delayed quantitative results with the original pre-post surveys also provided evidence that a response shift bias may have influenced the initial results. In particular, students retrospectively rated their levels of self-management, resilience, and mindfulness lower than their original pre-test ratings. Additionally, students rated their levels of interpersonal/teamwork skills and empathy higher in the delayed post-survey than in the immediate post-survey. These findings provided preliminary evidence that students may have overrated their intrapersonal skills coming into the program and underestimated the interpersonal skills they developed immediately after the program. It is possible that additional time was required for students to fully practice, integrate, and realize any improvements in interpersonal skills.

The qualitative results largely confirmed the findings of the delayed survey while providing rich insights on the specific intrapersonal and interpersonal skills developed. For intrapersonal skills, students reported observing increased levels of mindfulness leading to improvements in self-awareness, self-regulation, resilience, focus on personal

development and school-related tasks, and well-being. The degree of improvement on these intrapersonal skills varied for each student, but the overall feedback provided indicates the students were receptive to learning about mindfulness and engaging in training through meditations and reflections. A strong majority of the students described experiencing improvements in mindfulness despite the program being limited to just four weeks versus the more standard eight weeks seen in mindfulness programs like MBSR. Although many of the students had difficulties fully articulating the changes they experienced, collectively they did touch on all aspects of the current conceptualizations of mindfulness. The students described an enhanced ability to focus their attention internally and/or externally, a greater sense of being attuned with their everyday thoughts and emotions, more frequently being immersed in moment-to-moment activities, and noted an increased adoption of attitudes like acceptance, openness, curiosity, and non-judgment.

There was also strong evidence in the qualitative data suggesting that the changes in mindfulness led to an enhanced ability for students to self-regulate their thoughts, emotions, stress, and even anxiety. Many students described feeling less stressed or anxious. Some students described feeling like they were not as reactive or negatively affected by previous stressors. The changes in self-management likely are closely related to increases in self-awareness. There was evidence indicating many students become more self-aware of their everyday thought-patterns, emotions, and stressors. This finding suggests students began to pay more attention to what they think about. The changes in self-regulation and self-awareness relate closely to the concept of metacognition. Students developed the ability to metacognitively monitor and control their thoughts and

emotions. Enhanced self-regulation skills naturally manifested to students feeling more peaceful, optimistic, energetic, confident, and clear-minded. These improvements in intrapersonal skills transferred into their engineering education experience in several key ways. A number of students described feeling like they could focus better on school-related work and pay attention more in class. A few students noted feeling more resilient to school-related challenges and even adopting a growth mindset. Others described becoming more organized, scheduled, and procrastinated less on completing school-related work. This also transferred to being intentional about the general usage of time and allocating time for personal life activities they enjoy. Overall, the evidence indicates that these intrapersonal skills can enhance students' ability to self-regulate their learning.

The qualitative data also provided strong evidence that many students improved their interpersonal skills. Indeed, many of the students self-reported improvements in empathy, specifically perspective-taking. Many students also noticed that they now pay more attention to others and practice active-listening to a greater extent, which only enhances their ability to understand the perspectives of others. Several self-identified introverted students noticed that they are more confident and open in their interactions and expressed a greater willingness to share their perspective, especially in group work contexts. Several students observed that practicing empathy and being fully-present with others has led to more meaningful interactions and has made it easier to connect with and to build relationships with others. The cultivation of empathy and enhanced communication skills transferred over to teamwork and leadership skills. A number of students shared that they are less controlling, more open to the ideas of others, and actively seek and integrate the input of other team members to a greater extent.

Consequently, students are noticing that this has enhanced their group experiences, supported conflict-resolution, and lead to improvements in group outcomes. Several students also noticed themselves feeling more confident in their ability to be a leader on their team as a result of developing these team-related skills.

The overall changes varied for each student depending on their previous experiences and knowledge on these topics. For example, several students found the content to be interesting, but did not experience much change because they were already familiar with the content. The overwhelming majority of students found value in integrating many of the tools and techniques shared in the mindfulness training. For some students, a mindfulness meditation practice resonated with them and they were able to integrate this into their daily lives, while for others simply taking time to reflect, pause, or immersing themselves fully in an activity was enough to cultivate mindfulness.

IMPLICATIONS

The study has implications for engineering administrators, especially those involved in first-year academic success programs. Many of the intrapersonal skills (e.g. self-regulation) developed and outcomes experienced (e.g. reduced anxiety) have been demonstrated to support academic performance. A mindfulness training program successfully integrated into engineering education would likely improve retention. It is also likely that the intrapersonal skills students learned (e.g. empathy) would foster a more inclusive environment that promotes the integration of multiple perspectives in group projects, which would then likely support creativity and innovation.

Engineering faculty should also be aware of the findings of this study and the overall literature that indicates one's intrapersonal skills, especially self-regulation, have major implications on their academic performance and future career success. Faculty are encouraged to take responsibility and become aware of these insights to help support a culture that values well-being versus promoting a culture of stress that is predominant in higher-education. Engineering faculty should also be aware of the importance of promoting interpersonal skills such as empathy and active-listening, and how these skills influence the design process and group work overall. Engineering faculty and administrators should also be conscientious in how they are modeling these skills to students.

LIMITATIONS & FUTURE WORK

The quantitative data was limited by relatively small sample sizes. Although the retrospective pre-test format in the delay survey produced large effect sizes with a power of 1, there are biases introduced in using a retrospective-survey format that should be acknowledged including recall bias, social desirability bias, and effort justification. Students may not have accurately remembered their mindset before the program, which would have been 4-months in the past when they completed the delayed survey. Providing a means for students to retrospectively compare their scores before the intervention with their current self also would likely widen the difference in scores as well, especially if students thought they did improve on a number of items and constructs.

Other primary limitations for this study stem from the small, self-selecting sample of students, variance in participation and data collection across each student, and potential biases introduced in the qualitative data collection. Since this program was

positioned as an extracurricular opportunity, only a limited number of self-selecting students participated. These were students that were already actively seeking opportunities to improve as a leader and were perhaps more open to the mindfulness training than the average engineering student.

Although all students were encouraged to participate in all aspects of data collection, there was considerable variance in the level of participation and the data collected for each student. The quantification of the qualitative data does not provide a complete picture of the changes for all students involved but was satisfactory to provide a mode of comparison with the quantitative data. Only 18 students completed all four workshops and 29 students completed three out of the four workshops. This means that half of the students were not exposed to all of the content. Only 18 out of the 35 students elected to participate in the interviews. For the 17 students that did not participate in interviews, there was only qualitative data from open-ended responses to draw conclusions. Interviewing these students may have elicited additional insights into the impacts they experienced. There are also few rich inferences that can be drawn from the 10 students that attended only one workshop since no qualitative data was collected from these students. It is unclear why these students dropped and whether they would have experienced similar effects as the students that attended more workshops and participated in the data collection efforts.

Another main limitation of this study is that the workshop facilitator also collected survey data and conducted the interviews. Although the facilitator attempted to mitigate this limitation by actively encouraging students to provide their honest feedback, it is possible some students may have felt uncomfortable disclosing critical feedback.

This study also does not provide insight into what extent these types of trainings are scalable within engineering education. The facilitator, who was also the primary developer of these workshops, had a strong foundation of mindfulness training and extensive practice integrating these concepts into everyday life. It is unclear what level of knowledge and training would be needed to properly facilitate these mindfulness trainings to elicit similar results.

Future work would need to involve design and development research to explore the feasibility of scaling mindfulness training within engineering education. A starting point would be identifying potential pathways to integrate the trainings within engineering education. A potential fit would be integrating the content within first-year academic success courses and programs offered by some institutions. There would be a need to identify qualified mindfulness facilitators. Engineering schools could partner with internal or external organizations that can provide qualified mindfulness facilitators. Another option would be to use a "Train the Trainer" approach and train academic advisors to facilitate the workshops. Both of these options would likely be logistically challenging and require extensive administration work.

An alternative would be to provide the online content in the form of videos and modules. Academic success courses could then be utilized to facilitate in-person discussions and activities for students to fully grasp the applicability of mindfulness training in engineering education and personal life contexts. It is unclear how an online or blended approach would affect the impacts of the program. Finally, another option is to simply maintain the status-quo of having mindfulness training offered as an extracurricular program that students elect to participate in. This would allow student

affairs or another institutional organization to manage the program, such as a center for mindfulness, however, these programs would not be tailored for engineering students and it is unclear how many engineering students would actively seek out these types of opportunities.

The qualitative data could also help inform the design of future quantitative surveys. Future surveys could benefit from including self-regulated learning and well-being. These constructs emerged in the qualitative data as important outcomes for many students. Additionally, other forms of quantitative data that are no self-report instruments should also be considered.

CHAPTER 7: CONCLUSION

Thus far, there has been little work connecting mindfulness research to engineering education. In this multiphase, mixed methods study, a mindfulness training program was design, developed, and implemented on engineering students. In general, the results of this study provide evidence that mindfulness can indeed support the development of intrapersonal and interpersonal skills that transfer directly into supporting students' engineering education experience as well as their personal life. Although the initial round of quantitative data collection indicated no statistically significant changes, the delayed quantitative data collection provided evidence that a response shift biased occurred and that, overall, students did experience significant improvements across intrapersonal and interpersonal competencies.

The qualitative data aligned closely with the results produced by the delayed quantitative results. Improvements in mindfulness led to enhanced self-regulation skills, which resulted in a greater sense of well-being. Additionally, improvements in mindfulness also enabled a number of students to be more present and aware in their daily interactions, which improved their ability to connect with and understand the needs of others. These intrapersonal and interpersonal skills transferred to supporting engineering students' educational experience. The outcomes strongly aligned with the mechanisms of mindfulness shared in the theoretical frameworks section. While the findings are generally positive, future work will need to evaluate the feasibility of scaling a program like this in an engineering school.

REFERENCES

Ahn, Y. H., Annie, R. P., & Kwon, H. (2012). Key competencies for US construction graduates: Industry perspective. *Journal of Professional Issues in Engineering Education and Practice*, *138*(2), 123-130.

American College Health Association. American College Health Association-National College Health Assessment II: Reference Group Executive Summary. Silver Spring, MD: American College Health Association; 2018.

American College Health Association. American College Health Association-National College Health Assessment: Arizona State University Metro Phoenix Campuses Spring 2018. Baltimore: American College Health Association; Spring 2018 (n=1.304).

Arch, J. J., & Landy, L. N. (2015). Emotional benefits of mindfulness. *Handbook of mindfulness: Theory, research, and practice*, 208-224.

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, *13*(1), 27-45.

Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The Kentucky Inventory of Mindfulness Skills. *Assessment*, *11*(3), 191-206.

Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: an investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of autism and developmental disorders*, *34*(2), 163-175.

Beddoe, A. E., & Murphy, S. O. (2004). Does mindfulness decrease stress and foster empathy among nursing students?. *Journal of Nursing Education*, *43*(7), 305-312.

Birnie, K., Speca, M., & Carlson, L. E. (2010). Exploring self-compassion and empathy in the context of mindfulness-based stress reduction (MBSR). *Stress and Health*, *26*(5), 359-371.

Bish, A. J., Newton, C. J., Browning, V., O'Connor, P., & Anibaldi, R. (2014). An exploration of the professional competencies required in engineering asset management. *European Journal of Engineering Education*, *39*(4), 432-447.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., ... & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical psychology: Science and practice*, *11*(3), 230-241.

Bowen, S., Witkiewitz, K., Clifasefi, S. L., Grow, J., Chawla, N., Hsu, S. H., ... & Larimer, M. E. (2014). Relative efficacy of mindfulness-based relapse prevention, standard relapse prevention, and treatment as usual for substance use disorders: a randomized clinical trial. *JAMA psychiatry*, *71*(5), 547-556.

Brown, K. W., Creswell, J. D., & Ryan, R. M. (2015). Introduction: The evolution of mindfulness science.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of personality and social psychology*, *84*(4), 822.

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological inquiry*, *18*(4), 211-237.

Byrd, D. R., & McKinney, K. J. (2012). Individual, interpersonal, and institutional level factors associated with the mental health of college students. *Journal of American College Health*, *60*(3), 185-193.

Cahn, B. R., & Polich, J. (2006). Meditation states and traits: EEG, ERP, and neuroimaging studies. *Psychological bulletin*, *132*(2), 180.

Campbell-Sills, L., & Stein, M. B. (2007). Psychometric analysis and refinement of the Connor–Davidson resilience scale (CD-RISC): validation of a 10-item measure of resilience. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies*, *20*(6), 1019-1028.

Cardaciotto, L., Herbert, J. D., Forman, E. M., Moitra, E., & Farrow, V. (2008). The assessment of present-moment awareness and acceptance: The Philadelphia Mindfulness Scale. *Assessment*, *15*(2), 204-223.

Carson, J. W., Carson, K. M., Gil, K. M., & Baucom, D. H. (2004). Mindfulness-based relationship enhancement. *Behavior therapy*, *35*(3), 471-494.

Cash, M., & Whittingham, K. (2010). What facets of mindfulness contribute to psychological well-being and depressive, anxious, and stress-related symptomatology? *Mindfulness*, *1*(3), 177-182.

Chadwick, P., Hember, M., Symes, J., Peters, E., Kuipers, E., & Dagnan, D. (2008). Responding mindfully to unpleasant thoughts and images: reliability and validity of the Southampton mindfulness questionnaire (SMQ). *British Journal of Clinical Psychology*, *47*(4), 451-455.

Chiesa, A., Anselmi, R., & Serretti, A. (2014). Psychological mechanisms of mindfulness-based interventions: what do we know?. *Holistic nursing practice*, *28*(2), 124-148.

Clough, G. W. (2004). The engineer of 2020: Visions of engineering in the new century. National Academy of Engineering, Washington, DC.

Creswell, J. D. (2017). Mindfulness interventions. *Annual Review of Psychology*, *68*, 491-516.

Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research.

Cross, K. J., & Jensen, K. J. (2018). Work in Progress: Understanding Student Perceptions of Stress as part of Engineering Culture. In *American Society of Engineering Education Conference Proceedings*.

Csikszentmihalyi, M. (1997). Flow and the psychology of discovery and invention. *HarperPerennial, New York*, *39*.

Cunningham, P., Matusovich, H. M., Hunter, D. A., & McCord, R. E. (2015, October). Teaching metacognition: Helping engineering students take ownership of their own learning. In *2015 IEEE Frontiers in Education Conference (FIE)* (pp. 1-5). IEEE.

Danitz, S. B., & Orsillo, S. M. (2014). The mindful way through the semester: An investigation of the effectiveness of an acceptance-based behavioral therapy program on psychological wellness in first-year students. *Behavior Modification*, *38*(4), 549-566.

Davidson, R. J., & Kaszniak, A. W. (2015). Conceptual and methodological issues in research on mindfulness and meditation. *American Psychologist*, *70*(7), 581.

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of research in personality*, *19*(2), 109-134.

Deikman, A. J. (1982). *The observing self: Mysticism and psychotherapy*. Beacon Press.

Farb, N. A., Segal, Z. V., & Anderson, A. K. (2012). Mindfulness meditation training alters cortical representations of interoceptive attention. *Social cognitive and affective neuroscience*, *8*(1), 15-26.

Dekeyser, M., Raes, F., Leijssen, M., Leysen, S., & Dewulf, D. (2008). Mindfulness skills and interpersonal behaviour. *Personality and individual differences*, *44*(5), 1235-1245.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. P. (2007). Mindfulness and emotion regulation: The development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). *Journal of psychopathology and Behavioral Assessment*, *29*(3), 177.

Felsten, G., & Wilcox, K. (1992). Influences of stress and situation-specific mastery beliefs and satisfaction with social support on well-being and academic performance. *Psychological Reports*, *70*(1), 291-303.

Frank, M., Lavy, I., & Elata, D. (2003). Implementing the project-based learning approach in an academic engineering course. *International Journal of Technology and Design Education*, *13*(3), 273-288.

Folkman, S., & Lazarus, R. S. (1988). Coping as a mediator of emotion. *Journal of personality and social psychology*, *54*(3), 466.

Garland, E. L., Farb, N. A., R. Goldin, P., & Fredrickson, B. L. (2015). Mindfulness broadens awareness and builds eudaimonic meaning: A process model of mindful positive emotion regulation. *Psychological Inquiry*, *26*(4), 293-314.

Garland, E. L., Gaylord, S. A., Boettiger, C. A., & Howard, M. O. (2010). Mindfulness training modifies cognitive, affective, and physiological mechanisms implicated in alcohol dependence: results of a randomized controlled pilot trial. *Journal of psychoactive drugs*, *42*(2), 177-192.

Garland, E. L., Gaylord, S. A., & Fredrickson, B. L. (2011). Positive reappraisal mediates the stress-reductive effects of mindfulness: An upward spiral process. *Mindfulness*, *2*(1), 59-67.

Garland, E. L., & Howard, M. O. (2013). Mindfulness-oriented recovery enhancement reduces pain attentional bias in chronic pain patients. *Psychotherapy and psychosomatics*, *82*(5), 311-318.

Geller, S. M., & Greenberg, L. S. (2002). Therapeutic Presence: Therapists' experience of presence in the psychotherapy encounter. *Person-Centered & Experiential Psychotherapies*, *1*(1-2), 71-86.

Giluk, T. L. (2009). Mindfulness, Big Five personality, and affect: A meta-analysis. *Personality and Individual Differences*, *47*(8), 805-811.

Goldberg, D. E., & Somerville, M. (2014). A whole new engineer. *The coming revolution in Engineering Education. Douglas MI: Treejoy*.

Good, D. J., Lyddy, C. J., Glomb, T. M., Bono, J. E., Brown, K. W., Duffy, M. K., ... & Lazar, S. W. (2016). Contemplating mindfulness at work: An integrative review. *Journal of management*, *42*(1), 114-142.

Gotink, R. A., Chu, P., Busschbach, J. J., Benson, H., Fricchione, G. L., & Hunink, M. M. (2015). Standardised mindfulness-based interventions in healthcare: an overview of systematic reviews and meta-analyses of RCTs. *PloS one*, *10*(4), e0124344.

Goyal, M., Singh, S., Sibinga, E. M., Gould, N. F., Rowland-Seymour, A., Sharma, R., ... & Ranasinghe, P. D. (2014). Meditation programs for psychological stress and well-being: a systematic review and meta-analysis. *JAMA internal medicine*, *174*(3), 357-368.

Gray, C. M., Yilmaz, S., Daly, S. R., Seifert, C. M., & Gonzalez, R. (2015). Idea generation through empathy: Reimagining the 'cognitive walkthrough.

Greeson, J. M., Juberg, M. K., Maytan, M., James, K., & Rogers, H. (2014). A randomized controlled trial of Koru: A mindfulness program for college students and other emerging adults. *Journal of American College Health*, *62*(4), 222-233.

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. Hadim, H. A., & Esche, S. K. (2002). Enhancing the engineering curriculum through project-based learning. In *Frontiers in education, 2002. FIE 2002. 32nd Annual* (Vol. 2, pp. F3F-F3F). IEEE.

Hanley, A., Warner, A., & Garland, E. L. (2015). Associations between mindfulness, psychological well-being, and subjective well-being with respect to contemplative practice. *Journal of Happiness Studies*, *16*(6), 1423-1436.

Hayes, S.C., Strosahl, K., & Wilson, K.G. (1999). Acceptance and commitment therapy: an experiential approach to behavior change. New York: Guilford.

Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behaviour research and therapy*, *44*(1), 1-25.

Hess, J. L., Beever, J., Strobel, J., & Brightman, A. O. (2017). Empathic perspective-taking and ethical decision-making in engineering ethics education. In *Philosophy and engineering* (pp. 163-179). Springer, Cham.

Hess, J. L., Strobel, J., & Pan, R. (2016). Voices from the workplace: practitioners' perspectives on the role of empathy and care within engineering. *Engineering Studies*, *8*(3), 212-242.

Hess, J. L., Strobel, J., Pan, R., & Wachter Morris, C. A. (2017). Insights from industry: a quantitative analysis of engineers' perceptions of empathy and care within their practice. *European Journal of Engineering Education*, *42*(6), 1128-1153.

Hoffman, M. L. (2008). Empathy and prosocial behavior. *Handbook of emotions*, *3*, 440-455.

Hölzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives on psychological science*, *6*(6), 537-559.

Hunter, J. (2013). Is mindfulness good for business. *Mindful magazine*, 52-59.

Jain, S., Shapiro, S. L., Swanick, S., Roesch, S. C., Mills, P. J., Bell, I., & Schwartz, G. E. (2007). A randomized controlled trial of mindfulness meditation versus relaxation

training: effects on distress, positive states of mind, rumination, and distraction. *Annals of behavioral medicine*, *33*(1), 11-21.

Jesiek, B. K., Haller, Y., & Thompson, J. (2014). Developing Globally Competent Engineering Researchers: Outcomes-Based Instructional and Assessment Strategies from the IREE 2010 China Research Abroad Program. *Advances in Engineering Education*, *4*(1), n1.

Jha, A. P., Krompinger, J., & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective, & Behavioral Neuroscience*, *7*(2), 109-119.

Jones, B. D., Epler, C. M., Mokri, P., Bryant, L. H., & Paretti, M. C. (2013). The effects of a collaborative problem-based learning experience on students' motivation in engineering capstone courses. *Interdisciplinary Journal of Problem-based Learning*, *7*(2), 2.

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General hospital psychiatry*, *4*(1), 33-47.

Kabat-Zinn, J. (1990). Full catastrophe living: The program of the stress reduction clinic at the University of Massachusetts Medical Center.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: past, present, and future. *Clinical psychology: Science and practice*, *10*(2), 144-156.

Kabat-Zinn, J. (1994). Wherever you go. *There you are: mindfulness meditation in everyday life*, *304*.

Keng, S. L., Smoski, M. J., & Robins, C. J. (2011). Effects of mindfulness on psychological health: A review of empirical studies. *Clinical psychology review*, *31*(6), 1041-1056.

Kornfield, J. (2006). *Mindfulness, bliss, and beyond: A meditator's handbook*. Simon and Schuster.

Lattuca, L. R., Terenzini, P. T., & Volkwein, J. F. (2006). Engineering change: A study of the impact of EC2000. Baltimore, MD: ABET.

Lazarus, R. S. (1974). Psychological stress and coping in adaptation and illness. *The International journal of psychiatry in medicine*, *5*(4), 321-333.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer publishing company.

Lima, R. M., Carvalho, D., Assunção Flores, M., & Van Hattum-Janssen, N. (2007). A case study on project led education in engineering: students' and teachers' perceptions. *European journal of engineering education*, *32*(3), 337-347.

Lehmann, M., Christensen, P., Du, X., & Thrane, M. (2008). Problem-oriented and project-based learning (POPBL) as an innovative learning strategy for sustainable development in engineering education. *European journal of engineering education*, *33*(3), 283-295.

Leonard, D., & Rayport, J. F. (1997). Spark innovation through empathic design. *Harvard business review*, *75*, 102-115.

Ludwig, D. S., & Kabat-Zinn, J. (2008). Mindfulness in medicine. *Jama*, *300*(11), 1350-1352.

Lucas, B., Claxton, G., & Hanson, J. (2014). Thinking Like an Engineer: Implications for the education system.

Markes, I. (2006). A review of literature on employability skill needs in engineering. *European Journal of Engineering Education*, *31*(6), 637-650.
Meier, R. L., Williams, M. R., & Humphreys, M. A. (2000). Refocusing Our Efforts: Assessing Non-Technical Competency Gaps. *Journal of Engineering Education*, *89*(3), 377-385.

Mettler, J., Carsley, D., Joly, M., & Heath, N. L. (2017). Dispositional Mindfulness and Adjustment to University. *Journal of College Student Retention: Research, Theory & Practice*, 1521025116688905.

Mills, J. E., & Treagust, D. F. (2003). Engineering education—Is problem-based or project-based learning the answer. *Australasian journal of engineering education*, *3*(2), 2-16.

Mrazek, M. D., Franklin, M. S., Phillips, D. T., Baird, B., & Schooler, J. W. (2013). Mindfulness training improves working memory capacity and GRE performance while reducing mind wandering. *Psychological science*, *24*(5), 776-781.

Nair, C. S., Patil, A., & Mertova, P. (2009). Re-engineering graduate skills–a case study. *European journal of engineering education*, *34*(2), 131-139.

Nelson, K. G., Shell, D. F., Husman, J., Fishman, E. J., & Soh, L. K. (2015). Motivational and self-regulated learning profiles of students taking a foundational engineering course. *Journal of Engineering Education*, *104*(1), 74-100.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of abnormal psychology*, *109*(3), 504.

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on psychological science*, *3*(5), 400-424.

Nguyen, N., Yoshinari, Y., & Shigeji, M. (2005). University education and employment in Japan: Students' perceptions on employment attributes and implications for university education. *Quality Assurance in Education*, *13*(3), 202-218.

National Research Council. (2013). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. National Academies Press.

Ohland, M. W., Sheppard, S. D., Lichtenstein, G., Eris, O., Chachra, D., & Layton, R. A. (2008). Persistence, engagement, and migration in engineering programs. *Journal of Engineering Education*, *97*(3), 259-278.

Öhman, A., Carlsson, K., Lundqvist, D., & Ingvar, M. (2007). On the unconscious subcortical origin of human fear. *Physiology & Behavior*, *92*(1-2), 180-185.

Quaglia, J. T., Brown, B. W., Lindsay, E. K., Creswell, D. J., & Goodman, R. J. (2015). From Conceptualization to Operationalization of Mindfulness In K.W. Brown, J.D. Creswell, & R.M. Ryan (Eds.), *Handbook of mindfulness: Theory, research, and practice,* p. 151-170). New York, NY: Guilford Publications.

Raes, F., Dewulf, D., Van Heeringen, C., & Williams, J. M. G. (2009). Mindfulness and reduced cognitive reactivity to sad mood: Evidence from a correlational study and a non-randomized waiting list controlled study. *Behaviour research and therapy*, *47*(7), 623-627.

Rasmussen, Michael K., and Aileen M. Pidgeon. "The direct and indirect benefits of dispositional mindfulness on self-esteem and social anxiety." *Anxiety, Stress, & Coping* 24.2 (2011): 227-233.

Rieken, B., & Schar, M. (2017, January). Exploring the Relationship between Mindfulness and Innovation in Engineering Students. In *Proceedings of the American Society for Engineering Education Annual Conference, June 25-28. Columbus, OH.*

Rieken, B., Schar, M., & Sheppard, S. (2016). Trait mindfulness in an engineering classroom: An exploration of the relationship between mindfulness, academic skills, and professional skills. In *Frontiers in Education Conference (FIE), 2016 IEEE* (pp. 1-8). IEEE

Passow, H. J., & Passow, C. H. (2017). What Competencies Should Undergraduate Engineering Programs Emphasize? A Systematic Review. *Journal of Engineering Education*, *106*(3), 475-526.

Prince, K., Saveri, A., & Swanson, J. (2015). The Future of Learning: Redefining Readiness from the Inside Out. KnowledgeWorks. Retrieved from https://knowledgeworks.org/wpcontent/uploads/2018/01/redefining-readiness.pdf.

Pritchard, M. E., & Wilson, G. S. (2003). Using emotional and social factors to predict student success. *Journal of college student development*, *44*(1), 18-28.

Rasoal, C., Danielsson, H., & Jungert, T. (2012). Empathy among students in engineering programmes. *European journal of engineering education*, *37*(5), 427-435.

Roemer, L., Williston, S. K., & Rollins, L. G. (2015). Mindfulness and emotion regulation. *Current Opinion in Psychology*, *3*, 52-57.

Safran, J. D., & Segal, Z. V. (1990). Interpersonal Process in Cognitive Therapy. New York: Basic Boks.

Saldaña, J. (2015). *The coding manual for qualitative researchers*. Sage.

Sauer, S., & Baer, R. A. (2010). Mindfulness and decentering as mechanisms of change in mindfulness-and acceptance-based interventions. *Assessing mindfulness and acceptance processes in clients: Illuminating the theory and practice of change*, 25-50.

Savage, R. N., Chen, K. C., & Vanasupa, L. (2007). Integrating project-based learning throughout the undergraduate engineering curriculum. *Journal of STEM Education: Innovations and Research*, *8*(3/4), 15.

Sayers, W. M., Creswell, J. D., & Taren, A. (2015). The emerging neurobiology of mindfulness and emotion processing. In *Handbook of mindfulness and self-regulation* (pp. 9-22). Springer, New York, NY.

Schneider, L. (2007). Perceived stress among engineering students. In *St, Lawrence Section Conference, Toronto, Canada*.

Schunk, D. H., & Zimmerman, B. J. (Eds.). (1998). *Self-regulated learning: From teaching to self-reflective practice*. Guilford Press.

Schutte, N. S., Malouff, J. M., Bobik, C., Coston, T. D., Greeson, C., Jedlicka, C., & Wendorf, G. (2001). Emotional intelligence and interpersonal relations. *The Journal of social psychology*, *141*(4), 523-536.

Schwabe, L., & Wolf, O. T. (2009). Stress prompts habit behavior in humans. *Journal of Neuroscience*, *29*(22), 7191-7198

Shapiro, S. L., Carlson, L. E., Austin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of clinical psychology*, *62*(3), 373-386.

Shapiro, S. L., Schwartz, G. E., & Bonner, G. (1998). Effects of mindfulness-based stress reduction on medical and premedical students. *Journal of behavioral medicine*, *21*(6), 581-599.

Sibinga, E. M., Webb, L., Ghazarian, S. R., & Ellen, J. M. (2016). School-based mindfulness instruction: an RCT. *Pediatrics*, *137*(1), e20152532.

Smith, K. A., Sheppard, S. D., Johnson, D. W., & Johnson, R. T. (2005). Pedagogies of engagement: Classroom-based practices. *Journal of engineering education*, *94*(1), 87-101.

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. International journal of behavioral medicine, 15(3), 194-200.

Song, Y., & Lindquist, R. (2015). Effects of mindfulness-based stress reduction on depression, anxiety, stress and mindfulness in Korean nursing students. *Nurse education today*, *35*(1), 86-90.

Snyder, K. E., Barr, S. M., Honken, N. B., Pittard, C. M., & Ralston, P. A. (2018). Navigating the First Semester: An Exploration of Short-Term Changes in Motivational Beliefs Among Engineering Undergraduates. *Journal of Engineering Education*, *107*(1), 11-29.

Storrie, K., Ahern, K., & Tuckett, A. (2010). A systematic review: students with mental health problems—a growing problem. *International journal of nursing practice*, *16*(1), 1-6.

Struthers, C. W., Perry, R. P., & Menec, V. H. (2000). An examination of the relationship among academic stress, coping, motivation, and performance in college. *Research in higher education*, *41*(5), 581-592.

Stump, G. S., Husman, J., & Corby, M. (2014). Engineering students' intelligence beliefs and learning. *Journal of Engineering Education*, *103*(3), 369-387.

Tang, Y. Y., Hölzel, B. K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Reviews Neuroscience*, *16*(4), 213.

Tashakkori, A., & Creswell, J. W. (2007). The new era of mixed methods.

Teasdale, J. D., & Chaskalson, M. (2011). How does mindfulness transform suffering? I: the nature and origins of dukkha. *Contemporary Buddhism*, *12*(01), 89-102.

Teasdale, J. D., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *Journal of consulting and clinical psychology*, *68*(4), 615.

Trapnell, P. D., & Campbell, J. D. (1999). Private self-consciousness and the five-factor model of personality: distinguishing rumination from reflection. *Journal of personality and social psychology*, *76*(2), 284.

Treanor, M. (2011). The potential impact of mindfulness on exposure and extinction learning in anxiety disorders. *Clinical psychology review*, *31*(4), 617-625.

Turns, J. A., Sattler, B., Yasuhara, K., Borgford-Parnell, J., & Atman, C. J. (2014, June). Integrating reflection into engineering education. In *Proceedings of the ASEE Annual Conference and Exposition. ACM* (Vol. 35, p. 64).

Vallero, D. A., & Vesilind, P. A. (2006). Preventing disputes with empathy. *Journal of Professional Issues in Engineering Education and Practice*, *132*(3), 272-278.

Wachs, K., & Cordova, J. V. (2007). Mindful relating: Exploring mindfulness and emotion repertoires in intimate relationships. *Journal of Marital and Family therapy*, *33*(4), 464-481.

Walach, H., Buchheld, N., Buttenmüller, V., Kleinknecht, N., & Schmidt, S. (2006). Measuring mindfulness—the Freiburg mindfulness inventory (FMI). *Personality and individual differences*, *40*(8), 1543-1555.

Walsh, R., & Shapiro, S. L. (2006). The meeting of meditative disciplines and Western psychology: a mutually enriching dialogue. *American psychologist*, *61*(3), 227.

Walther, J., Kellam, N., Sochacka, N., & Radcliffe, D. (2011). Engineering competence? An interpretive investigation of engineering students' professional formation. *Journal of Engineering Education*, *100*(4), 703-740.

Walther, J., Miller, S. E., & Sochacka, N. W. (2017). A model of empathy in engineering as a core skill, practice orientation, and professional way of being. *Journal of Engineering Education*, *106*(1), 123-148.

West, C. P., Dyrbye, L. N., Rabatin, J. T., Call, T. G., Davidson, J. H., Multari, A., ... & Shanafelt, T. D. (2014). Intervention to promote physician well-being, job satisfaction, and professionalism: a randomized clinical trial. *JAMA internal medicine*, *174*(4), 527-533.

Wheeler, M. S., Arnkoff, D. B., & Glass, C. R. (2017). The neuroscience of mindfulness: How mindfulness alters the brain and facilitates emotion regulation. *Mindfulness*, *8*(6), 1471-1487.

Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical Gerontology*, *21*(2), 152-169.

Windle, G., Bennett, K. M., & Noyes, J. (2011). A methodological review of resilience measurement scales. *Health and quality of life outcomes*, *9*(1), 8.

Wolever, R. Q., Bobinet, K. J., McCabe, K., Mackenzie, E. R., Fekete, E., Kusnick, C. A., & Baime, M. (2012). Effective and viable mind-body stress reduction in the workplace: a randomized controlled trial. *Journal of occupational health psychology*, *17*(2), 246.

Xiao, H., Carney, D. M., Youn, S. J., Janis, R. A., Castonguay, L. G., Hayes, J. A., & Locke, B. D. (2017). Are we in crisis? National mental health and treatment trends in college counseling centers. *Psychological services*, *14*(4), 407.

Yadav, A., Subedi, D., Lundeberg, M. A., & Bunting, C. F. (2011). Problem-based Learning: Influence on Students' Learning in an Electrical Engineering Course. *Journal of Engineering Education*, *100*(2), 253-280.

Zimmerman, B. J. (1995). Self-regulation involves more than metacognition: A social cognitive perspective. *Educational psychologist*, *30*(4), 217-221.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In *Handbook of self-regulation* (pp. 13-39). Academic Press.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into practice*, *41*(2), 64-70.

Zoltowski, C. B., Oakes, W. C., & Cardella, M. E. (2012). Students' ways of experiencing human-centered design. *Journal of Engineering Education*, *101*(1), 28-59.

APPENDIX A

COGNITIVE AND AFFECTIVE MINDFULNESS SCALE-REVISED

Please respond to each item by marking <u>one box per row</u>		Rarely/Not at All	Sometimes	Often	Almost Always
CAMS-R1	It is easy for me to concentrate on what I am doing.	☐ 1	☐ 2	☐ 3	☐ 4
CAMS-R3	I can tolerate emotional pain.	☐ 1	☐ 2	☐ 3	☐ 4
CAMS-R4	I can accept things I cannot change.	☐ 1	☐ 2	☐ 3	☐ 4
CAMS-R5	I can usually describe how I feel at the moment in considerable detail.	☐ 1	☐ 2	☐ 3	☐ 4
CAMS-R6	I am easily distracted. (R)	☐ 4	☐ 3	☐ 2	☐ 1
CAMS-R8	It's easy for me to keep track of my thoughts and feelings.	☐ 1	☐ 2	☐ 3	☐ 4
CAMS-R9	I try to notice my thoughts without judging them.	☐ 1	☐ 2	☐ 3	☐ 4
CAMS-R10	I am able to accept the thoughts and feelings I have.	☐ 1	☐ 2	☐ 3	☐ 4
CAMS-R11	I am able to focus on the present moment.	☐ 1	☐ 2	☐ 3	☐ 4
CAMS-R12	I am able to pay close attention to one thing for a long period of time.	☐ 1	☐ 2	☐ 3	☐ 4

Scoring: Note that 6 is reversed scored. Sum of all values reflect greater mindful qualities.

Your total score: _____

APPENDIX B

THE BRIEF RESILIENCE SCALE

Please respond to each item by marking <u>one box per row</u>		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
BRS 1	I tend to bounce back quickly after hard times	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
BRS 2	I have a hard time making it through stressful events.	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
BRS 3	It does not take me long to recover from a stressful event.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
BRS 4	It is hard for me to snap back when something bad happens.	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
BRS 5	I usually come through difficult times with little trouble.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
BRS 6	I tend to take a long time to get over set-backs in my life.	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1

Scoring: Add the responses varying from 1-5 for all six items giving a range from 6-30. Divide the total sum by the total number of questions answered.

My score: _____ item average / 6

APPENDIX C

EMPATHY QUOTIENT

Item	Description
E1	I can tune into how someone else feels
E2	Other people tell me I am good at understanding what they are feeling
E3	I am good at predicting how someone will feel
E4	I find it easy to put myself in somebody else's shoes
E5	In a conversation, I tend to focus on my own thoughts rather than on what my listener might be thinking (R)
E6	It is hard for me to see why some things upset people so much (R)
E7	I am quick to spot when someone in a group is feeling awkward or uncomfortable
E8	I can sense if I am intruding, even if the other person doesn't tell me

APPENDIX D

GENERIC SKILLS PERCEPTION QUESTIONNAIRE

Please assess your current level of competency for each skill on a 5-point Likert Scale ranging
from 1 (very poor) to 5 (very good)

Generic Skill item				
Interpersonal Skills				
Be flexible	1	2	3	4
Be open-minded	1	2	3	4
Offer support and ideas to others	1	2	3	4
Negotiate to reach a decision	1	2	3	4
Work together to reach a decision	1	2	3	4
Listen to others' opinions	1	2	3	4
Handle conflicts	1	2	3	4
Persuade others	1	2	3	4
Build and maintain working relationships	1	2	3	4
Leadership Skills				
Motivate and supervise others	1	2	3	4
Coordinate and plan tasks	1	2	3	4
Build team cohesion	1	2	3	4
Critical Thinking				
Generate new ideas	1	2	3	4
Think critically	1	2	3	4
Think and act independently	1	2	3	4
Self-Management Skills				
Organize things effectively	1	2	3	4
Self-reflection	1	2	3	4
Manage time and meet deadlines	1	2	3	4
Be punctual to classes or meetings	1	2	3	4

APPENDIX E

SURVEY OPENED-ENDED QUESTIONS

Post-Survey Open-Ended Questions

1. What were your overall impressions of the program? What did you like about the program? What didn't you like?
2. Did you practice mindfulness on your own either formally (e.g. meditation) and/or informally (e.g. take a deep breath, mindful moment)? Please be as specific as possible on what you tried!
3. What effects, if any, have you noticed since the beginning of the mindfulness program?
4. Overall, what are some of the major things you will take away from your participation in the program (e.g. insights, new habits, etc.)?

Longitudinal-Survey Open-Ended Questions

1. The collection of items above describes resilience. How would you describe your level of resilience now in comparison to before the Inner Engineering Program?
2. The collection of items above describes mindfulness. How would you describe your level of mindfulness now in comparison to before the Inner Engineering Program?
3. The collection of items above describes empathy. How would you describe your level of empathy now in comparison to before the Inner Engineering Program?
4. The collection of items above describes interpersonal, teamwork, leadership, critical-thinking, and self-management skills. How would you describe your skill level in these areas now in comparison to before the Inner Engineering Program?

APPENDIX F

INTERVIEW PROTOCOLS

POST-PROGRAM INTERVIEW PROTOCOL

1. What were your overall impressions of the program?
    a. What did you like about the program?
    b. What didn't you like?
2. Did you practice mindfulness on your own both formally and informally?
    a. If yes, what did you do and to what extend did you practice?
3. Overall, what are some of the major things you will take away from your participation in the mindfulness program?
    a. Can you tell me about any insights you experienced during the mindfulness program?
4. What effects, if any, have you noticed since the beginning of the mindfulness program?
    a. How has this effect you have experienced supported you (if at all)? How about in school?
    b. Have you noticed any changes in your interactions with others? How about in an academic setting (e.g. group projects)?
    c. A core focus of this program was mindfulness. Do you feel like this changed? If so, how do you think practicing mindfulness has supported you?
    d. A core focus of this program was empathy. Do you feel like this changed? If so, how do you think practicing empathy has supported you?
    e. Has the mindfulness program influenced your engineering education experience in any way? If so, please elaborate how and in what contexts

DELAYED INTERVIEW PROTOCOL

1. What were your overall impressions of the program?
    a. What did you like about the program?
    b. What didn't you like?
2. Have you maintained any sort of mindfulness practice since the program ended?
    a. If yes, what did you do and to what extend did you practice?
3. Overall, what are some of the major things you will take away from your participation in the mindfulness program?
    a. Can you tell me about any insights you experienced during the mindfulness program?
4. What effects, if any, have you noticed since the beginning of the mindfulness program?
    a. How has this effect you have experienced supported you (if at all)? How about in school?
    b. Have you noticed any changes in your interactions with others? How about in an academic setting (e.g. group projects)?
    c. A core focus of this program was mindfulness. Do you feel like this changed? If so, how do you think practicing mindfulness has supported you?
    d. A core focus of this program was empathy. Do you feel like this changed? If so, how do you think practicing empathy has supported you?
    e. Has the mindfulness program influenced your engineering education experience in any way? If so, please elaborate how and in what contexts

APPENDIX G

ASU ENGINEERING MAJOR ANXIETY AND DEPRESSION RESULTS

Based on the ASU results of the National College Health Assessment[1], Spring 2017 (N=2096)

	Other Undergrads (%) N=1284	Engineering Undergrads (%) N=352	Sig.	Other Grads (%) N=298	Engineering Grads (%) N=110	Sig.	Other majors (all) (%) N=1581	Engineering majors (all) (%) N=462	Sig.
During the past 2 weeks, experienced this at least one time:									
Felt overwhelming anxiety	64.1	51.8	.000	58.4	52.7	.229	63.0	52.2	.000
Felt so depressed it was difficult to function	43.2	36.7	.000	34.4	45.0	.041	41.6	38.7	.000
During the past 12 months, was diagnosed and/or treated for:									
Anxiety	23.4	12.2	.000	20.7	6.3	.001	22.9	10.8	.000
Depression	19.3	11.7	.001	15.8	6.3	.012	18.6	10.4	.000
Panic Attacks	12.1	5.4	.000	8.0	0.9	.007	11.4	4.3	.000
Reported the following as serious [2]impediments to their academic performance in the past 12 months:									
Anxiety	12.8	12.0	.029	8.8	9.3	.004	12.1	11.6	.001
Depression	11.4	11.1	.059	6.1	8.3	.607	10.4	10.4	.001
Stress	14.3	15.6	.003	8.4	11.8	.000	13.2	14.5	.000

Significance = Sig. Value is based on Pearson Chi-Square Asymptotic Significance (2 sided).

[1] ASU administers the NCHA to a random sample of all ASU students (undergraduates and graduates) every spring. Students are asked to identify the college their major is in as a supplemental question within the ASU administration of the NCHA.

[2] Serious impediments to academic performance include: got a lower grade in a class, dropped or took an incomplete in a class, experienced a significant disruption in their graduate degrees process (thesis, dissertation, practicum).

APPENDIX H

INTERVIEW TRANSCRIPTS

POST-PROGRAM INTERVIEW TRANSCRIPTS

ARTHUR INTERVIEW 1 TRANSCRIPT

Mark: What were your overall impressions of the program?

Arthur: Overall, I liked it. I thought that it gave valuable tools I could use especially meditation, being mindful, planning, and motivation. Negatives I would say it would just seem like the days weren't quite related. There was almost a need to transition between days and relating them together. Even then without any connection, it was still great. You can use all the things you learned. I particularly enjoyed learning about growth mindset. I think that's a valuable thing to understand.

Mark: What are some of the main things you will take away from participating in this program?

Arthur: I will definitely try to be more mindful. I am already pretty mindful about everything but now I have the understanding of what it does so I can make more of a conscious effort to do it instead of just unconsciously doing it before. I will be now doing it more to a greater extent and have more benefits. The meditation I will probably use to a lesser extent since it takes more of a time commitment. Mindfulness you can just do whenever. I will be doing meditation just not every day. Whenever I have some time. I won't schedule time for it.

Mark: Could you elaborate more on what you initially said about now that you know it works, you intend to practice it more informally?

Arthur: With a better understanding of the benefits I can apply it in more situations. For example, maybe there's activities I notice where I am not mindful, I can then be like

“hey, why don’t I try practicing mindfulness here?” and see if I get more benefit from that.

Mark: Have you noticed any effects from practicing more mindfulness.

Arthur: Everything seems a lot slower. The days don’t really blend together anymore. I used to have no clue on what day events happened. They just happened sometime in the past. Now it’s like every day happens slower and I know that this happened of that day and this happened on this day. So instead of it being so quick where everything blends in together, it’s slow and I can find the breaks between the days. I have definitely been more present and in the moment than I used to be.

Mark: Have you noticed any other changes?

Arthur: Less worrying about the future and less anxiety. Now I can have these loose goals about the future and figure it out when I need to. I don’t need to figure it out 2 years in advance because I already have the goal. I don’t really have all of the information right now to figure out how I am going to do something so why worry about it now when I can’t do anything about it.

Mark: Could you tell me a little bit more about how you intend to practice mindfulness moving forward and what you have tried to practice during the program?

Arthur: During the program I did do meditation 3 times a week for about 5-10 minutes a day. Not every day but that is still better than my previous average of zero. I did the deep breathing for all of them. I definitely made a conscious effort to take what I learned, the insight I had gotten from class that week, and applied them that week to see the changes

that were made. I am methodical in how I do things. So, the first week I took this specific thing and applied that for a week. The next week, I would hold off on what I previously did, and see what the second week does on their own. I didn't combine anything because I wanted to see how the individual insights would help me and then I could combine them later, which is what I am going to do moving forward. Every week I am going to combine different elements.

Mark: Have you noticed any changes in your interactions with others?

Arthur: I would always try to understand what the other person is saying. I have never been one to talk over other people and interrupt them. I will try to make an effort to try to understand and empathize with the other person. I now do have a better understanding of the importance of doing this though so I will try to continue doing this and even do this to a further extent moving forward. I can't really think of how exactly, but I will try and do it more.

Mark: How do you think mindfulness/empathy can support you moving forward in the context of your engineering education?

Arthur: I work on a lot of projects in my free time and I would just do something. I wouldn't know how I started, how I got from point A to point B. With mindfulness I will be able to pay more attention to what I am doing and the process I am going through so I can improve it. I can be mindful of tasks that were previously unconscious. To be conscious of unconscious thinking. I often make things and have no documentation of what I did. I should document everything so others have an understanding of what I am doing and can learn from it.

Mark: Do you intend to maintain a mindfulness practice moving forward?

Arthur: I definitely plan on doing it more in the future. My goal is to make it into an unconscious habit so I can do it automatically. That way I can apply it to every aspect of my life.

Mark: Anything else I might have missed?

Arthur: I want to use the skills that I learned in the future. I want to…I have the desire to…I need to do it and I really want to, which is a big reason why I wanted to do the program. I definitely want to use what I learned.

RODRIGO INTERVIEW TRANSCRIPT

Question: What is your overall impression of the program? Are there things you liked or didn't like?

Rodrigo: I liked the program a lot. It was really helpful, which is probably the most important and interesting thing. It was in a field I never saw myself even looking at and now I am out of nowhere looking at it. And now I am even more interested even after the workshops. Thinking about mindfulness and learning more about it. In the past I would have payed attention to it. Like you said, mindfulness has been getting bigger late. I also came from a country where they don't take this learning into account: meditating, self-realization, and awareness wasn't a field I was exposed to before. Now I realize a lot of stress and anxiety has decreased since the start of this workshop. The more I mediate, the more stress-free my day is.

Question: What are some of the main things you will take away from this experience?

Rodrigo: To stop thinking about yourself when you listen to people and more so put yourself into their shoes so that you can respond or rely better. Also, be aware that mindfulness and meditation does work, and it can work from everyone. And in the long run, if you practice meditation you will have less psychological issues. You also learn about what type of person you are – whether you are intrinsically or extrinsically motivated.

Question: Where there any a-ha moments, insights or realizations you had during the program?

Rodrigo: Yes – I feel like you get to know yourself way better as you are practicing and learning about mindful theories. You get to know yourself more therefore you can any avoid issues you have with yourself. For example, I tend to overthink a lot and maybe when you listen to other people and their stories and help them daily, you will be more useful.

Question: How did you practice meditation on a daily basis on average?

Rodrigo: I would meditate for 2 to 5 minutes in the morning. At the end of the night I would have a longer belly breathing meditation for 10 minutes. I would also do the gratitude exercise you told us about – the one where you think about the good things you have and not the negative things. I've done this before as well. The more you do it, you start picking out the more positive things that happen during your day unconsciously. Your negative thoughts start to drain out of your mind. You have a better day in general. You start caring less about negative thoughts. Meditating also helps you clear your mind and refocus on what you have to do. For example, if I am doing homework and I become stressed about something, I meditate, I forget about it, and continue you with my work.

Question: Do you think you are able to bounce back from stress more effectively?

Rodrigo: Yes, I feel like my tolerance is slowly getting better towards stress. And I am just taking into account that stress is normal. It would be unusual if you don't get stressed from a hard task. So now thanks to these skills and the knowledge that I have, I now know how to deal with it better and the more I practice, the less stressed I get.

Question: In general, do you think the program as affected the way you think?

Rodrigo: Yes, I feel like I have more empathy for people. Feeling what they are feeling more. And then you realize what they are going through as well, and you started seeing everything from a different perspective. For example, before the program, I would judge people a lot but now after this program, I try to see things from their perspective more. Through this program, I learned everyone is right in their own way. You just have to interpret it.

Question: How do you think some of the things you learned in the program will transfer to academic contexts or in your future work as an engineer?

Rodrigo: In my schoolwork most definitely. If someone is going through a stressful situation and we have a group project. I can definitely try to communicate with this person and help them deal with it. We can both deal with it. It can lead to better communication with the group and better outcomes. Helping other people out, listening to them, and maybe give them ideas about meditating also.

Question: Has this program affected your ability to handle challenging situations?

Rodrigo: This program has helped me understand with meditating; you learn how to handle things better. It's not just a theory, it works.

The energizing meditation can really energize your mind. It helps when you are tired and helps you focus.

This program helped me reach out to people because it's not good to keep your thoughts and feelings to yourself. Knowing there are people out there that will listen to you. Knowing that it isn't just you are helping people.

Question: Do you think these practices would be helpful for more engineering students?

I think the program would really help us because we are going to be doing a lot of group work. Talking to each other, understanding each other's perspectives comes into that whole equation of making a good prototype or whatever we are working on. These exercises would also be good for engineering students because engineering is one of the hardest degrees you can get. So obviously students will go through a lot of stress which is where this program can come in handy.

Question: Do you plan to maintain a mindfulness practice?

Rodrigo: Definitely, it's something that you want to create a habit of. I will definitely keep practicing.

Question: Any final thoughts?

Rodrigo: I think after this program; I am more willing to learn about mindfulness. I would definitely recommend it to people who are interested.

SHANNON INTERVIEW TRANSCRIPT

Mark: What were your overall impressions of the program?

Shannon: I thought it was super helpful for me in terms of focus. The meditations really helped me realize what I needed to do to get my mind to focus. I can't really think of anything I didn't like.

Mark: What were your main takeaways?

Shannon: The empathy part of the program was super helpful. The next day in class we were actually talking about that. That stuck with me. The meditations were super helpful. I started incorporating those in my daily routine.

Mark: Were there any insights you took away from the program?

Shannon: There's a lot of stuff I took away I just don't know how to express it.

Mark: How often did you practice mindfulness from both formal and informal perspectives?

Shannon: Pretty frequently…, I would say daily. I tried doing body scan meditations. Mindfulness while walking or eating. I definitely worked on mindful listening.

Mark: What effects did you notice from practicing mindfulness?

Shannon: I was getting work done more effectively. I was listening to others more effectively. I felt more in control. I used to be the kind of person that would do homework and let it dictate the rest of my day. I just had issues getting stuff done. It

allowed me to focus better and have control over the homework instead of the work controlling me. I felt more productive while working.

Mark: How has the workshop influenced your interactions with other people?

Shannon: We are doing a group project in my engineering class right now and it's allowed me to listen to the team better instead of taking control, which is what I used to do. It's made it easier because I am not trying to do everything myself.

Mark: Do you feel like you can handle challenging situations better?

Shannon: I have definitely been less stressed and significantly less anxious.

Mark: Do you think mindfulness and empathy can support you moving forward in your engineering education?

Shannon: I'm going to make the assumption since I am in the first semester of my freshmen year and it's already a lot of work that there will be even more work from here on out. So, it will allow me to handle that better and to allow myself to keep my cool when things get stressful. Group projects are very important in engineering so being able to work better on those is very important.

Mark: Do you intend to maintain a mindfulness practice?

Shannon: Yes, I plan to make it a daily routine. I practice formally 5 minutes right now and try to be mindful throughout the day.

Mark: What did you learn from the program?

Shannon: The importance of empathy in engineering. I've always considered myself an empathetic person socially but never really realized how important

YSMAEL INTERVIEW TRANSCRIPT

Question: What was your overall impression of the program?

Ysmael: Overall, I really enjoyed the experience. It's something I really needed to learn. I feel like I've always known how to "meditate", but there is a difference between meditating and practicing mindfulness throughout the day. That's something I really liked – pairing meditation and mindfulness. I don't know if there's anything I disliked. I felt like everything I took away was really good information and will help me along the way.

Question: What are some of the main things you will take away moving forward?

Ysmael: Just being really mindfulness and in the moment. Just knowing where I am at. What I am doing. Thinking about what's going on right now without stressing about what's going on later. I feel like this time has been really stressful for me because I just started college. I didn't really know the gist of work and all the other things that go along with it like schedule but after the mindfulness class it's easier for me to take things in, make a game plan without being too stressed and clearer in my mind.

Whenever I am doing things or going out, I am more into it. I am not really worrying about my homework tomorrow or the phone call I need to make the next morning. I'm just really taking my time and whenever the time comes to do those things, I am already on it. There's no procrastinating, which is something I really did struggle with in the past, but now I am really getting on it now. I don't really know how to explain it.

Question: How have you practiced mindfulness from both formal and informal perspectives?

Ysmael: I do find myself taking a lot of deeper breaths. Focusing on my breathing a lot more. It's a lot easier to destress myself when I focus on my breathing. I feel like that's a really good thing I learned from the mindfulness class. I used to be really stressed and overwhelmed by little things and now it's just a little easier for me to get over it and just get it done. I do have the urge to meditate a lot more. I remember after each class there were things you would say that would play in my head and I just wanted to practice that for the week or the next few days. That was really helpful as well. It really just made me a better meditator especially all the ways to meditate and learning about the different mindsets of how to approach the meditations. I definitely meditate at least 20 minutes in the morning and at night I listen to binaural beats to fall asleep. It became an everyday thing.

Question: Have you noticed any changes within yourself?

Ysmael: I feel more observant. I'm noticing more stuff and that's just more information to me. Whenever I walk into my room, I know where everything is at even if I haven't cleaned recently. If I glance at something, I have this memory of where something is. I used to lose stuff like every day. Now if I lose something, it's usually quicker for me to find it because I can go back to my thoughts and play out in my head what I've done. It's just easier for me to recall my thoughts. It's pretty crazy – sometimes I can even picture it in my head.

I feel like my conversations with others are more elaborate. I am getting more out of it. It's not just a random quick talk even if it is. It just feels different in myself now so that's a little bit better. I've also noticed that ever since I have seen a change in myself, I have

been trying to put people on to meditating and trying different ways of staying peaceful and calm in the inside, and I hadn't been that open before, so it's definitely made me more confident in this sort of practice. On campus, I'll see people and it'll be like "hey, how's your day going?", "good", "how's your day going", "good". And it used to be like that and now I am taking a little bit more time. Not really asking because I've seen you. I am asking because I genuinely care. Usually if I saw you, it'd be like "oh how are you doing?" and it's normal for me to ask that because I see you but now I am actually taking the time and have the willingness to have a conversation even if I have somewhere to be because I'm not really in a rush anymore.

Before I moved out, I didn't realize how much I relied on my parents to do things like clean my room, eat, ask me if I am feeling okay, and what not. So, when I moved out it was kind of a shock. I'd be super hungry, and I don't know how I let myself get to this point. Right now, I need a haircut. Usually my mom would be telling me something about that. I've been now more taking care of myself – wanting to go see the doctor and dentist and wanting to take care of my body more than I used. I don't know if this is happened because I moved out and I realizing I need to, or I have just become more mindful of my inner self. I also talk to my mom a lot more and feel like I've gotten to know her so much than I ever did living with her my entire life prior.

Question: Have you experienced any changes in how you interact with others?

Ysmael: The empathy part definitely changed the way I look at the way I say things to people or the way I act around people. I'm taking more of how they are into consideration. How their personality might react to something. In my sustainability class,

we've been done a lot more group projects and I have been taking the leadership role a lot. It's been a lot easier assigning roles. Knowing what people are used to, their strengths and weaknesses. I actually feel in touch with it. I can understand where everyone is coming from. It's way easier to communicate.

Question: Do you feel like the program has affected your ability to handle challenging situations?

Ysmael: Meditation and mindfulness are really training our brains to act the way we'd like it to instead of reacting to what's around us. I used to have really weird heart skips when I think about certain subjects but now, I can think about whatever I want and not experience any discomfort.

Question: Do you think these practices can help you moving forward as an engineering student and in your professional life?

Ysmael: Definitely. I feel like empathy can help me understand introverted people and how to approach them and integrate them into the team in a way they are comfortable with but still forcing them to get a little out of their comfort zone. It's part of leadership – getting people to better themselves for the betterment of the team. It's a really good leadership trait that I didn't really know much about. Everything comes to come together perfectly – to know the dynamics of the team.

Question: Do you intend to maintain a mindfulness practice moving forward?

Ysmael: Definitely – I want to have a spiritually rich life and travel to learn more about different cultures and societies. How different people see their mindfulness or oneness

with themselves. This is a really good step in that direction. Even though I'm in an engineering field, I can still maintain mindfulness and spirituality in my life even though that isn't necessarily the popular thing among engineering students.

CHARLES INTERVIEW TRANSCRIPT

Question: What were your overall impressions of the program?

Charles: I like that it wasn't the typical program. I've done a couple of these before. Where they are like make sure you do what you need to do to stay ahead of the task – don't procrastinate. Typical things you even get in class. I like that you first interacted with the people. You talked about self-regulation, which is a huge part of procrastination. That's the bigger picture of that. If you can manage your stress and self-regulate yourself, you won't procrastinate. That's the bigger, better topic to discuss then just don't procrastinate, do your work ahead of time, and create study groups.

You get that thrown at you so many times even starting in junior high. This is the first time that I was told about self-regulation. My English teacher in high school once did a guided meditation but it wasn't like we encourage you to meditate and take some time to look inside yourself and settle. That was unique.

Question: What are your main takeaways?

Charles: I think the biggest thing is take time to yourself to settle your internal stress. College is stressful at times – not all the time – but if you can take time to settle down and work things out with yourself, that's a good skill.

Question: How did you practice mindfulness?

Charles: I've always been good at self-regulating myself. I can cope with stress. In high school I used to stress myself out a lot to the point where I know have a decent way of dealing with this. As long as I can remember to take 1 or 2 minutes to scan and feel my

body and settle any internal turmoil - that works. Even if I have to step outside, it's a really good feeling to sit by myself sometimes and think things out.

Question: Have you noticed any changes in yourself of effects?

Charles: A little bit. It makes it easier to cope with things. Mainly my roommate right now because sometimes they can be a little extra.

Question: Have you noticed any changes in your interactions with others?

Charles: They say don't room with your friends. I roomed with 3 other friends and for 2 of them it was a great idea. The other one, who is my actual roommate, he seemed like a good enough guy and a clean person. To a certain extent he is but we never really spent enough time with him to get a feel for his personality. It just kind of seemed like he wasn't the type to mix with our personalities. He always had a different outlook. He was raised a little too closely with his parents. We could tell. So, we dealt with that in a wrong way at first. We would pull pranks on him and just mess with his stuff really. Not in a way that would damage it, but just move it around in a way where he would be like "what happened". So as of late we just realized we should try to help him change. Now that we've had time to think about it, we decided we should stop messing with him and help him change his ways a little bit. It's something I have gotten better at. We realized we shouldn't be jerks like that.

Question: Has the program affected your ability to handle challenge situations more effectively?

Charles: The high school thing got me acclimated to stress so maybe a small improvement but nothing major.

Question: Do you think mindfulness and empathy practices can support you as an engineering student and in your professional life?

Charles: I can reflect to this well right now because last night I went to the career fair. They talked about networking a lot in engineering. He gave two examples. How he got two of his jobs through networking. One of them he really shouldn't have gotten. His old buddy popped up and they were talking about his eye doctor who was looking for a software engineer. He was a software engineer. He didn't want the job, but he is going to connect him with friends that may want the job. Anyway, I realized how important networking is.

Don't' really think about it word for word but take away the main meaning. In social situations, if you are more deconstructing as opposed to actually listening, then you may forget what they are saying, and you can't always ask them to repeat themselves. So being a mindful listener and listening to what they have said and repeating it back instead of deconstructing it is something I need to practice more. Transitioning from the deconstructing mindset to trying to understand what they are saying and feeling.

Question: Do you intend to maintain a mindfulness practice?

Charles: Yes – every time I go to bed, I'll just kind of sit there and relax. Mainly it makes me aware of my heartbeat, which I think is kind of cool. It's always nice to unwind before sleeping. I don't know if it causes better dreams or rest, but it's definitely more

relaxing. Especially processing what's happened during the day. I don't always take little breaks during the day, but I can always relax before going to bed.

TANYA INTERVIEW TRANSCRIPT

Mark: What were your overall impressions of the program?

Tanya: When I first signed up for it, I didn't expect it to be more focused on self-awareness. I just figured it would be getting to know your group or teamwork skills. That's what you normally hear about. I thought it was really good that it was focused on self-awareness. You have to start with yourself before you can lead or work with others. I thought that was nice about the program.

Mark: Are there any things you didn't like about the program?

Tanya: Not really. I really enjoyed it.

Mark: What are your main takeaways?

Tanya: Mainly that most people don't think about the content of the program. Not everything was completely new to me since I had already practiced mindfulness for my anxiety, but I didn't realize most people hadn't been exposed to that. It made me reevaluate people's point of view when interacting with them.

Mark: Were there any rewarding moments?

Tanya: Talking to the people that went was rewarding. I usually don't talk to a lot of people, but I felt like it was a safe environment, and everyone was understanding since we are all going through the same process.

Mark: What about challenging moments?

Tanya: Signing up was a challenge. I don't feel like I'm good at interacting with other people.

Mark: How much did you practice mindfulness?

Tanya: I practiced mindfulness more informally although I think it would help for me to have a structured daily time to do meditation. I mainly did it when I felt stressed out with homework.

Mark: What did you try?

Tanya: I usually did the breathing exercises to regulate my nerves. Sometimes I do a bit of journaling throughout my day but it's not really a habit.

Mark: Have you noticed any effects?

Tanya: I realized it is good to rely on meditation to break things down and not make things seem as big as they seem to be. Like taking a moment to pause and evaluate what is going on and realizing that it doesn't all have to happen at once – like completing all my homework. It makes me feel less overwhelmed.

I feel like I am more confident and self-assured. I have trouble being in the spotlight and I am more of a follower than a leader but now I am trying to put myself out there a little more.

Mark: Have you noticed any changes in how you interact with others?

Tanya: Not really – just realizing that not everyone has been exposed to self-awareness.

Mark: Has the program affected your ability to handle challenging situations?

Tanya: It has helped me in doing my homework. I always get stressed out when doing my homework. I sometimes procrastinate, and it would kind of buildup. The program motivated me to procrastinate less to make things easier.

Mark: Do you think what you learned could support you as an engineering student?

Tanya. Yes, especially when working with groups because you have to be aware of what you are doing and what others are doing. If you take things at more of a relaxed approach it can support communicating with others. Also, as an engineer you are fixing or creating things for other people. Empathy is important to making things that are actually useful to other people.

Mark: Do you intend to maintain a mindfulness practice?

Tanya: Yes, I plan on doing the breathing exercises moving forward. It was a really good program overall and I really enjoyed it.

JOSE INTERVIEW TRANSCRIPT

Question: What was your overall impression of the program?

Jose: The one thing that I was super onboard with was the belly breathing meditation you introduced us to. It's helped me a lot with my anxiety. I wasn't necessarily looking to solve that going into the program, but it did help relieve a lot of the stress I have during the day like homework. Or looking at all the homework I have to do. It just helped a lot with stress and anxiety. I even signed up for yoga class as I saw it as kind of a way to meditate. It opened me up to ways to relieve stress and not feeling anxious all the time.

Overall, it's helped my day. I liked how interactive the program was especially the third workshop where we were doing the talking and listening. It should the more you tried to pay attention, the harder it was to pay attention. It just showed me a lot of ways to approach communication. Even today in my ASU class, we were doing elevator pitches. After the assignment, we were supposed to relay what they said. The activity helped me a lot in listening. Overall, the main thing is stress relief and anxiety. The more you are interested in the topic or what you are talking about, the more motivated and natural/easier it is to listen.

Question: Do you feel like you can bounce back from stress easier now?

Jose: Let's say I get assigned a bunch of assignments. That's what usually would start some stress or feed into my anxiety. I am able to calm myself down in a way and tell myself it's not that bad. It's just assignments – take it step by step. You can only do one thing at a time. I don't know how to explain it. I've had anxiety for a long time. It was hard to explain it in class today. It's hard to explain that it is helping my day overall. I've

had anxiety for a few years now. It's helped me a lot. Things that would usually stress me out don't affect me as much. I now keep a to-do list on my phone with all of the due dates and today what I am going to do. All the emojis of what is mandatory. I'm following a lot of the workshop stuff. All of the little things you taught us throughout the program help a lot with my anxiety and stress.

Question: Do you think the workshop has supported or influenced your ability to interact with others?

Jose: Yea – I still do sometimes stutter on my words. I'm more open and less scared to reach out. The first workshop I didn't talk to anyone at all. We didn't do a whole lot of talking during the workshop but after I didn't talk to anyone. Just took the elevator and didn't say anything. As the workshops went on, I started opening up more to my peers maybe because I was getting to know them more. I was talking more. Even in class I am communicating better with my teammates in EGR 104 and 101 for my projects and papers. We are communicating better. I am being more open. You have to be comfortable when communicating with your group and create a good environment. The more comfortable I am with myself, the easier it is to engage with my group. In a way it gave me more confidence to engage and put myself in situations like that.

Question: Do you think mindfulness and empathy can support you as an engineering student and professional down the road?

Jose: Yes, you opened us up to seeing what other people are doing like their intentions not just what they are actually doing. You don't want to just jump to conclusions. You want to see the situation as a whole.

Question: Do you intend to maintain a mindfulness practice?

Jose: Yes - I've been doing the meditations and haven't stopped that. I even signed up for some local yoga classes.

I would make the first workshop more interactive and have others be more open early on. I just remember we were really quiet.

GREG INTERVIEW TRANSCRIPT

Mark: What were your overall impressions of the program?

Greg: Overall, I had a good impression of the program. I wasn't expecting it to be exactly what it was based on the description on the handout. I didn't know it would go into mindfulness and things like that. It was interesting to get exposure to those certain types of tools that can help develop yourself. It's all about focusing on yourself and your surroundings. I remember at one of the earlier workshops, we discussed how it could be useful. It allows you to focus on both the good and bad about yourself. It's an indicator of what you need to improve on. It was nice to learn that that it exists. In terms of integrating mindfulness, I never really did that outside the program. I only did it within the program sessions themselves. It was still a nice opportunity to slow down so I appreciated that.

Mark: What were your main takeaways?

Greg: The one that came to mind when I took the survey was the Ladder of Inference in your subconscious. It was interesting to have a psychological analysis of how you take in information and eventually coming up with a reaction. So, learning to become more involved in the Ladder of Inference and reacting better especially in difficult situations.

Mark: How much did you practice mindfulness on your own both formally and informally?

Greg: Pretty much just within the context of the program. I do consider ideas as I am walking but I don't know if that is the same as the meditation that was being shared in the program. I assume the goal is to habituate your Ladder of Inference, so you always have a

positive or healthy way of dealing with bad things that happen in your life. I guess one of the things I was wondering was maybe you don't always want your Ladder of Inference to jump to the positive. In certain scenarios you do want to have a certain level of prejudice or work under certain assumptions. I guess I'm sort of thinking about it now as I talk about it.

Mark: Overall the goal is to lean more positive when you can, but I think it's more so being objective in situations and noticing when you have assumptions that prevent you from being objective. Noticing when those assumptions lead to negative consequences when maybe the assumption wasn't correct.

Greg: One of the things I was reminded of in my Hinduism class, which is a part of mindfulness, is to not let your emotions get in the way of assessing a situation.

Mark: What effects have you noticed from your participation in the program?

Greg: Not something I would specifically notice. I do think about these things because they have been presented to me. I guess it would be more of a subliminal effect as of now. Maybe there will be a circumstance where I remember this.

Mark: It was more thought-provoking than anything and gave you something to contemplate?

Greg: Yes

Mark: Have you noticed any changes in your interactions with others?

Greg: I tend to try to think about how other people react to the way I present myself in general. It wasn't anything super new. It was nice to look at it in another way. This is for

engineering and to develop those skills to communicate more effectively with others. That's something I can take away Using empathy to not just make yourself look good but to try to make teamwork more efficient. It's related to conflict-resolution. It can help you detect when a teammate feels like their voice isn't being heard and ask them "well what do you think about this?"

Mark: Do you think mindfulness can support your engineering education?

Greg: I can acknowledge there is a connection. I'm not sure.

Mark: Moving forward do you intend to have a mindfulness practice?

Greg: I don't see that so much in the future as far as meditation. There are other things presented I will try to integrate in my life. I do toss around ideas in my head in general without the whole meditation. Maybe meditation can be useful in dwelling solely on those ideas? Or maybe I am meditating without even knowing it. It's not so much a thing where I would sit down in quiet room and focus on my breathing. I don't see myself doing that. I do pray at night. It's not something I do every night, but I do give thanks but it's also just like praying for certain things to happen.

AMY INTERVIEW TRANSCRIPT

Question: What were your overall impressions of the program?

Amy: I really loved the beginning meditations. Especially all of us strangers gathering together. It was nice to relax. I was really tense the first day. At first it seemed kind of awkward but then we all relaxed. Overall, it helped the flow of the program. A lot of the content was really helpful for me. In general, the presentations were really nice and informative. I really loved the power posing. That's something I really never thought of before, but it opens my views to a lot of things. I can see the difference between people that don't do that versus those that do. I've been trying to do that more myself. I think some of the things that could be improved were maybe having more group activities. In terms of the name leadership, the theme seems to be more so self-improvement, which is different than what a lot of us were expecting. It wasn't a bad difference though. I think as a presenter; you could have more stories and things to talk about. You engaged us really well so in general even though we weren't responsive all the time. Maybe you can coax people or even call on people. Even though it may be uncomfortable it may help people open up a little bit more.

Question: What are your main takeaways?

Amy: Meditation does a lot more than I originally thought. People say that a lot. In yoga, we are taught how to meditate but they don't really talk about the benefits. It's super underrated. I think power posing is something I am still working on. Staying engaged in conversations – I have been more conscious about it. Remembering what people saying – having more presence. It helps me analyze my communication in relationships. Perhaps why I am maintaining certain relationships versus not others.

Question: How much did you practice mindfulness?

Amy: I tried to do at least one formal one every night. Sometimes I forgot because I was too tired. I think every day there was a point in time in the evenings where I would think about what I am doing, the environment, nature, the people. Throughout the program, as I continued to be more aware, I tended to do it more times throughout the day. What are you doing right now? What's going on around me right now? I tried to stop listening to my music with my headphones in and be more present to what's around me.

Question: What effects have you noticed?

Amy: I feel more comfortable going around campus now. Before I was more self-conscious and not wanting to make eye contact. Being too shy. Being aware and looking around made me aware that most people aren't paying attention and there is no reason to be self-conscious. It helps me relate to people better too. Noticing that most people act the way I kind of used to. I can understand everyone is in the same boat as I am. It's like empathy – being able to relate to other people.

Question: Have you noticed any changes in how you interact with others?

Amy: Yes, I think it did. In general, I'm more willing to talk to people than I used to be. It's a little easier for me to reach out. It's something I still need to work. It's especially helped me at my dorm. Sometimes I'm willing to talk to and look at people in the elevator. That's the most significant thing I've noticed.

Question: Have you noticed any changes in how you handle challenging situations?

Amy: Not really. I think I already had good ways of managing things. My parents have given me a lot of tools to deal with that. If I am going through really depressing weirds like “oh my god I did bad on this test”, I try to move on. I didn’t really take away a lot from the program that would help me manage my stress and deal with negativity.

Question: Do you think mindfulness and empathy can support you as an engineering student and professionally?

Amy: Yea for sure. For engineers, that’s one of the biggest aspects of the job – to understand and satisfy people’s request and their situation. I hear about a lot of engineering projects and they bring it to a third world country where they have a problem, but they didn’t make an actual solution for them. A lot of the things they did were never implemented because the people didn’t like what the new thing for whatever reason. There was a probably a lack of communication on this is what we actually want and need. I think mindfulness is more useful on a personal level. Mindfulness is especially useful in today’s society with all of the technology there is a lot of disconnect. Even saying hi to someone you know passing by is more significant than never noticing them because you are distracted by personal things. Mindfulness helps keep people connected.

Question: Do you intend to maintain a mindfulness practice?

Amy: I do although it’s hard to always do it formally. Every day though it’s useful and beneficial at least informally throughout the day.

NATALIE INTERVIEW TRANSCRIPT

Mark: What were your overall impressions of the program?

Natalie: It was focused on meditation and mindfulness. I later came to the conclusion after the sessions which just a lot of self-awareness. Being aware of your environment and what you are doing and giving a second to pause and look at that. I thought that was an interesting way to look at the daily activities we are doing. I think it takes a lot of control and practice to step back and look back at what you are doing in an environment.

Mark: What are your main takeaways from participating in the program?

Natalie: I learned a lot of meditation types are not for me. I think looking into yoga or something with the kinesthetics is something I would lean more towards. I am not someone who typically sits still. And If I do sit still it's not something I feel I am doing as well.

Mark: How did you practice mindfulness on your own formally or informally?

Natalie: I mainly did informally. I did it a couple of times when I was reffing soccer games. As a team we had a habit of looking down at our scorecard and I just stopped for a second. I was trying to be mindful of what was going on and I noticed we were making it dangerous for the players on the field so that experience was insightful. When I try meditating though, I keep falling asleep. I'm not sure why.

Mark: Have you noticed any effects?

Natalie: Not really

Mark: Have you noticed any changes in your interactions with others?

Natalie: Most of it was stuff I was already pretty aware of. With my roommates I had the conversation of empathy and motivation. We had a conversation about list-making. One of them it really works and for the other it really doesn't. If we sit down and accomplish the biggest project on our list, we find that more powerful than doing 5-minute increments at a time. We find that to be overwhelming that you have to complete so many little things before you can sit down and do the big one.

Mark: Were you might procrastinate on the big project but doing all the little tasks?

Natalie: That's how I function.

Mark: Have you noticed any changes in handling stress?

Natalie: Not really

Mark: Do you think practicing mindfulness and empathy may support your engineering education?

Natalie: Well for my specific major I am doing Human Systems Engineering and empathy is a major part of the design process for user experience. That's how it's been beneficial so far.

Mark: Do you intend to maintain some sort of mindfulness practice?

Natalie: Yes - continuing to attempt it. I think I'm going to try journaling mindful moments.

CARLA INTERVIEW TRANSCRIPT

Question: What was your overall experience of the program?

Carla: I really liked that it was a smaller group because it felt more personal and it was easier to feel open in the environment. I liked that we had the guided meditations at the beginning each session. It really helped to stop everything that had been in my mind before the session and just put me in a focused mindset the rest of the day. Not anything I can think of that I didn't like.

Question: What are your main takeaways?

Carla: I definitely felt less stressed once I started doing some of the meditations that we practiced. Overall, I noticed on some of the days I did very little, I had more stress or the next day would be harder to get through. So, I hope to integrate some type of meditation each day – whether its belly breathing or some guided meditation for 30 minutes.

Question: How did you practice mindfulness from formal/informal perspectives?

Carla: I did a lot of the different techniques we practiced. I tried to do those for 30 minutes – sometimes more. Informally, on the weekends I do a lot of driving, so I tried to practice more mindfulness while driving. If I had no one in the car with me, it was easy to focus. I think overall, I did more mindfulness formally than informally. I did meditation almost every day – there were a few days I didn't do it because I was either sleeping for most of the day or I just completely spaced on doing. After a while it just became a habit to do the meditations daily.

Question: What changes did you notice?

Carla: I was more prepared schedule-wise. I had everything better memorized. I was able to remember when I had a meeting or class. What time it was over whereas before I struggled to remember what classes I had each day. I felt more focused in what I was doing each day.

One day I was really stressed, and it was hard to come back from. If it was a small level of stress like I forgot about an assignment that the professor had told us about 3 weeks prior and it was due that day, I was able to easily focus and get the assignment done in an hour or two whereas usually I would freak out and then do the work.

Question: Have you noticed any differences in terms of how you interact with others?

Carla: I feel like I have been listening more to others instead of focusing on making a remark to what they said. Or saying, "me too". It's more focusing on what they mean and supporting them instead of bringing myself into it.

We just finished a group project in an engineering class. At the beginning we were very jumbled. After the first week of working together it became easier to talk to everyone and I was more of a point person for everyone. "Well does this work? Nobody is answering – can you get back to me?" I would relay the messages between everyone, which was really interesting because I usually don't take a leadership role within my groups. There were some points where I was the only one available but other times it felt like I was stepping up to bring all of the ideas together or bring back up points that others left behind. I felt very comfortable with taking the leadership role over time. At first it felt really weird but over time I felt more comfortable with it and felt prepared to take on a leadership role.

Question: Do you feel like the program has supported your ability to handle challenging situations?

Carla: Yes

Question: How do you see mindfulness and empathy practices can continue to support you moving forward in your engineering education and long-term as an engineer

Carla: I feel more open to making friends and making connections. I think I've made 7 new friends since we started, and it seemed to get easier over time. I'm hoping to keep that going and be a little bit more extroverted. The program showed me I can be more open to other people. If it had been a larger group, I'm not sure I would have opened up as much and made remarks about myself personally.

Question: Do you intend to maintain a mindfulness practice?

Carla: Yes – I intend to maintain a mindfulness practice (30 minutes a day)

DELAYED INTERVIEW TRANSCRIPTS

SARAH INTERVIEW TRANSCRIPT

Question: What were your overall impressions of the program?

Sarah: Overall, I really enjoyed it. I thought it was going to be something different at first – perhaps more based on technology. It was more focused on introspective thinking, which is something I don't think is pushed enough in school in general. I thought some of the topics and ideas you brought up were interesting and useful. There aren't many things I disliked – I really enjoyed it. I know that you are looking for constructive feedback. It just stood out to me the theme of looking within yourself – it's usually all about grades grades grades. It's important to obviously know who you are and live productively and healthily.

Question: What are some of your main takeaways?

Sarah: One of the first things that comes to mind is the segment on gratitude. I don't really practice enough gratitude in general and that kind of hit me. That whole part where we meditated on it and thought about people that matter to us and even people that irritate us and whether we should appreciate them or not. I thought that was really important. And the part about motivation really stuck with me because I want to find more of it. Overall meditating and just breathing helps me because I'm just a pretty intense person and sometimes just need to breathe.

I think the dynamic breathing worked well for me because it woke me up. If I did it before a quiz or a class I needed to be awake for, it would help me feel more clear headed but also awake. It was energizing in a way.

Question: How did you practice mindfulness from formal/informal perspectives?

Sarah: It was interesting to meditate with other people in the class also meditating. It wasn't like I had to hide as like meditating in public. If I am just thinking and being calm and not saying anything with other people – it was interesting. Otherwise, I'm a quiet person anyway so I like thinking a lot. I see myself as someone always thinking about ways to improve myself. I think I may do that in a more productive and positive way now. I can think a little bit more about how these thoughts make me feel.

Question: Have you noticed any effects or changes as a result of the program?

Sarah: I felt great after each session. I would get back to my room and just felt like I had something that my friends hadn't gotten. I wanted my friends to do it. It was just really inspiring. I know it sounds cheesy but I'm just being honest. I feel like I took away a lot of little things – just being positive overall. It is what it is, but you can see it in a positive way. If you understand your own feelings, it'll make sense instead of just floating on by. Especially at this age, to have a direction. It feels like good timing.

Question: Have you noticed any changes in how you interact with others?

Sarah: Yes – I think so. I have been better at trying to understand that everyone has their own perspective, but you can't judge people off of what they exhibit in their feelings. So, if someone is in a bad mood, you can't just jump on them and bombard them with advice. You can help them in more subtle ways. I've always been the type to give advice but now I don't think I should push that on people because everyone is different.

Question: Has the program influenced how you handle challenging situations?

Sarah: Yes – if I am taking a quiz, I'll practice dynamic breathing or just more in a realistic, calm, or even positive way. I used to completely overthink things just sit their wondering if I am going to fail until I fail. I realized that if I just breathe and accept the reality, it's fine. Breathing is one of the biggest things.

Question: Moving forward, do you think mindfulness and empathy can support you in your engineering education and professional life?

Sarah: Definitely – as an engineer there's a lot of introversion in some ways. There's a lot of quiet people. Thinking about interacting with them better. To be able to understand them better and not get frustrated so easily. I think engineers have a lot of group work but have a lot of solitary environments to work alone. You should be able to sit alone but also work in a group. To have that balance between the two.

I kind of got frustrated with people who are too loud in groups because I am usually the quiet one. So, if I got kind of stepped on, I got frustrated with it. I am definitely trying to work on it because you can't just be made at people. You have to work with them. There are so many problems that can happen in a group with so many different personalities but if you can figure out how to work others and better position yourself in the group, it can help contribute to the dynamic of the whole. If other people see you handling things in a respectful manner, they may follow along. One change in the group can affect the entire thing.

Question: Do you intend to maintain a mindfulness practice?

Sarah: Definitely – I could probably use this until I am dead. I think everyone should.

MARY INTERVIEW TRANSCRIPT

Mark: Alright so I just started recording. The first question I have is, what were your overall impressions of the program?

Mary: I thought it was really planned out and not to use your own terms, but you seemed very mindful of everything you put into it. I know it's really helpful and I kind of expected it to be more specific, like just for engineers, but I appreciated that it wasn't.

Mark: What was that last part, that it wasn't necessarily unique to engineering?

Mary: Yeah, I expected it to be specifically for engineering, kind of more tips on how to handle our specific classes, but I appreciated that it was more directed towards growing as people.

Mark: Gotcha, okay. Reflecting now on the program, what would you say were your main takeaways or insights that you got out of your participation?

Mary: I think that it's really helped me become focused on the stuff that I'm doing, especially in the moment when I feel like anxious, notice myself start to get off task I do the deep breath exercise and just bring my mind back to what I'm focused on. When I'm interacting with other people too, I really try and understand their side [inaudible 00:01:59] and I think that's helped me give people the benefit of the doubt a lot more.

Mark: Okay that's awesome. So in the last survey that you've taken now for a third time, I kind of gave you, I pretty my outlined the key constructs that I as looking to really measure and so those were mindfulness, resilience, empathy and then generic skills, and I'll circle back on those a little bit later in the conversation. So, you kind of touched on two of those really specifically so the mindfulness part, being able to regulate your

attention especially when working on stuff, like getting less distracted. Then you also mentioned the empathy side so really trying to understand other perspectives. So, I'm curious for those two, and maybe we can start with mindfulness first. It sounds like that's something you were able to develop more out of the program. I'm curious, since the conclusion of the program have you noticed any differences in your mindfulness? Has it remained relatively stable or has it like increased or even decreased?

Mary: I think that it's increased. It's hard to say, especially over winter break, because I feel like I was a lot more aware of everything I was doing and everything around me since life isn't quite as busy as it is during school, but I would definitely say it's increased.

Mark: Then how about empathy?

Mary: I'd say that has also increased, probably a lot more than mindfulness.

Mark: What kind of makes you think that or say that?

Mary: I guess I would say, I don't know, I kind of have a mindset change of my relationships with people and realize that, I don't know, I guess it's hard to put into words, but I guess I feel like it has just increased.

Mark: Yeah, what differences have you noticed in your relationships with other people as a result of maybe practicing empathy?

Mary: I think that they've become deeper because, not that I'm always selfish, but I've become [inaudible 00:05:19] position and everything and how it affects them, and I'll ask them more so how it affects them instead of just assuming.

Mark: Okay is this mainly with close friends that you notice this, or everyone?

Mary: I'd say probably everyone.

Mark: Okay. I'm also curious if you've noticed any changes in your resilience or your ability to bounce back from stress. Is that something you think you've developed a little bit more maybe from the program?

Mary: I would say probably a little bit.

Mark: I was just going to ask, is there any like specific examples you may have that maybe you've noticed something before would stress you out but now it doesn't really do that anymore, or something like that, if you have any?

Mary: Okay so over break one of my friends got in a car accident and died, and that kind of changed my mentality about a lot of stuff. So, I'm not sure, like looking back before that happened, trying to compare that to now and I'm not sure if that's what changed a lot of stuff for me, or if it was the program. It's probably a combination. But I feel like the accident kind of brought back a lot of the stuff I learned in the program and helps me implement it more.

Mark: Wow, I am deeply sorry to hear that. Wow. I can't even put words to describe how bad I feel about your friend and her family and all that. I can only imagine. So, do you think some of the practices from the program maybe helped you cope with that maybe in a little bit more, in a different way then perhaps you would have before?

Mary: Oh yeah.

Mark: Okay. So, this is a really kind of broad question and I plan to narrow the scope of it, but before I do that I kind of just get, I'm curious like what direction you take it. Has

your participation in the program influenced your engineering education experience in any way?

Mary: I think that it's helped me become more positive about my classes because honestly a lot of them are really boring and don't excite me. So, it helps me stay focused and just take it step by step knowing that I need to get through the classes and each assignment to become an engineer and have that as a job. So, it's definitely helped in that way.

Mark: Okay. So some of the things I was looking at within the generic skills that I mentioned in the survey where interpersonal skills, teamwork skills, critical thinking, self-management and leadership skills and so, they're called generic skills because they're not necessarily unique to engineering or any field per say, but nonetheless they're very instrumental skills to pretty much anything you do in life. They're strongly connected to emotional intelligence which was a main focus of the program. So, I'm curious, out of the ones I listed, and I'm happy to repeat any of them again, do any of those stand out to you as something that you think the program may have helped develop?

Mary: Can you repeat them again please?

Mark: Sure. So, the first three are kind of interpersonal type stuff, so it's interpersonal, teamwork and leadership. Then there's self-management and critical thinking.

Mary: I think that self-management and teamwork and leadership definitely have been the most impactful.

Mark: Okay. Are there any specific examples or situations where you've kind of noticed that these things may have changed?

Mary: Let's see. I guess just like interacting with my friend group. Sometimes my friends are kind of negative, so I guess I've tried to steer the conversation like in a more positive way and then they've kind of realized that and gone with it. Then with self-management, I guess it's been easier [inaudible 00:11:57] to do each day or each week and figure out how I'm going to get them done and how to squeeze in more things that I know are good for me, but I don't necessarily want to do.

Mark: Okay. So, what sort of mindfulness practice have you integrated in your life since the program, if any at all?

Mary: I've tried to journal at least once a week and do the gratitude journal thing, and I've been trying to do the deep breaths and just make sure I'm more aware when I'm doing simple things like eating and walking and stuff.

Mark: Are these things that you would like to continue doing moving forward? Do you intend to?

Mary: Yeah for sure. I think they're really helpful.

Mark: Is this something that you would recommend to your friends or other engineering students?

Mary: Yeah, I tried getting a lot of the people in my classes last semester to sign up.

Mark: Okay. So that's like the last formal question I have. Is there anything that we might have missed or that you'd like to ask about?

Mary: Not that I can think of.

SHARON INTERVIEW TRANSCRIPT

Mark: Alright so I just started recording. The first question I have is, what were your overall impressions of the program?

Sharon: I thought it was really planned out and not to use your own terms, but you seemed very mindful of everything you put into it. I know it's really helpful and I kind of expected it to be more specific, like just for engineers, but I appreciated that it wasn't.

Mark: What was that last part, that it wasn't necessarily unique to engineering?

Sharon: Yeah, I expected it to be specifically for engineering, kind of more tips on how to handle our specific classes, but I appreciated that it was more directed towards growing as people.

Mark: Gotcha, okay. Reflecting now on the program, what would you say were your main takeaways or insights that you got out of your participation?

Sharon: I think that it's really helped me become focused on the stuff that I'm doing, especially in the moment when I feel like anxious, notice myself start to get off task I do the deep breath exercise and just bring my mind back to what I'm focused on. When I'm interacting with other people too, I really try and understand their side [inaudible 00:01:59] and I think that's helped me give people the benefit of the doubt a lot more.

Mark: Okay that's awesome. So in the last survey that you've taken now for a third time, I kind of gave you, I pretty my outlined the key constructs that I as looking to really measure and so those were mindfulness, resilience, empathy and then generic skills, and I'll circle back on those a little bit later in the conversation. So, you kind of touched on two of those really specifically so the mindfulness part, being able to regulate your

attention especially when working on stuff, like getting less distracted. Then you also mentioned the empathy side so really trying to understand other perspectives. So, I'm curious for those two, and maybe we can start with mindfulness first. It sounds like that's something you were able to develop more out of the program. I'm curious, since the conclusion of the program have you noticed any differences in your mindfulness? Has it remained relatively stable or has it like increased or even decreased?

Sharon: I think that it's increased. It's hard to say, especially over winter break, because I feel like I was a lot more aware of everything I was doing and everything around me since life isn't quite as busy as it is during school, but I would definitely say it's increased.

Mark: Then how about empathy?

Sharon: I'd say that has also increased, probably a lot more than mindfulness.

Mark: What kind of makes you think that or say that?

Sharon: I guess I would say, I don't know, I kind of have a mindset change of my relationships with people and realize that, I don't know, I guess it's hard to put into words, but I guess I feel like it has just increased.

Mark: Yeah, what differences have you noticed in your relationships with other people as a result of maybe practicing empathy?

Sharon: I think that they've become deeper because, not that I'm always selfish, but I've become [inaudible 00:05:19] position and everything and how it affects them, and I'll ask them more so how it affects them instead of just assuming.

Mark: Okay is this mainly with close friends that you notice this, or everyone?

Sharon: I'd say probably everyone.

Mark: Okay. I'm also curious if you've noticed any changes in your resilience or your ability to bounce back from stress. Is that something you think you've developed a little bit more maybe from the program?

Sharon: I would say probably a little bit.

Mark: Okay.

Sharon: Oh, it froze for a second. What did you say?

Mark: I was just going to ask, is there any like specific examples you may have that maybe you've noticed something before would stress you out but now it doesn't really do that anymore, or something like that, if you have any?

Sharon: Okay so over break one of my friends got in a car accident and died, and that kind of changed my mentality about a lot of stuff. So, I'm not sure, like looking back before that happened, trying to compare that to now and I'm not sure if that's what changed a lot of stuff for me, or if it was the program. It's probably a combination.

Mark: Wow, okay.

Sharon: But I feel like the accident kind of brought back a lot of the stuff I learned in the program and helps me implement it more.

Mark: Wow, I am deeply sorry to hear that. That's obviously really, really, I'm sorry you had to go through that experience. Wow. I can't even put words to describe how bad I feel about your friend and her family and all that. I can only imagine.

Sharon: Yeah.

Mark: I don't want to glaze over that or anything, it's wow. So, you think some of the practices from the program maybe helped you cope with that maybe in a little bit more, in a different way then perhaps you would have before?

Sharon: Oh yeah.

Mark: Okay. So, this is a really kind of broad question and I plan to narrow the scope of it, but before I do that I kind of just get, I'm curious like what direction you take it. Has your participation in the program influenced your engineering education experience in any way?

Sharon: I think that it's helped me become more positive about my classes because honestly a lot of them are really boring and don't excite me. So, it helps me stay focused and just take it step by step knowing that I need to get through the classes and each assignment to become an engineer and have that as a job. So, it's definitely helped in that way.

Mark: Okay. So some of the things I was looking at within the generic skills that I mentioned in the survey where interpersonal skills, teamwork skills, critical thinking, self-management and leadership skills and so, they're called generic skills because they're not necessarily unique to engineering or any field per say, but nonetheless they're very instrumental skills to pretty much anything you do in life. They're strongly connected to emotional intelligence which was a main focus of the program. So, I'm curious, out of the ones I listed, and I'm happy to repeat any of them again, do any of those stand out to you as something that you think the program may have helped develop?

Sharon: Can you repeat them again please?

Mark: Sure. So, the first three are kind of interpersonal type stuff, so it's interpersonal, teamwork and leadership. Then there's self-management and critical thinking.

Sharon: I think that self-management and teamwork and leadership definitely have been the most impactful.

Mark: Okay. Are there any specific examples or situations where you've kind of noticed that these things may have changed?

Sharon: Let's see. I guess just like interacting with my friend group. Sometimes my friends are kind of negative, so I guess I've tried to steer the conversation like in a more positive way and then they've kind of realized that and gone with it.

Then with self-management, I guess it's been easier [inaudible 00:11:57] to do each day or each week and figure out how I'm going to get them done and how to squeeze in more things that I know are good for me, but I don't necessarily want to do.

Mark: Okay. So, what sort of mindfulness practice have you integrated in your life since the program, if any at all?

Sharon: I've tried to journal at least once a week and do the gratitude journal thing, and I've been trying to do the deep breaths and just make sure I'm more aware when I'm doing simple things like eating and walking and stuff.

Mark: Are these things that you would like to continue doing moving forward? Do you intend to?

Sharon: Yeah for sure. I think they're really helpful.

Mark: Is this something that you would recommend to your friends or other engineering students?

Sharon: Yeah, I tried getting a lot of the people in my classes last semester to sign up.

Mark: Yeah, I remember that.

Sharon: I'm not sure if they.

Mark: Okay. So that's like the last formal question I have. Is there anything that we might have missed or that you'd like to ask about?

Sharon: Not that I can think of.

STEPHEN INTERVIEW

Mark: So, the first question I have is, what were your overall impressions of the program?

Stephen: Well it certainly wasn't what I thought it was going to be. I found that one of the things to be really interesting like learning about [inaudible 00:00:22]. With just the idea of meditation, taking time just to relax and all that. Yeah, learning about that, I found that to be interesting overall. Just that was my impression, just learning about stuff that I didn't know. It was just learning about stuff that I went and learned about in my engineering career but so related to it because you can use it to help you along.

Mark: Sure. So, what do you think you learned from the program that will help you moving forward as an engineering student?

Stephen: Well one of the main things was that empathy part, listening to other people instead of thinking about what you're about to say next. You know in engineering you have to be able to communicate with people. So, taking extra time just to pay a little more attention to what's going on in the conversation, probably the most important part in it, helping with becoming an engineer.

Mark: Yeah. Have you been able to apply that in some of your classes?

Stephen: Well, I think not necessarily in my classes but maybe with conversations because I'm mostly taking first-year classes so there's not really a lot of group stuff to do. But I think of other conversations, conversations I've had outside of class. I try to be a little more mindful of what I'm saying, what other people are saying in general.

Mark: As a result of I guess practicing active listening and empathy a little bit more have you noticed any changes in your conversations? Or nothing noticeable is totally fine as well.

Stephen: I don't really think so. No, I don't think my conversations themselves have changed, just how I viewed them. I think I look a little more inside towards myself or find more about myself when I'm listening a bit more. But I don't think it changes the overall conversation.

Mark: So, your perception of the conversation is a little bit different?

Stephen: Yeah. Pretty much.

Mark: Okay. Are there any, I guess, changes or affects you've experienced from the program other than empathy?

Stephen: Well, I think one thing I kind of think about sometimes is the mindful awareness part. Being more in the moment, focusing more in the moment. I feel like I'm just a lot of times just on autopilot. But I do sometimes think about it and take a moment to breathe, just focus on my breath. Usually, when I'm riding my bike, I've just thought about the feelings of riding a bike, that's pretty much it.

Mark: Yeah. So, it sounds like you've been integrating mindfulness in more and kind of informal everyday situations just as a reminder to maybe step out of the automaticity of life sometimes and notice what's going on. So, is this something you do on a daily basis now? Or could you elaborate a little bit more of how frequently that mindful moment happens now?

Stephen: I think when I get a bit stressed and there's a lot more buzz, I think that's when I realize that I need to slow down a bit. I've got test coming up so I ... It's not like, I don't think it's exactly every day, but I think usually when I get more stressed out that's the only time, I think about it.

Mark: Yeah. So, it's been helpful from a stress management side of things? You think the mindful moments?

Stephen: Oh, yeah. Yeah, definitely of feeling stress stressed specifically.

Mark: Yeah. Okay. Do you feel like when you take a breath and kind of step back, take a mindful moment, do you feel like you have the capacity to cope with stress more effectively?

Stephen: I think so. I think, yes. I think that before I just went [inaudible 00:06:39]. I guess it'd get to you more but yeah, I am able to cope with stress a bit differently now.

Mark: Wow, okay. That's great. So, so far we've covered the empathy component, you try to practice active listening more in your everyday conversations, it sounds like you practice mindfulness typically when you're stressed so it's a stress management type deal and it can help you cope with the stress more effectively just to tune into what's going on right now. Have you seen any other applications for mindfulness or empathy or anything like that?

Stephen: I think those are the main two things that I've noticed. Those are what I was able to away overall.

Mark: Yeah, okay. That's great. And have you noticed, I guess, any changes in those things since the conclusion of the program? So, in other words, it sounds like the program helped you develop empathy, a mindfulness tool to use when stressed. Do you think your ability in utilizing those things has remained stable since the program? Or do you think they've even increased or decreased? Let me know if that question makes sense?

Stephen: So, I think it's since the program if those things specifically have been able, well I've been able to use them in a greater capacity to deal with stress or something?

Mark: Yeah.

Stephen: Well I think being able to practice with them over time, yeah, I think that I'd be able to deal with stress more that way. I think also it's the going to college, you have to grow a bit [crosstalk 00:09:09] yourself anyways but having those tools that I learned about there ... I don't know specifically how much they've helped or if I take how much I've grown, those things are kind of on top, but they've helped in some capacity.

Mark: Sure. So, it sounds like these skills have already helped you in dealing with stress and the active listening side and over time you kind of anticipate further developing these skills and perhaps seeing even greater results along with just the idea of getting older and maturing.

Stephen: Oh, yeah.

Mark: Okay. So, are there any other ways you think the program has influenced your engineering education experience?

Stephen: I don't think there's anything really specific or anything tremendously ... I think one thing ... So, we learned about meditation there, like taking. I haven't don't that.

Mark: Sure.

Stephen: I guess it's not having single-minded about that. I just don't ... because you have to set time aside for it.

Mark: Did you try mediation during the program?

Stephen: Yes.

Mark: Like outside of the classes, right?

Stephen: Yeah, just a little bit but I guess I kind of forgot about that [crosstalk 00:11:11].

Mark: Yeah. Did you notice much when you were doing it a little bit more?

Stephen: Yeah. I think I remember going through some trouble with my roommate and that had me really stressed but after focusing on my breath for just a couple of minutes at a time that really helped at that time. Well, it really helped me dealing with that at that time even though I haven't kept that up at all.

Mark: Yeah. So, I guess in the future if something really stressful comes up maybe it's something you would try again?

Stephen: Yes. I feel like if I was going, felt like I was going absolutely crazy then yeah, I would do something.

Mark: Okay. Yeah, I think that's all the questions I have. Do you think there's anything we might have missed, or do you have any questions for me?

Stephen: No. Not about this. I think that's pretty much the whole thing-

COURTNEY INTERVIEW TRANSCRIPT

Mark: I'm starting to record. We'll just start off with some kind of broad questions, and then I'll kind of zoom in to some specific things. But overall, what were your impressions of the program?

Courtney: Overall, I just really enjoyed the program. It wasn't exactly what I thought it was going to be going in. I don't really know what I thought it was going to be, to be honest. But I was pleasantly surprised with how it went. I just felt like I learned a lot about myself through the program, and I looked forward to going to it every week, so I really enjoyed it.

Mark: That's great. What would you say are your main takeaways or things you learned as a result of participating?

Courtney: I think mindfulness was basically one of the biggest things for me. I feel like after the program and since the beginning of the semester and at the end of last semester, I've really been more self-aware with just everything I'm doing, and I think that's because I'm more focused on my mindfulness and being able to take myself out of my head and bring myself more into the present moment. Does that make sense?

Mark: Yeah. Did you feel like your mindfulness improved during the program then, from before and after?

Courtney: Yeah. Before the program, I did yoga and I meditated every once in a while. But since then, I meditate every morning, sometimes multiple times a day. I just feel like I'm more in the moment with everything I do.

Mark: Yeah. How do you typically meditate?

Courtney: It just depends on the time I have. But usually I start off every morning before I ... I'll wake up and I'll just stay in bed kind of, and just take five minutes, just close my eyes and kind of visualize my day. Then at night, I do another meditation where I just totally try to clear my mind and focus on my breath.

Mark: Okay. So, the morning's more of visualizing the day, and the night is more to just unwind and focus on the breath? Okay. That's great. Have you seen any changes in your mindfulness since the conclusion of the program?

Courtney: I think so. I still get stressed and everything from school and whenever life. But I feel like it doesn't affect me as much. I know it's there, but in my mind, I know it's okay. It's just what it is, and I can get through it.

Mark: Yeah. You're describing resilience, which is actually one of the constructs I was looking at. Stress is always going to be there. That's totally natural and normal. But it's how you respond to the stress that's kind of the construct of resilience. Do you think that was affected by the program? Do you think that changed?

Courtney: For sure. Stress, it's always been something I kind of had to work with, and it's always been kind of a toll on me. But now I feel like it's not as much of a toll. I know it's there and it still affects my life, but I feel like it's not hurting me as much emotionally or physically.

Mark: That's wonderful. During the program, you thought you saw an increase in your mindfulness, and then since then, you saw an increase as well, although maybe more subtle based on kind of what you said. What about for resilience? Do you think that's stabilized since the program, or do you think that strengthened as well?

Courtney: Over the break, I don't really know how much-

Mark: Stress you had.

Courtney: - [crosstalk 00:04:19] since I wasn't doing as much [crosstalk 00:04:22] things.

Mark: Yeah.

Courtney: But since the start of the semester, I feel like it's been stronger definitely compared to the end of last semester.

Mark: Okay. Sorry, I was hearing a howling outside and it wasn't from a dog. Okay. The other thing I was looking at was empathy. I think in your survey you mentioned that that might have changed as well. Could you elaborate a little bit more on that aspect, if you think it's changed at all?

Courtney: I feel like I've always been more of an empathetic person than the other, I guess, end of empathy. But I think [inaudible 00:05:14] when we really practiced active listening. I think it was the third session. I kind of always go back to that when people come to me now. I feel like I've always listened to people, but now I feel like I'm more focused on listening to what they have to say versus how I'm going to respond.

Courtney: I actually had an interview lately for a community assistant position.

Mark: Nice

Courtney: It was kind of like round robin setup, and we didn't know the questions ahead of time. So, I feel like this really helped me, because I was able to just hone into what they were asking and really understand it, and that way I could give the best response. I

feel like in other situations, too, whether it's just having a conversation with my friends or even listening and paying attention in class. I feel like I'm more able to focus on what they're saying versus the thoughts in my head trying to [inaudible 00:06:17] my response or just thinking about it.

Mark: Okay. Do you think some of the things you learned in the program…,it sounds like they have transferred into some of your classes as well in listening and paying attention more. How about working on teams and group projects? Have you noticed any changes there?

Courtney: Yeah, I feel like I haven't really engaged in as much group project at the beginning of the semester yet. But with my roommates, I feel like we're more easily to navigate [inaudible 00:06:55], or just able to listen and figure out what they want and kinda then put my input in, versus doing it at the same time.

Mark: Okay. That's great. Let's see, what else do we have here? Any other changes that you might have experienced from participating in the program?

Courtney: I just feel more calm. It doesn't seem like things bother me as much in general. Whatever it may be, just like, "Okay." I feel like I hear something or something happens. "Okay." Then I just feel like I absorb it and then I think about it, and then I'm more able to ... I'm not as rattled.

Mark: Yeah, I'm trying to think about other questions that I have. Do you feel more equipped to be a leader as a result of participating in the program?

Courtney: I think so. As I mentioned, I had my interview for the community assistant, and I think the program itself kinda gave me a little bit more confidence in applying for this job, because I feel like I would be better, more adept, to deal with different groups of people, different identities or different backgrounds. I felt like I'm more equipped to be able to figure out the best solution and just tackle whatever problem that comes at me.

Mark: Okay. How do you think some of the changes you've experienced have influenced your wellbeing?

Courtney: Like I said before, I feel like I'm just more calm. I guess I'm just more in the moment, which I like being present. I kinda before like where I'm too stressed about everything, or I'm too much in my head, where I'm not really there. I feel like now I'm more present and here and just in the moment versus in the past or in the future, and I'm able to enjoy things more because of that.

Mark: So you feel like you're enjoying things more. Moving forward, do you intend to maintain some sort of mindfulness practice?

Courtney: For sure.

Mark: Yeah? Kinda the same thing you have right now?

Courtney: Yeah.

Mark: Is this something that you'd recommend to friends and would like to see, I guess, more integrated into an engineering course like AC 101?

Courtney: Yeah. I think it would be really helpful for a lot of people, especially engineers, to do this course and just be more aware of mindfulness and empathy and ... I

think a lot of people, when they think of engineering, it's just the math and the solving. But when it comes to the actual job, in my opinion, you have to work with people, listen and understand problems. It's more social than people think it is.

Mark: Yeah. Okay. I think ... Let me just double-check. That's all the formal questions I have. Before I pause the recording, do you have any questions for me related to this, or maybe anything I might've missed?

Courtney: No, I think we pretty much covered it. But if you don't mind, I'd like to ask you a few questions about how you got involved with starting up the program and ...

ARTHUR SECOND INTERVIEW TRANSCRIPT

Mark: Okay. So, let's see, we can skip these questions. So, Have you maintained any sort of mindfulness practice since the program ended?

Arthur: Yeah. I have. I've tried to do where you just kind of think, when you're working or ... Things like that, but I've also been doing meditation. About half a week every week. Three or four days a week, is what I mean by that.

Mark: Really? Okay, three to four days a week. For how long?

Arthur: About ten minutes.

Mark: Okay.

Arthur: Yeah, that's really it.

Mark: And what are some of the things you've noticed from continuing to practice mindfulness?

Arthur: I'm more aware of my surroundings. More self-aware as well. Helps me think through things in general, because it kind of gives a different perspective or more perspective. Because you're thinking about things more. Or on a deeper level.

Mark: Do you think your mindfulness have strengthened or remained relatively stable since the end of the program?

Arthur: Definitely strengthened.

Mark: Definitely strengthened?

Arthur: Yeah. I feel like it's kinda a thing that needs to build off itself. Like once you start it, it grows from there. Almost exponentiation over time, it will get more and more, until of course there has to be a limit somewhere ... Your mind can only think so much.

Mark: Just checking something real quick. Okay. She wanted to pull up your survey data. In terms of some of the things I was measuring, it seems like your resilience, or ability to handle stress and over come it, your mindfulness, and your empathy, you all felt improved from the program and so, I already asked this for mindfulness, but do you think those other things have remained relatively stable, since the program? Or have strengthened or weakened?

Arthur: I think my resilience has increased slightly. It's already pretty high, because I don't get stressed out too much, which is not necessarily a good thing, because it kind of takes stress to get completely engaged in something, otherwise there is almost an element of aloofness to it.

Empathy has definitely strengthened. I find myself being much more empathetic towards others and towards people in situations in general, even if I have never even spoken to them, like just reading the news. Things like that. It's kind of made me a more positive person and I identify negative in my own thinking and in others thinking, and I try to do my best to reduce it because nobody wants negativity.

Mark: So, back to the resilience part, where you said you kinda need a little stress to get motivated. If stress doesn't drive you as much now, what motivates you now to do well in school and other things in life?

Arthur: I don't know. I just kind of do it. I've never been the most motivated person. I just kind of do things to do them. It's almost the idea of doing it that motivates me more than what happens from completion, be it grades or praise or what have you.

Mark: Yeah, that's good. So it's more of just the enjoyment of doing something. Remember we talked about intrinsic motivation. Sounds like that's a primary motivator for you.

Arthur: Yeah. I found that exntrinsic motivation almost completely doesn't work for me.

Mark: So the other part of the survey was the generic skills. So these are skills that are not necessarily unique to engineering, but they are useful for pretty much any field and in future work and stuff there are always skills you apply. Some of the ones I captured were teamwork, interpersonal skills, self-management, and thinking critically. Because I thought they could be loosely connected to mindfulness in some of the things I was doing.

Arthur: Well, yeah. Makes sense.

Mark: Yeah. So I noticed that you ... On a couple of them, you improved a little bit. But overall you felt that you were pretty confident in a lot of those skills. So I'm just curious, do you think the program had any effect on these kind of teamwork type skills or interpersonal skills that you use a lot in your engineering education and potentially your future work?

Arthur: I think so. I think it's kind of taken loose ideas or aspects that I've had and kind of made them more cohesive. And made them work together more. [crosstalk 00:07:23]

I think what the program has help me do is take everything that's out there and connect it all together. If that makes any sense.

Mark: Sort of. I want to dive a little bit deeper. I mean- You go ahead.

Arthur: No, that makes sense because I didn't feel like my explanation was too great.

Mark: Yeah. No. Okay. So, let me think how to frame this. So a lot of what mindfulness is, is dealing with your actual consciousness, your perception, your attitude towards life. And it seems like you've developed some kind of framework or outlook in terms of how you- I'm curious is that what you were trying to describe? You felt like you have a greater framework to describe what's going on in your life?

Arthur: Mm-hmm (affirmative) I have always been a pretty analytical person, so I develop frameworks, like you said, to force certain skills, actions, activities, I try to make a generalized idea of what needs to be accomplished in order to best fulfill those goals.

Mark: So, what kind of framework is this program allow you to develop?

Arthur: It lets me us meditation and mindfulness to- not only as part of a framework of thinking about my life or applying it to skills that I have but also to develop frameworks themselves, to better think about approaches in general.

Mark: Okay.

Arthur: Almost a tool to create.

Mark: This is really interesting. I feel like I'm getting there in terms of understanding where you're coming from. So, do you think it has to do with as you become more

mindful, you mentioned the increased self awareness, aware of surroundings, and stuff like that, do you think it has to do with the intake of information, that maybe has increased as result of these practices? From your surroundings, from yourself?

Arthur: Mm-hmm (affirmative). I find myself looking around more. Like as I walk I'll look, hey look at that thing or look at this. Not necessarily as being distracted, more as being aware. So somehow even less distracted. Being in a way more in the moment, less distracted from it.

Mark: Yeah. I think I know where you are coming from now. It's like because you feel more connected to what's around you and what's going on internally, it's like you are literally making more connections in your brain between things that maybe didn't seem like they related before. It is almost like you're forming your mental schema. I guess, in a sense, you are saying this is giving you an ability to relate things more and connect things.

Arthur: Mm-hmm (affirmative).

Mark: Okay. Are there particular areas in life, where you think it does that more?

Arthur: Not that I can think of.

Mark: Okay. So the things I focused on were: Resilience, as I mentioned that's the ability to bounce back from stress. I tried to capture empathy, we've talked about that one. And it sounds like that practice, you said resilience strengthened. You said mindfulness strengthened. How about empathy? Did that one remain relatively stable since the program? Or increase? Or Weaken?

Arthur: I think it's increased.

Mark: Okay.

Arthur: When I talk to people, I find it easier to relate to them, and kinda think how they're thinking. And then like approach the subject from how they might be thinking. I do a lot of inscription and education, and I find that it's much easier to actually teach people when you understand where they're coming from. And I believe that my abilities to do that have strengthened and therefore my ability to have empathy has also strengthened. I've been teaching pre-modeling to junior high school students. And the person who invited me to come teach has talked about every week after they're like, "Where's Arthur? That was great we want to learn more."

Mark: That's awesome. That's really rewarding.

Arthur: Whatever he wants to teach, we'll learn it, just bring him back.

Mark: Yeah, that's really powerful. So that's a really cool application for empathy. I've noticed it as well when I teach as well, taking everything, body language, what people are saying, and use that information to inform how I teach or whether I spend more time on a certain point or not. That's really great. Is this just like a volunteer thing you do? Or- Okay.

Arthur: Volunteer.

Mark: After school program?

Arthur: It's at my former high school.

Mark: Oh.

Arthur: The librarian, they call it a "cyberian", because they're like technology but the librarian invited me. Because they have, what they've named the Innovation Club. Based on somebody's [inaudible 00:14:38] and they do sort of general, creative, STEM related things. Because there is also Robotics Club that does robotics.

Mark: Yeah.

Arthur: But this club does more ... More ... What's the word I'm looking for? Supply more ideas, more creative. More in the mind, than in the world. There is a very specific word that I'm looking for that I haven't found.

Mark: Theoretical?

Arthur: Yeah, more theoretical. It kind of teaches them not skills but how to develop skills.

Mark: Learning how to learn.

Arthur: Exactly, learning how to learn.

Mark: Yeah, that's the best skill you can develop.

Arthur: And then, half the people in there are also in the Robotics Club, which is taught by the physics teacher. I haven't really been involved with that but he's talked about getting me involved in kind of talking to them about ASU's curriculum.

Mark: Let's see, what else do we have here? So, the skills part of it, the interpersonal, the teamwork, the self-management, and the critical thinking ... You said there was a

connection there between mindfulness. So I'm just wondering, in your engineering educational experience, those are skills that are definitely applicable, but has there been anything from the program that transfers over to your experience as a student? That supports your ability to have a good experience in your engineering education? Kind of a long winded question, but I think I got it across.

Arthur: Yeah, I think so. Yeah. I understand more what the assignments are for. A lot of people say, "Oh, I don't know what this is for, this is useless." But it's not unless once you think about it and you kind of develop an idea of how learning happens. You understand that the assignments that seem useless, may not be useful in other senses, but they are still very necessary. And so what I have been able to do is pay attention to the seemingly unnecessary parts of classes, and lessons, and I find that that has helped me learn more or at least learn better. Have more understanding of the subject.

Mark: Yeah. I know where you're going, Arthur. I'm curious, do you have an example you could share?

Arthur: There was an assignment in my math class last year, that was really weird. It was almost the exact same thing as something we had done earlier. It was very, very, very similar. And it wasn't like we that one and then it was this one, it was like that one was way early and this one was way late. And a lot of people were like, "What's the point? We already did this." But it had very subtle differences in it, that actually allowed us to apply that previous idea to the next assignment, and the next idea. So I think without that single useless assignment we wouldn't be able to learn the next topic as well, or

understand it as deeply. It kind of planted the seed of understanding. Well, it more watered the seed of understanding, it still would have grown just not as well as it did.

Mark: Yeah. That's interesting. Do feel like you had this perspective before or is it something about the mindfulness that has allowed you to see some of theses connections, between assignments, I guess what seemed to be unnecessary details that you notice now?

Arthur: I definitely did not have this same idea before. I was definitely one of those people who thought, "What's the point of this?". And it was almost every assignment, it was what's the point, what's the point, but the thing is you obviously have to a point because if you didn't do them, you wouldn't learn. There's obviously a point but I was like, no, this it useless, this is useless, but now looking back I realize, no, that was absolutely not useless in the slightest. They were incremental steps to help build to the larger idea.

Mark: That's really well articulated. In addition to what you said in terms of, paying attention more in class, noticing subtitles in how you're learning and what the assignments are for, have you seen any other applications, in terms of what you've learned and how it's transferred?

Arthur: Mm-hmm (affirmative). Nothing as concrete or as readily available for me to think of but there is definitely more general things. Probably more specific things, that I'm just not thinking of at the moment. That have been carried over. I find I'm in normal conversation, I find it easier to understand what people are saying, like "oh, yeah, that makes sense" because I spend a lot of time thinking about different things and when

conversation comes up it is usually similar to the topic that I'm think about. So I already have a bit more understanding than I would otherwise. I think during mindfulness, I can kind of develop self-awareness and then it helps me know what I don't know. So I can learn better and not be "oh I don't know what you are talking about, I don't need to hear what you're saying".

Mark: That's really cool. Have you heard the word metacognition before?

Arthur: Hmm?

Mark: Have you heard the term metacognition before?

Arthur: Mm-hmm (affirmative).

Mark: Yeah, it's essentially that, how do you know what you know. In a sense. What you said, knowing what I don't know, knowing when I need to, listen to something, and learn something, and stuff like that. So it sounds like you've seen a transfer to that side of things.

Arthur: Definitely a very powerful thing to know what you don't know. It's- I find that when talking to people they insist that they know everything, about X Y Z, when that's not the case. That can never be the case for anybody. Well, almost everybody, you know.

Mark: That's true, like some sort of genius with a photographic memory and you just learn everything. But even then you probably don't know-

Arthur: Like people researching, they know everything there is known, but it doesn't mean they know everything, because that's why they're researching.

Mark: Yeah.

Arthur: So even people that have the fullest knowledge available to us are creating new knowledge.

Mark: I agree. And so, have you had a group projects or anything like that, where you have been able to apply some of these skills, that have developed and strengthened? And what have you noticed is different?

Arthur: Yeah, most projects that I have had the engineering 101, were group projects. And I found that usually in group situations, I'm the leader, which I don't like but it happens because if no one takes charge everything falls apart. And so I have to do that. But I can still do it well. So I find a lot of groups that I've been a part of, where I'm not leading, the leader sort of takes over and says "this is what we're doing. I came up with it, I [inaudible 00:24:53]", it's all about them and that they are the most powerful, the most smart, or whatever, you know, smartest. That's the word. But I've attempted to bring in other people's thoughts, what does everyone else think, what do you specifically think. Instead of saying what does everyone else think and noone says anything, you say what do you think, and somebody's almost forced to say oh this is what I think. Because everyone has an opinion, it's just voicing them.

Mark: And what did you notice as the outcome of being intentional about getting everybody involved and getting their perspectives in?

Arthur: The final product is miles ahead of what it could have been, because people have different way of thinking and therefore they come up with different ideas. I remember there was a project where we were making a catapult thing, except it wasn't a catapult but

a spring powered launching thing. And half the ideas that we needed they never would have up come if I hadn't been we need to put everyone's ideas, everyone needs to be involved in this. And its like actually I was thinking this and it's like well that's a fantastic idea, I'm glad you brought it up, because that's what we're going to do. That works the best.

Mark: That's awesome. That's a really, really cool connection. And it's kind of my hopes for the program when I started and it wasn't your typical leadership program where you go up and maybe practice public speaking all the time, because it's more focused on developing yourself as a person. Naturally that will translate to being a good leader. And I think so of the things you brought up just listening to others bring you perspectives, that's literally you fueling creativity and innovation within your idea, within your group projects. Which is phenomenal. That's great.

Arthur: The thing about the program is, I think it helps you learn how to learn. Those other program's like here's this skill, learn this skill. But what this program does is they put to learn a new skill that might not necessarily translate to something else. The thing is what I've learned in this program transfers to everything. It's more skills about thinking and ways of thinking or learning. I didn't want to say the word again, but I did. And instead of this is the skill that you learn, like you learn public speaking. This can help you learn public speaking, instead of learning it itself. You know? That kind of fell apart there at the end, but I think you got the idea.

Mark: Yeah, yeah, I got it because it's dealing with the way you think so it can help you learn how to learn if you apply it in that way. And there's no doubt, skills like empathy,

you applied it in your group project. And even though you wouldn't necessarily connect empathy with creativity and innovation, applying that in a particular situation can lead to that type of outcome. So, yeah, I think a lot of these skills translate in a lot of different situations, if applied well and it can help you learn faster. Like public speaking, if you are practicing empathy while public speaking, and applying mindfulness you're probably going to better at it faster, right, and be able to relate to your audience more. So, yeah, I totally get where you are coming from. I think that's a really great connection.

Arthur: I've done public speaking in the past, and I have used empathy to, instead of thinking what do I have to say to them, what do they want to hear. What do they need, not what do I have. It's what do they need. Mark:

Mark: That's a powerful shift. And I think they try to teach you that a lot now. Like freshmen year in engineering, it's like focus on the user's need, human centered design and stuff. But it's one thing to understand that in theory and it's another thing to actually develop empathy and apply that. If that makes sense. Because you can understand that but if you don't have the ability apply empathy or these other things you're not actually going to improve.

Arthur: Right. It's so different from the traditional ways of doing things. That without actively trying to apply it, you'll fall back in to a routine of what's already there. The standard.

Mark: Okay. Yeah, that's a great last point. Anything else we should bring up, in terms of effects you've noticed and how they apply in engineering education context?

Arthur: None that I can think of.

Mark: Yeah, I think that was really thorough actually. I just remembered this but I remember you had this very strategic, deliberative way of trying the different meditation practices.

Arthur: Yes.

Mark: And not combining them initially.

Arthur: That's right.

Mark: I'm curious, what was the outcome of that? You mentioned you like mindful walking now and meditation. So I imagine you combine those and maybe even other ones?

Arthur: Yeah, they were combine in about late December. But, yeah, I did one and then the other and then both. So, I wasn't doing meditation earlier and I wasn't conscious doing mindful walking but I probably was. But I consciously changed what I was doing and that helped me realize the benefits of both of them separately. Oh, meditation helps you do, this, this, and this. While mindfulness helps you do, this, this, and this, as well as other things. So, there's crossover but they do have very separate things, because meditation more helps you think about, well not think, that's the thing. It helps you understand and control how you're thinking. Have more power over your own mind, while mindfulness helps you use that power to create incentives outside of that. So meditation almost increases the power of the mind and mindfulness put the power of mind to work.

Mark: Yeah, it's like meditation supports your capacity to be mindful. And then mindfulness is the every moment, every waking present moment, being apply to that in

all kinds of context to like you said enhance the way you think and learn. That's, yeah, that's really well said. So, I imagine you intend to maintain some sort of mindfulness practice moving forward?

Arthur: Definitely.

Mark: Pretty similar? Like ten minutes mindful walking?

Arthur: Mm-hmm (affirmative). I'd like to start walking in the morning but I haven't got around to that yet. I'll do it when it gets less cold but before it's burning.

Mark: Yeah, before it's too sunny. It's not really a bad time to go walking right now.

Arthur: Yeah, it's nice outside. It was a bit too cold earlier though.

Mark: So, final question that I have is, would you recommend the program to friends?

Arthur: Oh, hundred percent, yeah. Definitely. It helped me grow as a person and as a thinking being.

Mark: That's super cool. Do you have any questions for me? Or comments? Or anything that we might have not discussed?

Arthur: Not that I can think of.

Mark: Okay.

Arthur: I believe in the program.

Mark: Yeah, well thank you. I really appreciate it.

Arthur: Thank you for the opportunity to do it.

Mark: Yeah, yeah, no. Definitely rewarding for me and I'm publishing some papers out of it. Getting my dissertation done, so I'm glad I went this route even though it was challenging at times. But I think ultimately I've seen the impact and pretty all the students have completed the program. So, it's, yeah, I've enjoyed it. And it's taught me a lot and I think helped support my mindfulness practices as well. And there's things I've learned from you guys as well. Yeah, well, I may follow up in the future. I don't know. I don't have any other research in the queue right now, in terms following up with you guys but maybe in three years or something, when you're a senior, I'll follow up with you and see if any of these attributes and what you're seeing now have strengthened or remained stable or whatever. I think that would be pretty interesting.

Arthur: Sounds good.

Mark: Yeah. Okay. Well take care, and have a great semester. And hope the beginning of the year of off to a strong start.

Arthur: Yeah. Alright.

Mark: Alright. Talk to you later.

Arthur: Possibly.

Mark: Possibly. Alright, bye.

YSMAEL SECOND INTERVIEW TRANSCRIPT

Mark: Since I already talked to you I can actually skip over a couple questions since it was more your impressions on the workshop and stuff like that, but I already have that from you. So I guess I'm more curious now that it's been a few months since the workshop you participated in have you noticed any changes from the effects you experienced after the workshop?

Ysmael: I can say I did notice a couple of changes. I feel like I've been in more on a schedule, my time management is a little bit better. I have a couple calendars throughout the house where stuff goes on. The bills goes in the kitchen and stuff like that, and I have the dates of hunters and events over here. And then over there I have my class assignments and whatnot. So it's more scheduled and structured I feel like. And I didn't really have the will to be structured beforehand because I was just go with the flow I guess, just do what happens to come by and whatnot. But now I just feel more like I'm doing stuff for myself I guess. So I feel like it's been a learning process I guess throughout.

Mark: Okay. So I'm curious if ... you've taken the survey now for gosh, a third time. Sorry about that. So now this last survey was revealing in the sense of I actually pinpointed the constructs that I was looking at. So you have resilience, mindfulness, empathy, and then some skills that we call generic skills like interpersonal skills, teamwork skills, self management, critical thinking. They're not unique to engineering, but they're super important to just a lot of different things really. And they're really strongly linked with emotional intelligence, which is strongly linked with future success and things like that. Which is why I was interested in looking at those.

So maybe we could go one by one through all those different constructs and then you can tell me first off what did you notice? And any changes in those constructs immediately after the workshop. And whether you think your level in those different things has remained pretty stable since the workshop, has maybe even increased or strengthen, or perhaps weakened since the workshop. So maybe start with mindfulness 'cause that was the core focus of it, and then we can go from there.

Ysmael: So on mindfulness I feel like I'm always using it now that I have everything around me, I already know what's going on I guess. There's never a time where I feel like I'm not in control of where I'm at or what's going on I guess. I'm fully ... and it's not even a control thing, it's probably just more of content thing. It's just basically things don't really stress me as much as they used to. Sometimes I'll be thinking about things and I just wonder why it doesn't stress me out as much as I should be. Sometimes it feels weird that I'm not as stressed, I feel like I should be “Just staying in the moment” I feel like that's just an active thing that I just bring myself to do it.

Thinking about constantly, but it's more of a coping mechanism, I guess. It's not more of, "Oh, I'm trying to be mindful." When if something needs to calm down, look at my surroundings, evaluate what's going on. So I feel like since the class that it's just grooved me easier into thinking in this type of way. Or handling things more. But at first I guess I was stressed a lot a lot 'cause I barely moved out and started college at the same exact time. And so there was lot going on. So I feel like it really did help with a lot of taking time to myself. So then I had that time to myself, and I had even more motivation, or more insight on what I should do next.

Mark: So one thing that I think you said was interesting at the end was the more motivation and insight on what to do next as a result of taking more time to yourself and being a little bit deliberative about that time. So one thing that I think people commonly associate with being motivated is you have to be a little bit stressed. So I'm curious what drives you now at this point? And do you feel like even though you're less stressed, do you feel as motivated, less motivated, or just as ... even more motivated perhaps?

Ysmael: I feel a little bit more motivated in my opinion I think. It's probably just been coming from myself. I've been just focusing on bettering myself and what not. I don't know, I just have a feeling like I am in school, and I'm working and stuff like that. But if that's all I'm doing it's just gonna be boring or I hate it. And so just the bettering myself and trying to keep myself busy doing that could be positive for myself. That is I guess what drives my motivation I guess. So I just have a lot of end goals and a lot of things I want to accomplish in the future. So it's more that and the fear and so yeah. So it's not as time consuming as it used to be, or there's a limit. It's not like that any more, I just feel way more content and in control.

Mark: That's really cool. Okay so that's mindfulness. How about resilience or your ability to bounce back from stress and deal with it? I mean, sounds like you've already talked about it in terms of having good coping strategies, but maybe there's something else in there?

Ysmael: Honestly the resilience part I feel like that's ... I'm using that at most whenever I am meditating. 'Cause that's when there were a lot of thoughts just started coming in and whatnot. And it gives me a little bit of time to think I guess, break things down, what I

should do next. And then whenever I sleep on it and I wake up on it there's just ... I have a better thought about being. So the resilience I think yeah that definitely a factor that came with the meditation and just keeping myself .... taking that time to myself I guess. Making those times holy or spiritual, giving them some type of value has really helped me with the bouncing back and checking in.

Mark: Yeah, that makes a lot of sense, I love that connection. How much of a mindfulness practice have you maintained since the program?

Ysmael: I think I've maintained a pretty decent amount. Enough to considerably always be remembered about little things I probably had forgot. Just 'cause I'm generally thinking about a lot of it or thinking about a good portion of it. Most of it that I retained is those different meditation practices and whatnot. And also the ... there's this video that you showed us about the way that you appear and whatnot, and how it effects your confidence and how people see you and whatnot. Take that into consideration as well too. So I just feel like both my communication skills and my self bettering skills is the most that I've taken from it.

Mark: Yeah, okay. So being mindful of your body, and what specifically do you ... on an average week what specifically do you try to do meditation wise? Or mindfulness wise in general?

Ysmael: For the meditation I count binaural beats and whatnot as meditation. So I usually go to bed with binaural beats, if it's a normal day and I'm not too tired. I don't really wake up and meditate as much as I want to. Sometimes I do, but not as much as I want to or I'd like to I guess. For the mindfulness, yeah I'm pretty sure I'm using that all the time or

trying to at least use it all the time. But it's a good way to actually live I guess carry on day to day, make moves, you know what I mean. It's a good way to keep a lot of that balance and structure. And it works for me, so.

Mark: Yeah, okay. So it sounds like overall your formal meditation practice waned over time. But it's really translated into being mindful in a lot of your everyday activities. And you do the binaural beats before you go to bed. I'm curious so the mindfulness part, I forget if you answered this, do you think that's remained stable since the program or increased or decreased? Or it's too hard to tell is a perfectly fine answer?

Ysmael: I don't know, I think it probably increased honestly. I wanna say increased, but I guess it does wane. There'll be a time that I'm really really feeling like I'm accomplishing everything, I'm feeling really really good, everything's going right, I'm saying the right word, my mind's clear. And there's those other days where I guess I didn't wake up in the right mood, or I'm not in the groove as much. And I get thrown off I guess. It just depends on I guess the day, what's going on I guess.

Mark: Yeah, okay. But overall it's up and down but you think it's trending up overall over time?

Ysmael: Yeah.

Mark: Okay. That makes a lot of sense. In my experience I've had the same thing where you fluctuate all the time depending on what's going on in your day and yourself. And there's so many things that influence it. I find sometimes you make these huge leaps and then you steady out, and then you make another leap if you stick with it over time. Maybe you'll notice the same thing, I don't know. And then resilience do you think that has

remained relatively stable, or do you think that's also increased with your mindfulness as well since the culmination of the program?

Ysmael: For the resilience part at the time I feel like the resilience was probably what I needed the most. So I took what I could from that, and I use resilience a lot and whatnot when it comes to trying to get myself back in the mood or trying to get myself back in my zone, you know what I mean? Just I guess I wanna say there's a lot of stuff going in and I just want to say I have a lot on my plate I guess. So I was just what are some times when one thing just doesn't go the way it should, it throws off a lot of other things. 'Cause I don't really have that foundation financially or any other real fallbacks. But really so the resilience partly is really why I kept my head on I guess. It makes stuff really a lot easier to deal with. I don't know, it just ... I don't know how it's increased or decreased over time. But I do feel like it's definitely been ... I don't know, something that's there I guess, I don't know.

Mark: So you noticed that improved a lot from the program, but since then it's been pretty stable in a sense?

Ysmael: Yeah.

Mark: Okay. And then empathy. I think in your survey that increased from the program. Have you noticed any changes in that over time since?

Ysmael: For the empathy part I feel like it's more natural now than it used to be. I used to be ... I couldn't quite understand people and looking from their point of view, do all these things. Which was a good starting point and stuff like that, just to get me into the mindset of approaching these thoughts first and whatnot when it's coming to certain situations.

But now it's pretty much more natural, it just feels like it's the way I should react to things when they happen or whatnot. Even though it might not have everything to do with me or it could be something that ... it could be a sensitive topic.

I noticed that it's something that I could speak about and I could possibly help, then it's easy for me to go ahead and communicate in that way. But I noticed before I had the empathy part was forced I guess. I don't know if I was saying the right words, I would just put myself ... not really put myself in their shoes, but put their condition on me. You know what I mean? And so it wasn't really ... I don't know as ... what's the word? Sincere I guess as how it's been now.

Mark: Yeah, sincere, genuine.

Ysmael: Yeah, exactly.

Mark: Okay. So and then the last part was related to generic skills. So the interpersonal teamwork. Have you noticed anything you've picked up from the program has transferred over to your engineering classes and teamwork and interpersonal skills or in any other way? You mentioned the self management part with how you're more organized and stuff like that. Could you elaborate more on that side of things if there's anything to?

Ysmael: The organization part was just 'cause basically the calendar reference is one of them. I add everything on a schedule I guess, and I know when I'm free, I know when I'm not free. I just feel like I got a lot of communication skills, which does help me in the group work and whatnot from the things. The empathy really does help a lot in the group work. I was in a sustainability class last semester and people had stuff going on, people have work, people sometimes don't know all the content, sometimes I don't even know

what's going on in the class. Empathy really helped me keep my cool and actually you'll be a part of that group and not really put anyone down or disrespect anyone but still try to understand they're still doing their best and whatnot.

Whenever it came leadership though, whenever it was needed I did just assume the leadership role and I just felt like that made everything easier. That group I was with last semester, it didn't specifically have anyone that was really willing to make those type of decisions like, "Oh, you do this, you do this." They weren't really about that, so I just did it myself. Even though we were supposed to change rolls every week and whatnot I just ... I changed a role technically, but I would still tell everyone what was going on and answer their questions and whatnot. And at sometimes it would be really really annoying, just 'cause I'm like, "We're in the same class, we do the same thing, we should know the same stuff."

But I feel like when it came to teamwork and actually getting the work done, and at the end of the day my grade those things I had to be cool about doing it in a certain way, just to keep everyone happy. And it wasn't just one group project, it was literally the whole semester we were just writing essay after essay. Group essays. So just I was like, "There's no way I can just quit on them or give up on them, because that's a whole grade for this semester." So it was hard, but yeah, I had to write ... it started getting harder after the course the ... oh my gosh, the program.

And I feel like I was using the information I got from there just to deal with a lot of that stuff. 'Cause beforehand or during I'd just go off on a tangent, just rant to my roommate or whatever about what's going on and whatnot. But so I would notice that he'll ask me,

"Oh yeah, how's your sustainability class going?" 'Cause I'd always be ragging about that class, and then the responses changed. It's not, "Oh, I'm mad at this girl because of blah blah blah, she won't turn this in." It's just more like, "Oh yeah I just let them know to hurry up, just 'cause they haven't done this and this and this." And so I read my part. But the context did change a little bit and stuff.

I feel like teamwork, the general skills and generic skills that's a strong part of the program I feel like. Even though it's to the side, everything feeds into it, it made it easier.

Mark: Yeah, that's a good way of putting it. I'm curious, it sounds like you noticed a change in yourself in how you communicated with your teammates and the role you took. Did you notice anything in how the changes ... how they received that and if they noticed any difference? And whether you think the outcome was better as a result of changing yourself in a way in the way you communicate?

Ysmael: I would hope that that changed how they probably looked at the group or how they looked at me when it came to a team member. I don't know if I just became more approachable after doing so. I don't know how it particularly seemed to them in the full aspect, but they were generally very very cooperative as time went by and what not.

Mark: You noticed more cooperation over time? Or it's pretty-

Ysmael: Yes.

Mark: Oh, really? Okay.

Ysmael: Definitely more cooperation. And it was crazy 'cause one of our group members had dropped out, so then we were missing a group member during that semester as well,

so it didn't really affect too much, so I'm really happy about that. Just 'cause one of our people leave we don't [inaudible 00:19:53] or decide to throw everything out the window. I was really really happy about that, so. I don't know, I feel like I'm generally an approachable person, so whenever I did do those things, it really didn't change if they liked me less or liked me more. But I did think I still helped at the end of the day the team relationship and whatnot. And how we communicated.

I noticed that they'd let me know things a little bit earlier, 'cause I felt like they used to be scared about saying things, if they were scared to turn something in a little bit later. 'Cause I like turning things in a little bit earlier just so we know this is the time we're turning it in, so we know this is the time to get it done by. Just 'cause 11:59, we're just gonna wait until 11:50 and then do whatever they wanna do. So I didn't notice that. Well, generally they would just come to me late with a lot of stuff, but they were on top of it I guess when it came to asking me different questions or turning in their work and whatnot. So I guess it did improve, but not really our relationships, but the communication it did improve, yeah.

Mark: That's great. So moving forward what do you think your I guess mindfulness practice is going to look like?

Ysmael: I feel like one way I'm keeping this continuously going is the calendars. I'm definitely gonna keep up with my calendars and by putting every little thing on there. The meditation and all those different practices that has to do with setting your mind in that right ... I guess position to do the things you want so you can excel at it. I would definitely take that from it forever I guess. That's a skill skill. I feel like I'm always gonna

be in a team as well, moving on to my career, so I'm gonna take all that stuff from the generic skills and whatnot from the course. I feel like it was a pretty pretty good course or program for engineering students when it came to mindfulness and whatnot. I never think engineering whenever mindfulness comes-

Mark: I don't think many people do.

Ysmael: So it really did correlate and it really did help surprisingly so that was crazy.

Mark: That's awesome. So I imagine you'd probably recommend the program to your friends?

Ysmael: Oh, of course I do all the time.

Mark: I'm curious the setting of the program was more positioned as an extracurricular thing that you guys could self enroll in if it resonated with you guys. And I was a little ... I don't want to say misleading, but vague in terms of how I describe the program in the flyers and so forth. And it wasn't obvious it was going to be a mindfulness program. And I'm just curious from your perspective, do you think a program like this should be integrated more formally in the engineering curriculum as maybe part of the ASU 101 class or another way? Or do you think it's positioned well as a extracurricular program that students ... that's more optional?

Ysmael: I think it should be incorporated like ASU 101 is and stuff like that. Just 'cause it's a lot of life skills and whatnot that is very involved in their career, but at the same time they can use this in their day to day struggles. And there's a lot of people that deal with a lot of stuff, especially freshmen I feel like. It's new to them, it's new to us, so it's ...

I don't know, it's a whole entire new world whenever we get to college. So that mindfulness course ... 'cause I feel like either two things happen in college. You get there and you have too much fun, or you don't have enough fun. And so I feel like that mindfulness class will really help people plan their zen mode, their zen point where they know what's going on. Or they know not just too much fun, they can have a little bit more fun and whatnot. I feel like it would be really really really really helpful [inaudible 00:24:33]

Mark: Yeah, that makes a lot of sense. There's something everyone could take away from it. The people that are maybe too carefree can find more balance the other way, and the people that maybe stress a little bit too much can go the other way and relax more. Yeah, that's cool, that's a good way of putting it. I've never really thought about it that way. So that's all the formal questions I have, is there anything we might have missed that you wanna discuss related to the program?

Ysmael: I think we did generally everything. I don't know, it's a little bit of time ago, but I think we did.

JESSICA SECOND INTERVIEW TRANSCRIPT

Mark: I'll start recording, and the first question I have, I'm just going to move this window here so I can take a few notes. I mean, now it's been a few months since the conclusion of the program. I remember when we talked before you had mentioned some things that you noticed, and so specifically, in the survey, you kind of get an idea now of what constructs I was particularly measuring. Like mindfulness, resilience, empathy and so forth. Now that it's been a few months, what do you think, do you think your mindfulness has really changed from the conclusion of the program?

Amy: I think it's changed a little bit. The program definitely helps, like opened my eyes to a lot of things I never thought of before. As well as my parents are always kind of pushing towards mindfulness as well. It all kind of like worked together. I think, yeah. I mean, part of it is my own values, just especially if I walk alone at night, always be mindful of what's around me, things like that. I definitely, okay.

The one thing for sure that the program influenced me on was putting down my phone more and just being able to see more that's around me, and not just always staying connected to the Internet. I think sometimes now I do just think on my own. I don't really do anything all the time. I can just sit down and think, I guess. That really helped a lot. Yeah.

Mark: What do you think, are there any benefits of kind of integrating these new things into your life of maybe putting down the phone more, paying attention to what's around you, or being able to think by yourself?

Amy: Yeah. It's the way I can organize my thoughts. A lot of times when I'm feeling stressed, it's a way that I can cope with my stress is to just think. Sometimes just take a break. Like stop looking at the things I keep looking at, whether it be online, or maybe a person I'm dealing with. A lot of times just kind of focusing my attention back to myself and sometimes like spending time doing things that I enjoy, and that really hold my attention away from distractions.

Mark: Yeah. That all kind of fits the mode of mindfulness, just kind of focusing your attention every now and then, regulating stress. That's awesome. Do you think since the conclusion of the program that your mindfulness has pretty much been stable? Or do you think it's even increased, or perhaps decreased?

Amy: Since the program, I think my mindfulness has stayed relatively stable and increased only slightly.

Mark: And increased what?

Amy: Slightly.

Mark: Okay. Okay. Then, this kind of connects to what you're already talking about, but resilience was also another construct I was interested in. It sounds like, based on some of the things you said, mindfulness has been able to help you cope with stress and things like that. Do you think your resilience has improved as a result of the program?

Amy: Oh yeah, definitely. I think it has. I guess, well, since I'm a freshman, this is more of, like high school is what I'm comparing it to. In high school, I got stressed over a lot of little things that I didn't really know how to cope with. Then now, because of the

resources that the program gave me, as well as just things I've been learning as I go, I can manage things a lot better. Sometimes I still feel overwhelmed. In general, I feel happier and able to overcome the stress easier.

Mark: Do you think your resilience has also remained relatively stable since the program? Or do you think you've experienced any changes in that? Or hard to tell?

Amy: Actually, I feel like my resilience has increased pretty significantly compared to the mindfulness.

Mark: Wow. Even since the conclusion of the program?

Amy: Yeah, I'd say so.

Mark: Wow.

Amy: Yeah.

Mark: Yeah, this is really interesting. How about for empathy?

Amy: I think my empathy has probably gone down a little bit since the program.

Mark: Okay. That's really interesting.

Amy: Yeah.

Mark: In what way do you think it's decreased?

Amy: I think because of all the other things that I'm trying to take on, I kind of don't spend as much time with people I care about, and like paying attention to other people's

needs, I guess. I mean I feel like I still understand how people feel. It's just I don't really always relate well to it. Yeah.

Mark: Just to clarify something, so from the program itself, like before and after, do you think you experienced a change in empathy? Or that was-

Amy: I feel like my empathy stayed about the same.

Mark: Okay. It stayed the same and then since the program you think it's even maybe gone down?

Amy: Yeah.

Mark: Okay.

Amy: Probably. Yeah.

Mark: Okay, great. Have you maintained some sort of mindfulness practice since the program? I think you started to talk about a few things you do. Like going on a walk and noticing what's around you. On an average day, is that something you do often?

Amy: In a sense, yes. In different ways. It's not always intentional, but I find myself at least once or twice a day, just kind of being really aware of my surroundings and how I'm feeling and just everything that's going on. It's sort of appreciation. I take a moment to really appreciate the things around me and pay attention to what's around me. Yeah, I'd say so.

Mark: That's not something you really had before?

Amy: Not as much.

Mark: Not as frequent.

Amy: I used to, but less so.

Mark: Okay. Okay. This is kind of a broad question to start and we can certainly narrow the focus in maybe some follow up questions, but without me kind of pinpointing certain areas I want to hear, is there anything that you took away from the mindfulness program that has influenced your experience as an engineering student?

Amy: Hmm. Yeah, that's pretty broad. Hold on.

Mark: Yeah, it's really broad. There's a lot of different directions you can take it, if there's anything at all.

Amy: Let me see. Actually yes, as an engineering student, one thing that I took away from the program itself is being able to focus on something that I'm doing, and just kind of get the motivation to do that in the moment. Instead of like putting it off and procrastinating. I actually do realize like after the program ended, I started finishing projects sooner. Even if it's due the next day, I would stay up late to work on it rather than wait until the last minute to do it. I know it's like a really strange thing, but something I used to do is wait until the very last minute, because I wanted to get my sleep instead of finish something, but I realized that actually finishing something is the most important thing to me. Instead of putting it off and giving myself even more stress at the very last minute. That's something that I've seen actually multiple times since the program that I've started doing. Yeah.

Mark: Yeah. It sounds like it's less stressful when you do that.

Amy: Yes.

Mark: Okay.

Amy: Yeah.

Mark: Okay. That's really interesting. I probably would not have asked about that in particular. I'm glad you brought that up. That's why I kind like to leave it open ended at first.

Amy: Uh Huh.

Mark: Uh Huh. In the survey, there is some skills in there that I think connects with emotional intelligence skills, which was like a big emphasis on the program is connecting mindfulness to emotional intelligence. Some of the ones I was looking at were interpersonal skills and teamwork skills, leadership skills, self-management. I'm forgetting one, critical thinking. Out of the ones I listed, have you noticed any changes in those particular skills? If it's not noticeable, that's totally fine.

Amy: Okay. I feel like self-management has been a noticeable difference. Let me see. Leadership, but in a different way. I used to kind of just take charge of a team, but in this kind of sense, I will take charge if I feel like I need to, but I'm more like open ended with a lot of the decisions, and I really want to listen to what other people say. Just kind of taking others into account, and being a leader in that sense. Critical thinking also in a sense. I guess what I'm thinking of with critical thinking is more like staying organized and thinking ahead towards the future. Like how am I going to plan this out so it works well in the future. That sounds critical thinking.

Mark: Yeah.

Amy: Yeah.

Mark: Thinking more about like your goals in a sense? Or just like things you have to do?

Amy: Both. I think both.

Mark: Both.

Amy: Yeah, short term and long term. Yeah.

Mark: Okay. I want to ask a little bit more about the leadership, because I think that's pretty interesting what you said that now you're kind of more open to others' opinions and stuff like that. Do you have any specific examples where you've noticed this, maybe in a group project? I'm also curious, how do you think that may have influenced the final outcome of the project, if you think it did in any way?

Amy: My biggest thought was from an event I did for [inaudible 00:14:08], because I was working with a lot of graduate students, and they were all skilled in their own areas. It kind of felt more like an engineering team. They were like a [inaudible 00:14:20] student, and then to electrical engineering students. Then, another girl and I were both freshmen engineering students, but she's, I think, computer science as well. I was kind of like in my own section of mechanical engineering and I felt like I could draw from other people's expertise, but I kind of had my own creativeness that I could contribute myself. In a lot of ways, like I would ask for their opinions for like, "Oh, how do you think this would be set up?" And like, "Will this work or like do this instead?"

Then, during a lot of the group planning and discussions that we had, I still contributed a lot and put a lot of my own ideas in there, but I wasn't too stubborn about it, especially because, I mean, I consider myself like relatively stubborn. If I get stuck on an idea, then I can't let go of it. Just kind of like staying open and thinking like, "Okay, if everyone thinks this is the best thing, then I will go along with it." Just do my best to suggest what I truly believe is right, but still being just like really cooperative and always communicating well, and things like that.

Mark: Okay. That's great. Do you think this is something, I guess, is this something different then, than how you would have approached things before?

Amy: Yeah. I think in the past, if I was put into this kind of situation, I wouldn't really be happy with the way we would be like taking the project, and then I would have probably made a lot of different decisions, because I wasn't fully committed to the idea that we had agreed upon and things like that. In that sense, I mean I would still work hard, but I think my mind wouldn't be as open to new ideas, to input to what has already been built upon. Yeah, I'd say in that sense I would have been just kind of, in a way, emotionally affected, because I'm too stubborn to accept the idea if I don't like it.

Mark: I see. It was kind of like before in group projects, you would prefer to have your ideas be the core focus of whatever you guys end up doing, versus now, it's like you'll still provide input and things like that, but you're also more open to mixing other people's ideas into the final deliverable of what you decide? Is that kind of accurate?

Amy: Yes.

Mark: Okay. Yeah, that's really, really good. That's a great skill you're developing. Then, the self-management part, I think you've talked a little bit already about that in the sense that you said that you focus a little bit better, you have less procrastination. You also said that you think about future things and larger goals, and stuff like that a little bit more than perhaps you did before. Are there any other connections to self-management that you've observed?

Amy: Well, since this school year started, I've been paying more attention to taking care of my health, just sleeping more. In a way, like keeping myself organized and clean, and in that sense self-management. Trying to like stick to a routine and take care of myself.

Mark: That's great. Do you think that has supported your wellbeing?

Amy: Oh, for sure. Yeah.

Mark: Okay. Trying to think if there's anything else I wanted to dive deeper into. Moving forward, do you think you want to maintain some sort of mindfulness practice?

Amy: Can you repeat the question? Sorry.

Mark: Yeah, I'm just curious. It sounds like you've integrated a form of mindfulness practice in your life and that, you know, the paying attention to what's around you and within yourself. Is that something you want to continue to grow on?

Amy: Yeah, I'd say so. There's always room for self improvement and being more connected, you know, things like that. There's always room for being more connected.

Mark: Okay. The last question is, this is more for myself, for my own personal interest, but I'm curious, would you recommend the program to your friends? I guess more so

what I'm getting at is like, did you enjoy, do you think this would be better positioned as it is right now, in terms of an extracurricular type program that's optional, or do you think this should be potentially more formally integrated into an engineering curriculum?

Amy: It's hard to say. I think the stuff that we learned in the program is something that everyone could benefit from. If it is a specific extra requirement for every engineer to have. It seems like it could be a lot for some people, especially because the engineering load does seem to be a lot already. Having it as an extra curricular works really well on its own. I mean if there's a way to integrate it in a sense, like maybe put elements of it into another existing class already.

Mark: Like ASU 101?

Amy: Yeah. Actually yeah, that's a really great idea. Because then it doesn't become like a whole new requirement, but it's something that will just add to the experience of what's already existing.

Mark: Okay.

Amy: Yeah.

Mark: Is this something that you'd recommend to your friends overall?

Amy: Yeah, I would.

Mark: Okay.

Amy: Yeah. For friends who care enough about their wellbeing, yes.

Mark: I think that's most people.

Amy: Yeah.

Mark: Okay. That was really, really good. I think I got a lot of great information. Is there anything else that we might've missed?

Amy: Not that I can think of. I feel like it was covering like the wide range of things that was relevant.

Mark: Yeah.

Amy: I think it was good.

APPENDIX I:

INDIVIDUAL STUDENT EFFECTS EXPERIENCED FROM PROGRAM

		Intrapersonal Skills					Interpersonal Skills			
	Mindfulness	Self-Awareness	Manage Stress / Resilience	Well-Being	Self-Regulated Learning	Total	Empathy	Communication / Listening	Leadership / Teamwork	Total
Charles	1		1			1	1	1		1
Amy	1	1	1	1	1	1	1	1	1	1
Stephen	1	1	1			1		1		1
Ysmael	1		1	1	1	1	1	1	1	1
Carla	1		1		1	1	1	1	1	1
Rodrigo	1	1	1	1	1	1	1	1	1	1
Sarah	1	1	1	1		1	1	1	1	1
Tanya			1			1				
Eve	1		1			1	1		1	1
Greg			1	1		1			1	1
Arthur	1	1	1	1	1	1	1	1	1	1
Shannon	1		1		1	1	1	1	1	1
Maria	1	1	1	1	1	1		1		1
Roy	1		1	1	1	1	1	1	1	1
Mary	1	1	1	1	1	1	1	1	1	1
George			1		1	1	1	1	1	1
Courtney	1	1	1	1	1	1	1	1	1	1
Natalie										
Sharon	1		1	1	1	1				
James	1			1		1				
Tanya	1	1	1	1		1	1	1	1	1
Jose	1	1	1		1	1	1	1	1	1
Naresh	1			1		1				

Joseph	1		1			1				
David	1		1	1	1	1				
Asaf	1	1		1	1	1				
Ravi	1			1		1		1		1
Jane	1	1	1			1		1		1
Harry	1				1	1		1		1
Joan										
Wade			1			1	1		1	1
Vishal	1				1	1				
Robert	1	1	1			1	1		1	1
Samantha	1	1	1			1	1			1
Gabriel	1	1	1		1	1	1	1	1	1
	29	15	27	17	18	33	19	20	18	25