I WILL NOT STAND IN MY WAY – EXPLORING THE EFFECTS OF
MINDFULNESS ON IMPOSTOR FEELINGS THROUGH SELF-AUTHORSHIP IN
FEMALE STEM GRADUATE STUDENTS

by

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ABSTRACT

Background: The impostor phenomenon (IP) describes a condition in which one has a feeling of intellectual phoniness, leaving one to doubt their ability to succeed. Research states that in particular, female STEM (science, technology, engineering, math) college students in male-dominated programs, such as engineering and computer science, are affected by such feelings. IP has shown consequences for female students' retention, feeling of belonging, and success, which contribute to STEM gender inequities. Recently it has been stated that strengthening the student's sense of self individually through mindfulness might be another avenue of support.

Purpose: Using self-authorship theory, and with that taking into account science identity development, the purpose is to explore and interpret the effects of mindfulness on female STEM graduate students' experience with IP in computer science and engineering and their advancement on the self-authorship trajectory.

Methods: Ten graduate and doctoral students participated in this exploratory, mixed-methods study, by completing an eight-week, self-led mindfulness program. The participants completed three semi-structured interviews, and weekly journals entries, including drawings. Four surveys were administered pre- and post-intervention.

Results: A Mindfulness Foundation was developed that supported the participants in internalizing mechanisms to deal with IP. Mindfulness also strengthened the participants' sense of self-authorship and a correlation of mindfulness, IP and self-authorship was identified.

Conclusion: The study emphasizes the importance of incorporating mindfulness into STEM graduate education due to its multifaceted impacts. Further underlined is the importance of giving female STEM graduate students the opportunity to uncover their impostor feelings, explore their science identity, and grow self-authorship for professional success and well-being.

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LIST OF ABBREVIATIONS

IP	Impostor Phenomenon
SAT	Self-Authorship Trajectory
STEM	Science, Technology, Engineering, Mathematics
MAAS	Mindfulness Attention Awareness Scale
CIPS	Clance Impostor Phenomenon Scale
ESAS	Emotional Self-Awareness Scale
WIALS	What I am Like Scale
U.S.	United States

CHAPTER ONE: INTRODUCTION

Many women in STEM graduate degree programs experience the impostor phenomenon (IP, e.g. Tao & Gloria, 2018), a condition that shows a pattern of specific personal doubt, described as intellectual phoniness (Clance & Imes, 1978). IP contributes to, among other issues, lower academic performance (Parkman, 2016), severe psychological and physical issues (e.g., Parkman, 2016; Cokely et al. 2013), and ultimately affects women's performance in STEM education (Chakraverty, 2019). Current trends show that female college students share, or approach equal enrollment numbers compared to their fellow male students in most STEM degree levels. However, within individual STEM graduate fields, especially in the computer sciences (CS) and engineering, a gender enrollment gap that favors male students, perseveres (National Science Foundation, 2019). In particular, graduate degree levels show gender differences across both disciplines overall. According to the National Center for Education Statistics only 31% of all master's degrees in CS programs and 25% of master's degrees in engineering and engineering technologies were earned by female students (National Science Foundation, 2019). These gender differences are worrisome on numerous accounts, not least of which are restricted career opportunities for women and the loss of a diverse workforce that could limit scientific innovation and technological progress (Tao & Gloria, 2019). Given that IP impacts women's success in STEM degree programs, it is arguably possible that IP is contributing to these statistics. Many studies have focused on addressing the negative impact and root factors of IP for women in STEM scholarship,

especially on an institutional level. However, given that the issue is still pervasive in many STEM degrees and professions (see Tao & Gloria, 2018; Chakraverty, 2019), additional interventions must be explored to offer affected students ways to cope with and overcome IP. This arguably includes opportunities on an intrapersonal level.

One possible avenue to improve intrapersonal strength might be found in mindfulness practices (MPs), which have received increased attention in education research. For the purposes of this study, mindfulness will be defined as introduced by Kabat-Zinn (1994) as “paying attention in a particular way: on purpose, in the present moment and non-judgmentally” (p. 4). Its positive influence on helping students overcome issues such as depression, anxiety, and stress are highlighted throughout the literature (e.g., Bellinger, DeCaro & Ralston, 2015; Bowlin & Baer, 2012). Especially important for this current study, mindfulness has been shown to strengthen individual’s academic self-efficacy and self-awareness (Bernay et al., 2016; Jennings & Jennings, 2013; Bowlin & Baer, 2012; Kemper & Khirallah, 2015), both of which are said to be lacking in individuals with IP (Hanley et al., 2015). However, here, academic self-efficacy and self-awareness are not understood to be stand-alone attributes, instead they are part of a larger theoretical approach known as self-authorship (Baxter Magolda, 1999). Self-authorship will provide a) the theory in which this study will be grounded in, and b) a phenomenon encompassing the potential growth that participants may experience in terms of mindfulness and IP, including improved academic self-efficacy and self-awareness.

Thus, the primary purpose of this mixed method study will be to explore and interpret the effects of mindfulness on female STEM graduate students’ experience with

managing IP. Additionally, the effects on students' advancement on the self-authorship trajectory (SAT) will be investigated. Specifically, the focus will be on female graduate students in CS and engineering degree programs. This study is socially significant on multiple levels: First, it will contribute to the gap in the literature concerning STEM graduate education and IP; second, it will contribute to the gap in the literature linking IP and mindfulness; third, more research that supports female students' academic success and self-authorship in STEM fields is needed. The first question that is guiding this research is:

1. How does mindfulness support female STEM graduate students in terms of managing the impostor phenomenon?

Based on the literature addressed in the following chapter, I posit that in response to research question one, mindfulness can have a positive influence on how female STEM graduate students manage the impostor phenomenon. In other words, mindfulness is anticipated to give the participants a 'toolbox' of practices that can help them to manage the negative effects of IP. Intrapersonal self-authorship is providing the theoretical framework for this study.

According to literature, the trajectory of intrapersonal self-authorship is showing potential similarities to the journey towards managing impostorism. In addition, both, the path to intrapersonal self-authorship and the journey to manage IP, require in some sense the development of a mindful awareness, which might be accomplished through the intervention in this study. Therefore, the second research question is:

2. How does mindfulness help people advance on the self-authorship trajectory, as seen through self-awareness and academic self-efficacy?

In terms of the second research question, I posit that mindfulness will support the participants in advancing on the intrapersonal self-authorship trajectory by moving them closer to an internal foundation of compromising between internal and external expectations. Thus, heightened mindfulness awareness is posited to and improve the participants' self-authorship, as seen through improved academic self-efficacy and self-awareness. This is anticipated to reflect the potential intrapersonal growth that participants can perceive.

In the next chapter I will provide more detail about the social significance in which this study is grounded, and explanations of the characteristics and frameworks surrounding IP and mindfulness, specifically as they may relate to female STEM graduate students. In addition, the theoretical framework of self-authorship and how it is utilized will be elaborated upon. Chapter 3 will describe the methodology, including the mindfulness program, and details about the participants, recruitment process, data collection, data analysis, subjectivities, as well as measures taken to support quality

CHAPTER TWO: LITERATURE REVIEW

Introduction

Through the lens of self-authorship theory (Baxter Magolda, 2014), as explained in the following Theoretical Framework section, this review of the literature aims to explore the effects of mindfulness practices on female STEM graduate students' experience with IP. First, I will provide a clear background about why it is socially significant to conduct this current research. Second, I address the characteristics of and assumptions made about IP as described in the literature, drawing on the phenomenon's original model by Clance and Imes (1978) as well as more recently published literature. IP is then further explored in terms of how it affects female STEM students in higher education, specifically in graduate school as well as in engineering and CS degrees, and a selection of previous interventions that have been created and utilized to support those with IP will be stated. An overview of mindfulness, its benefits, and its uses in educational spheres is offered as well. Lastly, I provide connections assumed in this research between mindfulness practices and impostorism.

Why Are We Still Missing Out? - The Social Significance of Studying Impostorism in Female STEM Graduate Students

Kets de Vries (2005) acknowledges that,

To some extent, of course, we are all impostors. We play roles on the stage of life, presenting a public self that differs from the private self we share with intimates

and morphing both selves as circumstances demand. Displaying a façade is part and parcel of the human condition. (p. 2)

According to this statement, IP is an integral part of many people's lives, but research shows that it can especially affect students in higher education (Parkman, 2016) in terms of their academic achievement, retention, diverse aspects of well-being, and reducing their future career aspirations (e.g. Dahlvig, 2013; Sakulku & Alexander, 2011). IP's negative outcomes have also been tied to the gender gap in male-dominated science fields, like engineering and computer science (e.g., Lewis et al., 2017). A neglect and underrepresentation of women in United States' (U.S.) STEM careers implies wide economic and intellectual impacts. First, given that the link between the technological skills an individual possesses, and their ultimate economic opportunities is still emphasized across western society, women's economic independence is influenced and even limited by their under-participation in the technological fields (Weinman & Cain, 1999). In short, if women are underrepresented in diverse STEM careers, many will miss out on high-paying job opportunities in industries that show high demand in the current economic landscape (Bystydzienski & Bird, 2006). Second, the U.S. is relying heavily on technological innovation and progress in order to compete on the world market and provide a strong economy (Tao & Gloria, 2019). Research has shown that a diversified workforce, which arguably includes a diverse spectrum of gender representation, can support such scientific innovation and technological progress (Tao & Gloria, 2019). Thus, missing out on the potential of female scientists means to miss out on different, potentially groundbreaking ideas and perspectives.

Brainard and Carlin (1998) addressed in the early discussions of the STEM gender gap that women students do not leave science and engineering degree programs because of limited academic ability, but due to a lack of what Shapiro and Sax (2011) later called, “scientific self-confidence.” Consequently, limited ability and knowledge cannot be considered a reasonable explanation, which is why sociocultural factors have become a focus in the literature. One such sociocultural focus is a student’s sense of belonging within their academic spaces (Lewis et al., 2017). Bostwick and Weinberg (2018), for example, found that women in STEM doctoral programs with no other female peers were less likely to finish their degree in the typical timeframe than women in programs with more than one female student. Thus, the quantity of female peers in degree cohorts is a crucial factor in terms of belonging and ultimately retention.

National calls for more equity and access in STEM education to account for increased diversity of thought, economic possibilities, as well as national success (McClelland & Holland, 2015) is a key factor in the importance of this current research. The other factor is that of the alarming consequences IP can have on female STEM graduate students and their potential to successfully complete their doctoral degrees. IP is a crucial barrier that keeps people from reaching their potentials and can affect their psychological and physical well-being dramatically, which in turn affects retention and academic success (Parkman, 2016).

Interventions have been implemented at both the institutional and group level to ameliorate IP (Tao & Gloria, 2019). However, in order to deal with impostor feelings, affected people may require support on an intrapersonal level as well, which has been understudied thus far. Accordingly, there is a lack of research concerning whether

mindfulness practices can positively influence individuals' experience with IP. Therefore, this current study addresses this lack of research and contributes to the existing literature concerning a) the gender gap in male-dominated STEM graduate programs, b) the underrepresentation of women in STEM careers, and c) the interventions to support those with IP. It also aims to offer practical recommendations in terms of viewing mindfulness practices as additional interventions to address IP and, consequently, support individual and societal calls for more equity and access in STEM.

Do I Even Belong Here? – Characteristics and Assumptions of the Impostor Phenomenon

Maya Angelou was quoted in the New York Times with the following statement: “I have written 11 books, but each time I think, ‘Uh oh, they’re going to find out now. I’ve run a game on everybody, and they’re going to find me out’” (Richards, 2015, para. 7). Angelou, an American poet, singer, memoirist, and civil rights activist, describes a common phenomenon many high-achieving and successful people suffer from: Impostorism. The Impostor Phenomenon, or impostorism, was introduced by Pauline Rose Clance and Suzanne Ament Imes in 1978 (Clance & Imes, 1978). The researchers worked with over 150 successful, high-achieving women and observed a pattern of self-doubt towards personal success and abilities, as well as an overall feeling of not belonging. Clance and Imes (1978) explain that, “Women who experience the impostor phenomenon maintain a strong belief that they are not intelligent; in fact, they are convinced that they have fooled anyone who thinks otherwise” (p. 241). Such feelings – known as intellectual phoniness – in high-achieving people, cannot be solved through repeated and long-term evidence-based successes.

In fact, individuals who experience feelings of IP (also called *impostors*) create explanations for their achievements to be justified (Chapman, 2017). These justifications include luck, happenstance, or supervisors having such low expectations that they are easy to reach. (Sakulku, 2011; Sakulku & Alexander, 2015). These self-created explanations contribute to a constant fear that the impostor's imaginary identity of being a phony will be discovered and their unintelligent self will come to the surface (McGregor, Gee & Posey, 2008). Therefore, impostors create several self-protecting behaviors that ultimately result in maintaining IP and feelings of not belonging. Accordingly, IP is critically linked to low self-efficacy research, which only emphasizes that IP is an intrapersonal phenomenon (Jöstl et al., 2012). According to Clance and Imes (1978), one IP self-protecting behavior is diligent and hard work that the impostor hopes will evolve into good grades and/or performance. This can result in temporary approval and satisfaction and cover up the concern of low intelligence. A second behavior is said to be "intellectual inauthenticity" (p. 244), where individuals shy away from sharing their personal thoughts and ideas but rather take up on those of their supervisors, colleagues, or professors, in order to not be viewed as a failure. In addition, seeking perfectionism is another primary behavior of impostors and puts strains on their mental and overall health (Sakulku & Alexander, 2011).

Due to a constant depressive self-awareness and self-efficacy (Royse Roskowski, 2010), internalizing failure, as well as meticulously over-emphasizing past and present mistakes, impostors' day-to-day companions are stress, unease, and anxiety (Dahlvig, 2013; Parkman, 2016). McGregor, Gee and Posey (2008) acknowledged a relationship between depressive symptoms among college students and their impostorism scores.

Additionally, burnout has been highlighted as a common effect of over-working, stress, and a workaholic-like behavior resulting from IP (Kumar & Jagacinski, 2006; Villwock et al., 2016). Other outcomes are low conscientiousness (Bernard et al., 2002) and also narcissism (Gibson-Beverly & Schwartz, 2008). Although some studies suggest that impostor feelings can enable someone to work harder and over-prepare in a positive sense of performance and success (Caselman, Self, & Self, 2006), it can also transition into negative work traits such as procrastination or less effort (Cowman & Ferrari, 2002; Want & Kleitman, 2006).

Since IP was established through research with primarily white, female participants, many other scholars from various fields have expanded the examination with diverse populations. Peteet, Montgomery and Weekes (2015) have found correlations specifically between ethnic minority students' IP scores and their first-generation status, psychological well-being, and ethnic identity. In a study conducted by Lige, Pettee and Brown (2017) the authors examined a mediation model relating private regard, self-esteem, and IP in a sample of African American undergraduate students. The results suggest support for the model in that participants who felt positively about African Americans and their belonging in a group were likely to show higher self-esteem and consequently lower levels of IP. Additionally, researchers have explored IP and its link to academic success (Thompson, Davis, & Davidson, 1998; Parkman, 2016; Ramsey & Brown, 2018), gender stigma consciousness (Cokley et al., 2015), IP among young adults transitioning into professional life (Lane, 2016), connections to type A personality (Hayes & Davis, 1993), and IP's impact on coping with stress concerning work outcomes and job satisfaction (Hutchins, Penney & Sublett, 2017). Taking this wealth of research

into account, impostorism can be described as lacking the ability to accurately practice self-assessment with attention to performance (Want & Kleitman, 2006) and ultimately becoming numb to abnormally high feelings of self-doubt. Thus, lesser self-awareness and (academic) self-efficacy are shown to accompany impostors (Dahlvig, 2013).

Impostors' Attributes: Negative Academic Self-efficacy and Self-awareness

Impostors show certain characteristics that reinforce their feelings of intellectual phoniness over time, despite evidence of success and intelligence (Harvey & Katz, 1985). Two of these main attributes are negative academic self-efficacy (e.g. Jöstl et al., 2012) and negative self-awareness (Mount & Tardanico, 2014). In turn, positive self-efficacy and self-awareness are both crucial in supporting impostors through their journey of realizing success; a negative relationship to both concepts has been linked to negative well-being, decreased academic and personal success, and an inability to cope with stress and function in social settings (Bandura, 1989; Hudson, 2007; Richards, Campenni & Muse-Burke, 2010). Because academic self-efficacy and self-awareness have also been related to retention and academic excellence in higher education (e.g., Tao & Gloria, 2019) and show a great intrapersonal component, the following will introduce research about each concept and their connections to IP and female STEM graduate students.

Academic Self-Efficacy

Self-efficacy in this research is consistent with Bandura's (1989) definition, which refers to one's beliefs about their own ability to organize and eventually conduct necessary steps that lead to a desired success. Consequently, academic self-efficacy is described as the perceived confidence individuals have in their own task performance and achievement in academic contexts (Komarraju & Nadler, 2013). Bandura (1989)

highlighted that the concept of self-efficacy has many dimensions and is important for the social-cognitive abilities a person possesses as well as their agentic approaches, purposefulness, proactiveness, self-regulation and understanding of self, making it an interpersonal as well as an intrapersonal component of people's lives. The interpretations of one's ability and confidence are largely dependent on existing self-beliefs and has been associated with directly affecting a person's motivation to succeed in future situations (Pajares, 1996).

A wide variety of research has been conducted on this academic self-efficacy, especially in the spheres of educational psychology as it relates to predicting students' academic success and differences by gender (Lewis et al., 2017). For example, it has been found that academic self-efficacy shows a positive relationship with academic performance (Hudson, 2007; Honicke & Broadbent, 2016) and persistence in degree programs (Bouffard-Bouchard, Parent, & Larivee, 1991). Scholars have also directly researched the connection between academic self-efficacy and IP. In 1998, Thompson et al. found a negative correlation between IP and academic self-efficacy. More recently, Tao and Gloria (2019) explored the relationship between impostorism and 224 female STEM doctoral students' self-efficacy, perceptions of the research-training environment, and their attitudes toward academic persistence. The results echoed those of Thompson et al. (1998) and showed that participants identifying more highly with IP characteristics reported lower self-efficacy, increased negative beliefs concerning their academics, and more pessimistic views about their doctoral studies.

Self-awareness

Self-awareness is a fundamental factor for positive mental health (Carson & Langer, 2006). Carver (2003) explained that self-awareness is an integral indicator for the complex processes between human thought and actions. This means, “people can represent the self abstractly, think about their thoughts and experience, and judge their ideas and actions in light of abstract goals and standards” (Silvia & Philips, 2013, p.114). Richards, Campenni and Muse-Burke (2010) studied self-care and well-being in mental health professionals in terms of how they can be affected by self-awareness and mindfulness. The study showed that practicing mindfulness is a valid mediator between self-care and wellbeing, and implied an increased sense of self-awareness within the participants. This contributes to prior research, stating that self-awareness is a crucial factor in people’s self-care and well-being, in order to sustain stressful situations and circumstances (e.g., Coster & Schwebel, 1997).

In terms of IP, Clance et al. (1995) stated that impostors show a disconnect between self-awareness and reality, which leads them to not realize their own potentials. Thus, increasing self-awareness is a major component of successfully dealing with impostor feelings. In terms of the correlation between IP and self-awareness, Mount and Tardanico (2014) stated that embodying self-awareness about one’s personal strengths and accomplishments is a first step to coping with impostor feelings, which has been supported by Seritan and Mehta (2015) as well. Lastly, while exploring the link between attachment as an organizational framework to study close relationships, Hazan and Shaver (1994) showed that anxious attachment – relying on others due to a negative sense of self – is a predictor for impostor feelings.

Fitting in or Opting Out? - Women and the Impostor Phenomenon in Higher Education

Higher education is embedded in an environment of high performance, which can produce certain pressures and expectations that contribute to students' negative mental and physical well-being (Chakraverty, 2019). Prior studies have addressed these concerns and highlighted the connection to IP (Parkman, 2016). According to Shapiro and Sax (2011), women's interest and retention in STEM education is affected by four major components; three of them are specific to higher education. For one, the culture and pedagogy women are exposed to in college STEM classrooms is crucial to increase retention and learner satisfaction. The authors suggest that due to the high competitiveness, the 'cold climate' in STEM classrooms, and the lack of collaborative learning, women feel less comfortable and may face more challenges to persist than their male peers. Another component Shapiro and Sax (2011) identified as an influential aspect for women concerning the college STEM degrees was peer-and-curriculum connections in the college program overall. Similar to the classroom climate, this aspect emphasizes the importance of collaboration and healthy competitiveness, instead of mere focus on individual success. Thus, the access to female faculty and the overall program culture are significant factors to build confidence in students' ability to succeed and strive.

The last college concerning aspect addressed the interactions with teachers and faculty that female STEM students have (or not). The authors address the lack of female role models in such positions and with this, point out the missing mentor relationships and applicable discussions about the reality and future for women in STEM in and beyond higher education. That female students have limited opportunities to connect with

same-sex role models and mentors as compared to men has been discussed in the literature. Blickenstaff (2005) noted that a low representation of women in a discipline can send the message that the field is “unattractive to women, and they should avoid it” (p. 376). Thus, same-sex faculty and professional role models can support women students to be more confident and encouraged that they can succeed in STEM majors and careers in the present and future, which allows them to overcome some of the negative stereotypes about having a career in STEM (Kim, Fann, & Misa Escalante, 2011). In addition, having discussions about mutual and/or similar experiences can bring about strategies to work through such barriers (Lewis et al., 2017). Young et al. (2013) found that women undergraduate STEM majors that reported favorable perceptions of their women STEM professors had a stronger tendency to connect science to feminine attributes than those that did not.

Beyond Shapiro and Sax’s (2011) suggested factors, another factor that influences women’s experience of IP in STEM degrees is the perceived extent of effort and struggle that is needed to succeed. This approach is taken by Smith et al. (2013) and is supported by their findings where female STEM graduate students believed they had to show more effort to achieve success than their peers. This influenced their feelings of belonging and motivation negatively. Male peers did not, however, express the same feelings when they were in the same situation. The authors suggest further that such effort expenditure perceptions are dependent on whether the field of study is known as male-dominated. In other words, if it is emphasized particular degrees are male-dominated, women express higher effort expenditure perceptions and thus, their feeling of belonging and motivation will likely decrease. In a study to assess gender issues experienced by graduate students

at Princeton University, researchers could conclude that most gender differences were dependent on departmental gender compositions and climates (Williams & Korn, 2018). More specifically, women students reported lower belonging and inclusion perceptions than male students only in male-dominated programs. In addition to this, even though many women show qualifications similar to or even better than those provided by their male peers, they are more inclined to question their abilities in math and the sciences (e.g., Steffens & Jelenec, 2011).

While there are many more examples of how female STEM students perceive, experience, persist, and struggle in present and past STEM domains, a few key findings emerge from the literature provided: First, female STEM students are victims of a wide variety of stereotyping and fixed social assumptions towards their ability and belonging in STEM. Second, a feeling of belonging must be established by the college community, but the student has to be open to and consciously aware of this culture as well. Third, both aspects (pressure on personal ability to success and the feeling of belonging) are connected to the characteristics of impostors as noted in the research. While the literature on IP in higher education is increasing, research on this phenomenon in graduate school in particular has not been extensively focused on (Chakraverty, 2019), meaning that this current research will contribute to closing the gaps in this certain literature domain.

STEM Graduate School as a Potential Catalyst for Impostorism in Female Students.

Doctoral training is a complex, time-intensive process in which novice students are introduced into a career field, learn to work independently and creatively, develop scientific skills, undergo psychosocial transformation and train to become independent knowledge producers (Lovitts, 2005; Etzkowitz, Kemelgor & Uzzi, 2000). Those who

feel like impostors may be susceptible to struggling through their training, despite their competence (Chakraverty, 2019). Yet, literature on how especially female graduate students – both at the master and doctoral level – perceive and internalize IP and the role graduate school climate plays in understanding impostor feelings shows gaps (Chakraverty, 2019).

Studies discussing IP in graduate level programs have been conducted with physician assistant students (Mattie, Gietzen, Davis & Prata, 2008), as well as in the fields of psychology (Gibson-Beverly & Schwartz, 2008), nursing (Huffstutler & Varnell, 2006; Vance, 2002), molecular biology (Pinker, 2009), and the field of astronomy and astrophysics (Ivie & Ephraim, 2009). Indeed, prior studies have shown that female students may be more likely to experience IP in graduate school. Jöstl et al. (2012) studied 631 Austrian doctoral students, over 50% of whom were women, and female PhD students reported higher IP perceptions. Cope-Watson and Betts (2010) found through autoethnographic research with two female doctoral students that the systemic expectations of higher education and the uncertainty about behavior rules in these settings produced insecurities about being a woman in academia. Pell (1996) agrees that the unfamiliarity with the culture and the unwritten norms of academia are a pressure point for graduate students, regardless of gender.

Women in Engineering and Computer Science

IP research is not extensive across graduate level STEM programs yet. However, some related studies across higher education have been conducted concerning engineering and computer science (CS). In terms of women in engineering degrees, gender stereotypes addressing who is and could make a good engineer have been retained

throughout history and across degree levels (Muller, 2003). Such gender stigmas have contributed to keeping female students away from finishing or attending such a degree in addition to limited perceived support among women engineers (e.g. Goodman, 2002; Jenks & Maninder, 2005; Rosser, 2003).

Murphy, Steele, and Gross (2007) conducted a study researching the so-called 'cue hypothesis', which proposes that situational cues, like settings and organizations, can have an impact on vulnerable populations and cause a social identity threat. In their study, female and male math, science, and engineering (MSE) students viewed an MSE conference video that showed a) a balanced gender ratio or b) a similar video that visually communicated an unbalanced gender distribution. Women, who viewed the unbalanced version expressed careful cognitive and physiological observations, whereas women watching the gender balanced video did not. Additionally, women watching the unbalanced video reported decreased feelings of belonging and would less likely want to participate in the conference. Their male peers were reported to be significantly less affected by either version of the video. Similarly, Sankar, Gilmartin, and Sobel (2015) examined the feelings of belonging and confidence among female CS students. They acknowledge that many talented female students choose not to pursue a career in the CS field or choose to drop out of a computer science degree because of isolation in male-dominated classrooms. This complements Lewis et al.'s (2013) suggestion that due to the gender gap factor and fewer female mentors in their field, women in CS may require a greater sense of belonging than the men in their classrooms. Ilias and Kordaki (2006) highlight that feeling out of place in the classroom and degree cohort is a main contributor to women's low academic self-esteem. That the low number of women in CS

research can negatively affect psychological well-being of female students has also been stated by Cheryan et al. (2011).

According to the examples of the research addressed thus far, stereotyping and gender stigmas play a significant role in whether and how female students experience IP in engineering and computer science programs. Language that calls out stereotypes and inequities in STEM might trigger and potentially worsen the participants' experience with IP. Consequently, a primary concern in this study is that becoming mindful of stereotype threat may result in worsening impostorism. This current study will be attentive to how IP is talked about during the intervention and particularly during the interviews with participating students. Thus, the interview questions are designed to prevent such a threat by asking careful questions. Rather than acknowledging and pointing out that IP can be a threatening phenomenon the questions ask the interviewee to elaborate on their personal experiences and perceptions of their place and belonging in STEM. If nonetheless stereotype threat is detected by the researcher, it is their responsibility to observe the participants reaction, to be open about the situation, and to support the participant in working through the emotions the threat created. Depending on the outcomes of the intervention, one potential discussion point might address the investigation of the stereotype threat concern.

How to Break the Impostor Cycle? – Previous Interventions to Cope with Impostorism

Since IP was defined as an issue, interventions have been created to counteract its negative implications. Yet in the literature, the focus on institutional and group interventions is emphasized rather than a focus on intrapersonal components (e.g.,

Parkman, 2016; Tao & Gloria, 2019). Further, there is limited research on how to offer support to individuals to manage stress and expectations, once they have found themselves in the STEM fields, specifically for those who experience impostor feelings (Chakraverty, 2019). Tao and Gloria (2019) stated that STEM departments have a potential role in helping their students persist and should consider creating early opportunities for collaborative research and embed an early culture of accomplishment in their student body. In addition, they say that parents and teachers need to be aware of the effects of gender-based stereotypes and have to openly address such.

The departments of student, academic, multi-cultural affairs and counseling in many academic institutions have created workshops for students to help them define success, identify strengths and weaknesses, cope with failures, realize perfectionism and set more attainable personal expectations (Cokely et al., 2013). Such programs have also been put into practice for college faculty and staff. Peer groups, mentoring, and identification of organizational expectations (especially those that create high anxiety) were found to positively support students overall academic persistence (Huffstutler & Varnell, 2006). In these lines, university orientation workshops have included the issue of IP in their programs in order to spread awareness and support (Mount & Tardanico, 2014; Parkman, 2016). Vergauwe et al. (2015) have highlighted that an enhancement of workplace social support has potential to ease some of the effects of IP. Other support recommendations have included using a multifaceted structured feedback concept (Fulmer & Conger, 2004), appropriate selection of mentors (Huffstutler & Varnell, 2006), as well as clear designed and transparent learning outcome expectations (Hutchins, 2015; Vergauwe et al., 2014). The outcome of these interventions is mixed

and dependent on the individual that is receiving the intervention. However, raising awareness about IP and offering opportunities to manage it through institutional and group support has showed overall positive impact in the studies addressed in this section.

Turning the Focus Inward – Exploring Mindfulness to Cope with Impostor Phenomenon

The essential concept of mindfulness is the main element of the Buddha's lectures (Grossman & Van Dam, 2011). While playing some part in many religions and spiritual traditions, mindfulness is thus especially relevant in Buddhism (Bernay et al., 2016; Ergas, 2013). The Western word 'mindfulness' is said to be introduced as a translation of the Pali term *sati* by religious scholar T.W. Rhys Davids in 1881, and also means 'to remember', such as "to remember to maintain awareness" (Grossman & Van Dam, 2011, p. 220). *Sati* is an essential concept within the *Satipatthana sutta*, which is declared to be the most important text on the creation of mindfulness (Rahula, 1959). However, Buddhism scholars and Western scientists are still in negotiation about one distinct and shared definition of *sati* (Gethin, 2011).

This study relies on Kabat-Zinn's (1994) framework of mindfulness, in which he describes mindfulness simply as "paying attention in a particular way: on purpose, in the present moment and non-judgmentally" (p. 4). Other scholars have drawn on this definition and added to its elements. Creswell et al. (2014) acknowledged that being mindful is the ability to "openly attend, with awareness, to what is happening in one's present-moment experience" (p. 401). This open awareness makes it possible to take the current situation fully in, no matter whether it shares a positive or negative experience, or somewhere in between. In essence, this adds to what Kabat-Zinn (1994) described as

non-judgmentally being present, where a person is open to new perspectives with a curious mind and general interest, while accepting their uniqueness. These abilities, to be both aware of one's self in the current situation and to imply acceptance of diverse perspectives that shape the situation (e.g. other human beings, culture, etc.), are the most repeated elements of mindfulness in western literature (Quaglia et al., 2015).

Technology, contemporary economic and social philosophies, as well as pressure to succeed from a young age, leave many people captured in outside distractions and away from the self (Germer & Barnhofer, 2017). People are left, essentially, mind-less. Mindful practices – the systematic practice of contemplation and awareness to concentrate on the present – have been used to conquer such concerns (Hwang & Kearney, 2015). Current applications of mindful practices are still rooted in the traditions of contemplative Buddhism. Meditation and yoga practices are the most common activities that have been studied to enhance mindfulness. Additionally, a core component of mindfulness is the focus on the breath. Bernay et al. (2016) pointed out that rhythmic breathing is known to decrease nervousness and anxious behavior and increase focus and self-awareness.

The benefits of mindfulness have been addressed across a wide range of research. Among the positive outcomes is that getting to know certain techniques that can bring one closer to the state of mindfulness has shown to benefit behavioral regulation, especially self-control, and emotion regulation (Brockman et al., 2017; Brown, Ryan, & Creswell, 2007). Because mindfulness is positively related to attentiveness towards the self and others, aspects like communication, relationship quality, and empathy for others and oneself can be expected to increase to some extent when practicing mindfulness

(Brown, Ryan, & Creswell, 2007; Dekeyser et al., 2008). Prior research has stated that mindfulness supports well-being, it is a rooting factor of positive emotions, and it lowers stress-related illnesses like anxiety, pain, substance addiction and depression (Baer, 2003; Hofmann, Sawyer, Witt, & Oh, 2010). In addition, mindfulness has been linked to positively influence executive functioning (Zeidan et al., 2012), emotional regulation (Jazaieri et al., 2013), and reduce cognitive bias (Garland & Howard, 2013).

Mindfulness Practices from Awareness to Yoga

Mindfulness practices encompass a wide variety of activities including meditation, focused thought, deep breathing, visualizing, connection to nature, and artistic self-expression, which are all based on non-judgmental and critical first-person awareness, as well as focus and intention to the present (Ramasubramanian, 2017). What are said to be ‘real’ mindfulness practices and what is not depends largely on different schools of thought (Hanley et al., 2015). Most specific mindfulness program studies concentrate on modern mindfulness activities such as mindfulness-based stress reduction (Kabat-Zinn, 1990) or mindfulness-based cognitive therapy (Segal et al., 2002). They combine formal practices that focus on the breath, with rather informal exercises that aim to instill mindfulness in everyday activities, such as walking and eating (Hanley et al., 2015). On the other hand, compared to field experiments, laboratory studies focus primarily on formal mindfulness practices (e.g., Jha et al. 2007; Kramer et al. 2013). Some formal practices and modern practices will be explained next, but I will also address the informal ways that highlight how people can increase their mindful awareness though everyday life. However, it should be noted that no matter the type of practice, a

main goal of mindfulness is to become a more aware and engaged individual throughout life - not just during a temporary mindfulness practice (Hanh, 1975).

One formal mindfulness practice is mindful breathing, which can support participants in growing a more stable sense of focus, which is said to increase wellbeing and reduce stress (Greeson et al., 2014). This includes exercises such as breathing-focused meditation and everyday breath awareness activities. Mindful body movement has also been used as a foundation for establishing mental skills including attention, self-control and mindfulness (Clark, Schumann, & Mostofsky, 2015). Activities include but are not limited to yoga and tai chi. The third category, meditation, can include many kinds of exercises that help individuals de-stress, calm their minds, and widen their consciousness (Chen et al., 2012). The purpose of meditation is to reach pure awareness without getting wrapped up in content, which is a foundation of non-elaborative, non-judgmental awareness of the present moment experience — the definition of mindfulness (Tononi & Koch, 2015). Activities include the Body Scan, which emphasizes focus on different body parts; and the Raisin Meditation that involves a conscious attention toward every movement and sensation when eating a raisin. However, Hanley et al. (2015) suggest that mindfulness experience can be cultivated within diverse everyday activities of one's life, if intentionally engaged in such. As an example of more informal mindfulness practice, their study asked 51 college students to engage in either mindful dishwashing, stressing the importance of being in the moment and making intentional movements and decisions, or engage in normal unintentional dishwashing. The mindful dishwashing group reported an increased sense of mindfulness, elements of positive affect, and lessened negative effects, such as nervousness.

Mindfulness in the Classroom

The path of integrating mindfulness activities into education has not been a straightforward approach. The foreign vocabulary and spiritual characteristics kept western societies and scholarship mostly at distance (Germer, 2004). Yet, over time, it found its way into such spheres and one concrete event in the exploration of western mindfulness has been said to have taken place in 1979, when mindfulness-based stress reduction (MBSR), created by John Kabat-Zinn, received a place to live and evolve in the Stress Reduction Clinic at the University of Massachusetts Medical Center (Williams & Kabat-Zinn, 2011). Medicine and psychology were two of the first scholarly fields to research mindfulness, while education remained skeptical for a long time (Ergas, 2013). However, there were some early education scholars who highlighted the effects of mindfulness and contemplation for people's well-being and linked them to their studies in teaching and learning many years before. William James (1890), for example, wrote his *Principles of Psychology* in the 1890s, where he introduced four teaching methods, including introspection. James ends his work with a quote, which is well-cited in current contemplative education and pedagogy:

The faculty of voluntarily bringing back a wandering attention, over and over again, is the very root of judgment, character, and will [...] An education which should improve this faculty would be the education par excellence. But it is easier to define this ideal than to give practical for bringing it about. (James, 1890, p. 424)

Even though mindful education research has not been established for long, there is a reasonable chance that this part of scholarship will continue to disrupt conservative forms

of teaching and learning to highlight the whole student's growth, as current research projects demonstrate (e.g. Ergas, 2013; Berto & Barbiero, 2016). Certainly, a substantial number of academic reviews and meta-analyses have compiled the increasing evidence for beneficial effects of mindfulness, yoga, and meditation in schools (e.g. Meiklejohn et al. 2012; Felver et al, 2016). Such research is crucial to assess mindfulness intervention outcomes and test contemplative programs' efficacy to grow support and funding for this scholarship (Greenberg & Harris, 2011).

Contemplation and mindfulness have grown into a supplementary practice to support theories related to topics within education, including emotional intelligence, positive psychology, social and emotional learning (SEL; Durlak et al., 2011), holistic education (Miller, 2007), a positive classroom environment and anxiety management for students (Schwind et al., 2017), and others. Through this, a number of mindfulness related curricula have made their way into school systems, such as the mindfulness-in-schools project, which merged into the 'b curriculum', founded by Richard Burnett and Michael Cullen in Great Britain in 2007. The 'Whole Child' and 'Whole Student' approach considers the emotional needs and development of students as an important addition to factual knowledge of subject material (Lewallen et al., 2015). Both include mindfulness-based practices to help students emphasize their individual growth within the larger school systems (Lewallen et al., 2015). Other examples are the Mindfulness Education (ME) Program (Schonert Reichl & Lawlor, 2010), Cultivating Awareness and Resilience in Education (CARE; Jennings et. al., 2013), and the SMART-in-Education Program (e.g. Roeser et al., 2012).

Despite creating whole contemplative curricula, many scholars advocate for focusing on mindfulness activities in singular courses and using it throughout lessons of various topics (Ergas, 2013; Zajonc, 2009). Using mindfulness-based activities in the classroom has shown to support children and adolescents in enhancing their cognitive performance and benefit resilience toward stress and anxiety (Schwind et al., 2017; Zenner et al., 2014). As students spend extensive amounts of time in a school setting throughout their life, through education-related mindfulness practices and curricula, pupils can be familiarized with and learn skills that can support building resilience behaviors (Meiklejohn et al., 2012; Merrell, 2010). Growing research-based evidence shows that mindfulness activities can be beneficial in reaching this goal (Jennings et al., 2013). Resilience can be related to students' increased emotional regulation (Lam & Seiden, 2020), which has been shown to help improve relationships with peers and family (Bernay et al., 2016). In these terms, many scholars have grown interest in advocating for mindfulness in K-12 schools and higher education to support students' overall physical and psychological wellness well-being. Mindfulness has also been found to support students' attention, regulation of emotions, test anxiety, academic achievement, as well as reflective behaviors towards learning (Bakosh et al., 2015).

How Can We Connect the Pieces? – Making the Case for Linking Mindfulness and

IP

Limited previous studies have begun to explore the effect of mindfulness on impostor characteristics (e.g. Zanchetta et al., 2020; Schmulian, Redgen & Fleming, 2020). Yet, most studies had mixed results and called for qualitative, intervention driven research. The connection in this present research that links mindfulness practices and

impostor characteristics, is driven by the previously stated literature. Many aspects could be identified. However, in line with the theoretical self-authorship framework, the two strongest links are self-awareness and academic self-efficacy. While research has shown that impostors lack both self-awareness and academic self-efficacy, mindfulness practices have been acknowledged to support the development of both of these.

Hanley et al. (2015) stated that individuals who showed greater mindful awareness and behavior were more likely to engage in active, positive reappraisal, which increased their academic self-efficacy following a personally perceived academic failure. Sampl, Maran and Furtner (2017) concluded that using a mindfulness intervention in the college setting revealed significantly higher academic self-efficacy levels in the intervention group than in the control group. Other research suggests that self-awareness is important for self-regulation of behaviors (Carson & Langer, 2006). A study by Evans, Baer and Segerstrom (2009) found that mindfulness, especially its non-judging and non-reacting aspects, predicted stronger persistence on difficult tasks. Increased levels of mindfulness have been related to stronger self-awareness, understanding and acceptance of emotional reactions, and increased ability to correct or repair negative and harmful mood levels (Brown, Ryan & Creswell, 2007). As stated earlier, a key issue for impostors is their lack of ability to accurately engage in self-assessment with attention to high performance ability and thus becoming numb to extreme feelings of self-doubt. This self-doubt is highly related to low academic self-efficacy and self-awareness (Ramsey & Brown, 2018; Carson and Langer, 2006).

Consequently, if students suffering from IP are supported in increasing their academic self-efficacy and self-awareness, they might have a higher chance in coping

with impostor feelings. Mindfulness practices focus on cultivating personal awareness, which is connected to academic-self-efficacy. Figure 2.1 visualizes this initial connection made for this particular research between IP and mindfulness, and its potential implications.

Figure 2.1 Connecting Mindfulness and IP Through Academic Self-efficacy and Self-awareness

It is the purpose of this research to inquire the effects of mindfulness on female STEM graduate students' experience with managing IP and the effects on the students' advancement on the self-authorship trajectory. The intervention in this study focuses on creating a sense of belonging within the student, teaching empathy towards the self, and describing this development from the perspective of students' self-authorship in STEM.

The findings from this study will complement the existing work of researchers who a) strive to give female STEM students equitable opportunities to succeed (e.g., Lewis et al. 2017), and b) draw attention to mindfulness and its potential to support personal development in higher education (e.g., Patzak, Kollmayer & Schober, 2017). In addition, it is important to state that such an approach, along with other methods to support inclusivity, equity, and access in (STEM) education, should not be seen as an exclusive medium to focus on one group of individuals. While female STEM graduate students are the focus in this study, other minority and/or marginalized students could potentially profit from mindfulness interventions as well.

Theoretical Framework

The goals of graduate education are complex. They include enabling students to become critical thinkers and citizens, supporting them to succeed in their desired career field (Barber, King, & Baxter Magolda, 2013), and preparing the future generation of scholars (Borrego & Newswander, 2010). Such goals require the student to express intellectual and practical abilities, to navigate personal and social expectations, and to engage in experiential learning to utilize all of these aspects in addressing complex issues. The theory of self-authorship, as addressed by Baxter Magolda (1999), describes in a holistic way the journey individuals take during personal growth and change and has been used frequently in higher education related studies (e.g., Carpenter & Peña, 2017; Nadelson et al., 2017; Perez, 2017; Meszaros, 2007). Baxter Magolda's version of self-authorship theory draws on Robert Kegan's (1994) model of lifespan development and frames my theoretical approach for this study. Kegan (1994) called for more complex forms of education and educational formats in order to satisfy individuals' diverse

experiences and thoughts. His framework explains how he believed human consciousness develops across a person's lifetime, which he summarized in five orders of consciousness (Kegan, 1994). These stages range from infant consciousness (Order 0), where newborn infants are "living in an objectless world, a world in which everything sensed is taken to be an extension of the infant" (Kegan, 1982, p. 78), to the Self-Transforming Mind (Order 5), where people realize their "commonalities and interdependence with others" (Kegan, 1982, p. 239). Kegan (1994) described order 4, Self-Authoring Mind or Self-Authorship, as

...an ideology, an internal identity, a *self-authorship* that can coordinate, integrate, act upon, or invent values, beliefs, convictions, generalizations, ideals, abstractions, interpersonal loyalties, and intrapersonal states. It is no longer *authored* by them, it *authors them* and thereby achieves a personal authority (p. 185, emphasis original).

Baxter Magolda (e.g., Baxter Magolda & King, 2004) developed the self-authorship stage further into a theory that is rooted in her work with college students. Self-authoring people are open-minded to diverse perspectives, are aware of and reflect on their own values and motivations, and approach goals and perspectives that are well-rooted and evaluated as a basis for meaning making (Barber, King & Baxter Magolda, 2013). The theory encompasses three developmental dimensions to conceptualize how people interpret and analyze their experiences and what they mean to them (Baxter Magolda, 2004). First, the epistemological dimension of development addresses how individuals use assumptions regarding nature, limits, and knowledge certainty to weigh what to believe as true (Perry, 1970). Second, the interpersonal dimension, or

relationships with others, refers to establishing respect for self and others to create mature relationships. Third, the intrapersonal dimension emphasizes an individual's journey to internally select personal values to form a persistent and coherent identity rather than basing their identity only on the assimilation of external others' expectations (Kegan, 1994). The intrapersonal domain especially highlights an individual's internal navigation of their identity concept, which is interpreted here in terms of STEM identity and belonging in this field. In addition, intrapersonal self-authorship encompasses a mindful self-awareness that supports the navigation of internal (the student themselves) and external (e.g. stereotypes, stigmas, and immediate social environment) perceptions and expectations. This condition is supported by prior research, which calls for self-awareness as an important aspect and even prerequisite for self-authorship (Eriksen, 2009). The ability for individuals to establish a coherent STEM identity through developing intrapersonal self-authorship, is linked to their beliefs around academic self-efficacy. Meszaros, Creamer, and Lee (2009) stated that because self-authorship entails substantial self-reflection, it may overlap with self-efficacy. In turn, Pizzolato (2004) claims that a college student's lacking confidence in their abilities to academically succeed can diminish self-authorship.

Academic self-efficacy and self-awareness, or the lack thereof, are dominant aspects in each, mindfulness, self-authorship and IP. To make the connection stronger, in this current study, self-authorship draws on the participants' perception of *self-awareness* and academic *self-efficacy* in STEM related aspects. In this sense, a person with high intrapersonal self-authorship participating in this study, might say something along the lines of: "I am aware that stereotypes can influence how I think about myself in STEM.

Because I am aware of this, I know that self-doubt is not always reflecting my true abilities to succeed in the field.”

The journey toward self-authorship is conceptualized through four developmental steps (Baxter Magolda, 2001; Kegan, 1994). These steps can be conceptually related to the impostor phenomenon as well as a growing mindful awareness, as outlined in the following. The developmental trajectory towards self-authorship begins with a ‘Following Formulas’ stage that implies dependence on external voices or derived ways of thinking. This stage is characterized by a lack of (mindful) awareness of personal values and identity. Similar to people with high impostor rates, individuals in this stage have a high need for other peoples’ approval, which results in an identity framework that is externally defined and easily influenced. In relation to this, one may recall “intellectual inauthenticity” (Clance & Imes, 1978, p. 244) which entails conforming to others’ ideas rather than one’s own due to lack of confidence in personal abilities. A person in this stage does not have a mindful awareness of their own efficacy to succeed in academic STEM challenges.

Next, a person progresses through developmental ‘Crossroads’ (Baxter Magolda & King, 2012). Individuals in this state start to form an awareness of their own beliefs and values. They are beginning to explore their personal perspectives to eventually create an identity that is primarily based on their own perceptions, instead of others’ (Baxter Magolda, 2001). People who are in this phase of their journey to manage impostor feelings might have recognized that they are suffering from IP. Thus, they are in the midst of realizing their own potential but find themselves pulled back by feelings of impostor doubt, which hinders management tactics and behaviors.

The following two steps involve ‘Author of One’s Life’ and ‘Internal Foundation’ (Baxter Magolda, 2001). Both stages imply that the total development of self-authorship involves an internally established sense of self that guides the person’s interpretation of experience and decision making. Individuals are enabled to select and highlight personal identities and values while negotiating outside voices. Students who have founded a self-authorship and have eventually internalized it, are mindfully aware of their feelings and emotions concerning IP and have tools in place that support them in difficult situations. King and Baxter Magolda (2011) point out that learning in graduate education

...includes developing a frame of mind that allows students to put their knowledge in perspective; to understand the sources of their beliefs and values; and to establish a sense of self that enables them to participate effectively in a variety of personal, occupational, and community contexts. (p. 207)

Students who suffer from IP are caught unaware of their own strength and ability to succeed, their achievements are not put in a perspective or reality yet, and they cannot communicate their knowledge and sense of self to either themselves or others (Royse Roskowski, 2010). However, prior research has shown that mindfulness offers tools to establish a self-awareness and academic self-efficacy (e.g., Hanley et al., 2015; Sampl, Maran & Furtner, 2017), which according to research addressed above, are also necessary to enhance on the self-authorship trajectory as well as manage IP. To underline this approach, Creamer and Laughlin (2005) have acknowledged in their study concerning women’s career decision making that “by fostering self-authorship, educators may encourage women to explore a wide range of career options, including in fields where women traditionally have been underrepresented, such as STEM fields” (p. 26).

Self-authorship theory has been applied in the past by Meszaros, Creamer, and Lee (2009) to understand career choice decisions made by women to decide to enter or not to enter a CS job field. The authors said that conflicting assumptions and opinions are quite impactful in career decision making and requires strong self-knowledge, awareness and ways of meaning making. Therefore, self-authorship is a key part in career decision making since it theorizes how individuals make meaning of the advice and information they receive from outsiders, supports them in navigating negative feedback and stereotypes, and facilitates how personal reasoning is grounded in one's understanding of the self. Carpenter and Peña (2017) explore self-authorship in relation to first generation undergraduate students. The study highlights that to offer underrepresented student groups appropriate support and ensure their academic achievement it is necessary to understand their epistemological, intrapersonal, and interpersonal development as main contributing factors. In addition, Nadelson et al. (2015) utilized the theoretical lens of self-authorship to create a model for STEM student professional identity development. The study used self-authorship to investigate the relationship between how STEM students perceive their professional identities and how they understand their academic experiences, preferences in learning, and level of comfort with faculty communication.

Self-authorship offers a fitting theoretical approach for the current study on female STEM graduate students, their mindfulness and perception of impostorism. In this current study, the dimension offers links to mindfulness and IP especially through academic self-efficacy and self-awareness. As shown, the journey towards successfully managing IP can be linked to the journey of developing self-authorship for one's

academic abilities. Further, both journeys require the individual to establish a sense of self that is based on mindful reflection and awareness.

Summary

After reviewing the literature, it can be said that IP is affecting female STEM graduate students negatively on multiple levels, including academic performance and retention (e.g. Sankar, Gilmartin & Sobel, 2015), as well as physical and psychological well-being (e.g. Ilias & Kordaki, 2006). The implications of the consequences (e.g., depression, anxiety, and underperformance) can have great impact on the individual but can also affect national progress in STEM research (Weinman & Cain, 1999). The literature on IP and the link to (STEM) graduate education shows gaps that need to be addressed. Two of the primary attributes that impostors show concern low academic self-efficacy and negative self-awareness (Lewis et al., 2017; September et al., 2001). These missing ‘pieces’ can be found in the study and practice of mindfulness. Indeed, mindfulness has shown to improve individuals’ well-being (e.g. Brown, Ryan, & Creswell, 2007), academic success (see Felver et al., 2016), as well as academic self-efficacy and negative self-awareness (e.g. Bernay et al., 2016). Mindfulness, or the practice and state of being in the presence, has received increased attention in the field of education and is slowly transforming western classrooms to return its focus on the individual student (e.g., Ergas, 2013).

Linking IP and mindfulness can furthermore be related to the theory of self-authorship that includes an intrapersonal dimension in which individuals develop a more robust sense of self and learn to manage internal and external expectations (Baxter-

Magolda, 2014). The impact of IP on female STEM graduate students, on STEM degree cohorts, and the STEM industry is too heavy to be ignored. However, while some interventions have been developed, more support needs to be offered to strengthen the students from the inside and provide possibilities for personal growth (internal/external), academic confidence, and self-authorship.

CHAPTER THREE: METHODOLOGY

Introduction

The main purpose of this current mixed method study was to explore and interpret the effects of mindfulness on female STEM graduate students' experience with managing the impostor phenomenon and the effects of mindfulness on the students' advancement on self-authorship trajectory. Special focus was given to female graduate students in CS and engineering degree programs. It was hypothesized that mindfulness has a positive effect on students' academic self-efficacy and self-awareness, which supports them in dealing with impostor feelings. The research questions guiding this study were:

1. How does mindfulness support female STEM graduate students in terms of managing the impostor phenomenon?
2. How does mindfulness help people advance on the intrapersonal self-authorship trajectory?

To answer these questions, a qualitative mixed methods study was conducted (Creswell & Clark, 2007; Hesse-Biber, 2010) at a large urban university in the western part of the U.S. The mindfulness program intervention developed for this study took place during the summer 2020 semester and lasted eight weeks. It is reasonable to note that the study took place during the global COVID-19 pandemic. While the methodology of this current study was not greatly influenced by the pandemic (merely the interviews had to be conducted virtually instead of in person) it is an important background information that may further inform the findings. Qualitative and quantitative data was

collected in a sequential order, with a paradigm emphasis on qualitative data (see Figure 3.1). A sequential mixed-method design implies collecting and analyzing two types of data, qualitative and quantitative, whose research process phases are generally succeeding each other (Hesse-Biber, 2010). Fuentes (2008) justified her sequential exploratory mixed-method approach by stating that it provided her with “richer detail than either method can generate alone” (p. 1592), which was used as a key argument for using a mixed-method approach in this current study as well. To explore female STEM graduate students’ experience with IP while engaging in regular mindfulness activities, this current study emphasized qualitative data over the quantitative data, making it the dominant paradigm in this inquiry. Employing stronger emphasis on qualitative data offers benefits that will support the research inquiry in this study, as explained below.

As Hesse-Biber (2010) stated, qualitatively looking at data provides a wide range of possibilities of how social reality can be seen and does not privilege authority and power within a societal context. Besides highlighting academic equity and social change as main research aims, qualitative research promotes deep listening practices between the researcher and participant in order to achieve a “deeper and more genuine expressions of beliefs and values that emerge through dialogue [and] foster a more accurate description of views held” (Howe, 2004, p. 54). As such, the aim of the qualitative portion of this current study, including interviews and journal entries, was to give the participants the possibility to share and elaborate on their own experiences with IP and mindfulness. In addition, it gave me, as the researcher, the chance to ask clarifying questions and receive a more detailed picture of the relationship between IP and mindfulness, which arguably

depends on subjective experiences that together might form a breadth of possibilities to describe the link between both.

The quantitative component of this study entailed pre- and post- data collection and analysis of the participants' mindfulness and impostor perceptions (RQ1), as well as academic self-efficacy and self-awareness rates in order to assess self-authorship (RQ2), by using established instruments. The use of these instruments aimed to generalize the results of the qualitative study and will offer an additional, numerical perspective that can offer "evidence for a conclusion through convergence and corroboration of findings" (Johnson & Onwuegbuzie, 2004, p.21). Thus, by taking advantage of both qualitative and quantitative components in this research, I explored the research questions of this study while grounding findings in the participants' lived experiences and their voices gathered through qualitative data collection.

Figure 3.1 Sequential Exploratory Mixed Methods Design Outline

In the following sections, I describe the mindfulness intervention, its roots, and components. Second, the recruitment process is stated in detail, which is followed by a demographic overview of the participant pool. Third, qualitative and quantitative data collection and analysis methods are highlighted, including a timeline summarizing the

data collection events throughout the intervention. Lastly, subjectivities and how I addressed them are acknowledged.

Mindfulness Program

The mindfulness program (see Appendix A for a framework) in this study was adapted from the Learn to Breathe curriculum (L2B; Broderick, 2013), as well as from the Mindfulness-Based Stress Reduction (MBSR) program, developed by Kabat-Zinn (1982,1990). In addition to three weekly, formal mindfulness practices such as breathing exercises, yoga, and meditation, the program included informal practices, including mindful journaling activities and interpersonal mindfulness interviews with me as the researcher. The practice descriptions were adapted from the L2B curriculum workbook (Broderick, 2013) and from A Mindfulness-Based Stress Reduction Workbook (Stahl & Goldstein 2019), which is an established MBSR-inspired home workbook, written by certified MBSR instructors and mindfulness professionals. These workbooks were chosen because they are in close compliance with the L2B and the MBSR curriculum. In addition, the authors of these workbooks worked closely with the creators of the mindfulness programs to create the workbooks.

Interpersonal mindfulness and self-authorship interviews

Duncan, Coatsworth, and Greenberg (2009) defined interpersonal mindfulness as characterized by attentively listening: awareness of one's own and others' emotions in an interaction; openness, acceptance, and receptivity to thoughts and feelings of others; self-regulation in terms of responding to behaviors of others with controlled emotional and behavioral reactivity and low automaticity; and self-compassion and compassion for others. The usefulness of conducting the interviews using an interpersonal mindfulness

approach, was to first, establish a deeper research relationship between the participants and me as the researcher and to build trust and potentially receive more information and details as well as increase retention from the participant. Second, I was able to ask the participants to elaborate on certain aspects and observe the interviewees' body language while talking with them.

While interpersonal mindfulness will provide the framework and tools for how the interview was approached, the self-authorship interview model (Baxter Magolda, 2001) gave guidance for the questions asked. The behavioral guidelines for such an interview process are, in fact, similar to those of interpersonal interviewing. The interviewer's main task is to investigate how the interviewees construct themselves and be attentive to the shared interpretations and stories. This entails a focus on active listening, open-ended questions, non-judgement, and exploration through free-flowing conversations (Baxter Magolda & King, 2007). To those ends, I did not introduce the concept of self-authorship into the interview, nor did I place pressing emphasis on IP (also to avoid stereotype threat) but instead used invitational language that allowed students to define meaningful experiences that added to their development and growth in STEM. The interview questions focused on asking the interviewee to talk about themselves in the STEM field, their highs and lows, influences, and how they make sense of them (Baxter Magolda, 2001).

Three interviews - before, midway through, and after the intervention - were conducted with each participant. The interviews were modeled after and considered to be interpersonal mindfulness practices and thus, are not only data collection strategies. They are also considered a key component of the proposed 8-week mindfulness program, since

they allowed the participants to further reflect on their impostor experiences, elaborate on their mindfulness journey and offered another avenue of practicing mindfulness communication and listening. Additionally, intrapersonal self-authorship questions guided the interviewees toward mindful reflection on their sense of self and STEM identity. The interview question outlines for each interview (pre, during, after the program) are shown in Appendix E. The logistical aspects of the interview procedures are explained in more depth in the upcoming methodology section

Mindfulness Practices

The participants completed at least three mindfulness practices per week for eight consecutive weeks, which they selected from a weekly online guide. In addition, they created a weekly mindfulness journal that documented their experiences and progress, especially concerning their impostor feelings, and self-authorship, also through academic self-efficacy, and self-awareness. The journal was made of reflective question prompts including reflective drawing activities and were anticipated to take approximately 30 minutes per weekly entry. The journals were considered part of the mindfulness intervention as well as a data collection strategy. Their logistics are discussed in the data collection section. Weekly session reminders were sent to the participants via email. To distribute the mindfulness program, a website was created that guided the participants through the program (see Appendix H).

Mindfulness-Based Stress Reduction (MBSR) program

MBSR was developed by John Kabat-Zinn in 1990. The program was chosen for this study because it was one of the first of its kind that has demonstrated great results across studies (e.g. Lamothe et al., 2016), is created for adult participants, and offers

many activities that can be done without in-person guidance. The MBSR program is an eight-week program that supports individuals in practicing mindfulness using several different formal mindfulness practices, such as breathing exercises, yoga, and meditation (Kabat-Zinn, 1994). The program essentially integrates Buddhist traditions of mindfulness with contemporary, western, clinical psychology concepts (Espeland, 2006; Dobie et al., 2016). MBSR has shown strong impact with those working in high stress situations such as in the healthcare field. Evidence exists that MBSR can balance stress (e.g. Shapiro, Schwartz, & Bonner, 1998), support empathy (e.g. Krasner et al., 2009), and reduce burnout cases in medical students, nurses, and primary care physicians (e.g. Cohen-Katz et al., 2005). Prior research has also explored the effects of standard and modified versions of MBSR for youth and young adult populations and showed a wide variety of benefits regarding academic performance, stress, and student wellbeing (e.g. Biegel et al., 2009; Semple et al. 2010). Such outcomes are said to be related to the versatile and adaptable nature of the program to a variety of physical, social and psychological issues, as mentioned by Grossman et al. (2004).

Learn to Breathe (L2B) Mindfulness Program

Learn to Breathe is a mindfulness-based wellness program that entails eight mindfulness components and is tailored to the experiences and mindfulness needs of adolescents (Broderick, 2013). Many studies have reported positive effects of L2B on adolescents and their ability to cope with stress and other psychological issues (Dvorakova et al., 2017). Participants in the L2B program have also acknowledged stronger emotional awareness and relationships, as well as self-compassion (Metz et al., 2013). Research has stated that participants became more satisfied with their lives

(Dvorakova et al., 2017) and helped to decrease addictive behaviors around alcohol and as well as sleep deficits (Mahfouz et al., 2018).

The L2B curriculum aims to gradually introduce mindfulness into students' lives and offers space for individual adaptation. It highlights the cultivation of inner strength and intrapersonal empowerment throughout the program, which is particularly relevant to this study. The word BREATHE serves as a mnemonic device: mindfulness of the **B**ody, **R**eflections and **E**motions; **A**ttention; practice of **T**enderness; **H**eady habits; and **E**mpowerment (Broderick, 2013). Even though L2B was originally designed to be implemented in a face-to-face setting, it offers an extensive repertoire of practices and material that is promising for this current study's intervention and appears to be adaptable for practice at home. Practices include mindful breathing exercises, mindful eating (i.e., the raisin exercise), mindful movement (i.e., stretching, walking, yoga), and meditation (i.e., body scan, loving-kindness). The L2B curriculum is inspired by Kabat Zinn's MBSR program and will thus be compatible. The language and materials used in the MBSR program are said to be more attractive for populations beyond the traditional college and young adult time of life (Bennett & Dorjee, 2016). The organization of the L2B program offers well designed and written mindfulness activities, audio files as well as additional material (e.g. note cards and reflection prompts) that added well to the adapted program used in this study.

Participants Recruitment and Demographics

Female CS and engineering graduate students were actively recruited to engage in the mindfulness program intervention. The recruitment process took place during the weeks of April 1st and April 22th, 2020, for a total of 3 weeks. The intervention was

promoted on a voluntary basis with the offering of a \$200 gift Amazon certificate given to the first ten participants who successfully completed the program and data collection process. The study was promoted by sending out emails (see Appendix B) to CS and engineering graduate programs, by approaching instructors and college advisors to promote the study, through relevant listservs, as well as the Graduate College and its program that promotes graduate student well-being. All recruitment materials included a short explanation of the program and its components, details about the completion reward, the researcher's background and contact information, and the following initial participation criteria. Eligible female participants must:

- Be (at the time) enrolled in a doctoral or master's level engineering or CS program
- Be considered full-time students at the time of the study
- Have completed at least one full semester (at least 9 credits) of their current graduate program

Interested students were asked to fill out an online form (see Appendix C) that included contact and general background information (see Appendix C), self-reported assessments of mindfulness perceptions and perceived impostor experiences (see Appendix C). The goal was to conduct the intervention, journal entries, interviews, and quantitative measures with 10 students. Students who met each initial participation criteria and reported high levels of imposter feelings were given priority to participate in the data collection. 11 students expressed interest in participating in the study. Each of them was invited to partake in a one-on-one meeting with the researcher that addressed the details of the study, organizational practices, and the following study criteria.

In order to receive the Amazon gift card, students had to participate in the entire study to the best of their ability, including:

- Attending three interviews with the researcher throughout the study
- Completing eight weekly mindfulness journals using the weekly journal prompts (completed forms will be sent to the researcher by Sunday night of each week)
- Practicing at least three mindfulness activities per week from the intervention guide
- Being in contact with the researcher about potential issues concerning the study
- Completing the pre- and post- quantitative measures (during the informational meeting and final interview)

All 11 students expressed interest at the end of the information session and agreed to the criteria listed above. They also signed the consent form (see Appendix D) in order to be included in the data collection process. Before the study began, one person dropped out of the participant pool due to personal scheduling reasons. Thus, the total number of participants, who also completed the entire study process was ten.

The ten female participants came from four engineering and CS related degree fields with nine doctoral degree students and one participant in a master's program. The age ranged between 25 and 32 years. Six participants' first language was English, and the sample was diverse concerning its ethnicity. All women were considered research assistants and the anticipated graduation timeline ranged from Fall 2020 to Spring 2023. In terms of the participants' prior experience with mindfulness, three participants claimed to have intentionally practiced mindfulness, whereas the other seven students had limited to no intentional experience. Since the participant sample is rooted in a limited student

population, no further details about the demographics will be given in order to protect the anonymity of the participants.

Data Collection

Data collection included both qualitative and quantitative components. As noted above, many of these components served as both data collection strategies as well as part of the intervention. For the qualitative measures, participants were asked to create a weekly journal regarding their experiences with the intervention and the effects of mindfulness on their impostor feelings, also including academic self-efficacy and self-awareness. Additionally, the stories that participants provide in the journals added to the interpretation of their self-authorship. Reflective writing prompts as well as drawing activities were assigned weekly. Finally, each student was interviewed, before, midway through, and after the intervention, using an interpersonal mindfulness approach.

Concerning the quantitative measures, four questionnaires were administered in order to further explore potential changes in the participants' mindfulness and perceptions of IP (RQ 1). In addition, concerning the second research question, the participants completed a questionnaire to assess their state of self-awareness and academic self-efficacy in order to further interpret their progress on the intrapersonal self-authorship trajectory. In past research, students' journey toward self-authorship has primarily been assessed through semi-structured, in-person interviews (e.g., Baxter Magolda & King, 2007; Creamer & Laughlin, 2005; Pizzolato, 2003). Pizzolato (2007) developed a self-authorship scale but found merely moderate results in using the instrument. Thus, research has yet to widely adopt a reliable quantitative instrument for self-authorship overall.

Because self-authorship in this current study is connected to IP and mindfulness mainly through academic self-efficacy and self-awareness, the Emotional Self-Awareness Scale (EAS; Kauer et al., 2012), and the Academic Self-Efficacy Scale (ASES; Zimmerman, Bandura, & Martinez-Pons, 1992; Chemers, Hu, & Garcia, 2001) will be utilized. Table 1 shows a visualization of the data collection process timeline.

Table 3.1 Data Collection Process Timeline

Time	Data Collection
Quantitative Pre-Measures	Mindfulness, IP, academic self-efficacy, self-awareness
Pre-Intervention Interview	Interpersonal mindfulness/ self-authorship interviews with each participant Focus: status quo and setting the stage, building a relationship
Week 1-5	4 weekly mindfulness sessions (15-45 minutes each); weekly mindfulness journal entries
Week 5: Intervention-Progress Interview	Interpersonal mindfulness/ self-authorship interviews with each participant Focus: Experiences, mindfulness perceptions, academic self-efficacy, self-awareness
Week 6-10	4 weekly mindfulness sessions (15-45 minutes each); Weekly mindfulness journal entries
Post- Intervention Interview	Interpersonal mindfulness/ self-authorship interviews with each participant Focus: Experiences, mindfulness perceptions, academic self-efficacy, self-awareness, review
Quantitative Post-Measures	Mindfulness, IP, academic self-efficacy, self-awareness

In summary, although the study investigated only ten students, the data collection was robust, resulting in 25 hours of interviewing time, 240 pages of transcriptions (typed, 1 pt. margins with space between speaker parts), 40 journal pages (typed, 1 pt. margins),

30 pages of drawings, and 40 quantitative data points for each pre- and post-intervention (80 data points total).

Interviews

The interviews were semi-structured in order to give a general direction for the conversation while still offering participants the opportunity to elaborate on their experiences, build a stronger trust relationship with me, and construct meaning of experiences together. Brinkmann and Kvale (2008) state that knowledge is constructed within the interaction between the interviewer and the researcher, which leads to an “inter-change of views between two persons conversing about a theme of mutual interest” (p. 2). I took a constructionist approach to interviewing as it is defined by Roulston (2010). Accordingly, the approach acknowledges that both interview participants – the interviewer and interviewee – co-construct data in both unstructured and semi-structured interviews. Together, they create narratives that inform how the researcher and the interviewee made sense of their experiences with the research topic. Similarly, Baxter Magolda and King (2007) address that “everyday conversational questions such as ‘tell me more about that’ or ‘help me understand why you reacted in that way’ help participants clarify and make explicit their meaning” (p. 498), which can assist them in identifying their self-authorship.

The interview protocols (see Appendix E) were adapted from the self-authorship interview model (Baxter Magolda, 2001) and asked participants to describe their experiences with the intervention and in the STEM community, how they saw themselves within the STEM field and their intrapersonal perceptions, as well as possible changes that occurred throughout the mindfulness program. The interviews lasted between 40 and

70 minutes. Due to the COVID-19 pandemic, the interviews took place and were recorded via ZOOM.

Journals

The journals asked students to reflect on their weekly practices, their experiences with learning about and through mindfulness, and changes they noticed in their personal lives and their academic experiences. They were encouraged to not only focus on positive changes but also highlight negativities, as McCollum and Gehart (2010) state that this is an integral aspect of mindfulness practice: “To accept whatever experience is happening” (p. 349). Each participant conducted eight journal entries that came out to be one half to two pages in length.

In addition to reflective writing questions, participants reflected on how they see themselves and their belonging, competence, etc. in the STEM field through drawing. Bagnoli (2009) states that “the inclusion of non-linguistic dimensions in research, which rely on other expressive possibilities, may allow us to access and represent different levels of experience” (p. 548). In addition, Allen (1958) explains drawing practices as minimally structured, which can encourage participants to express their deeper needs, emotions, and motivate them to describe their experiences. The weekly journal questions and drawing prompts are shown in Appendix H. The participants submitted each weeks’ journal entry and drawing via Google Forms.

Quantitative Data

The quantitative measures to support research question 1 were collected through the Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003) and the Clance Impostor Phenomenon Scale (CIPS; Clance, 1985). The quantitative measures to

support research question 2 were collected through the Emotional Self-Awareness Scale (ESAS; Kauer et al., 2012), and the What I AM Like Scale (WIALS; Harter, 1992).

The MAAS is a 15-item scale with negatively worded statements connecting to personal mindfulness traits, using a 6-point Likert scale (1 = almost never, 2 = not very often at all, 3 = not very often, 4 = some- what often, 5 = very often and 6 = almost always). The scale is scored backwards to attain a summative score for dispositional mindfulness (e.g., a low score indicates a low level of mindfulness). The MAAS was originally developed for children and was the first mindfulness scale to show a high level of validity and reliability for children aged 9–12 (Lawlor et al., 2014). However, Brown and Ryan (2003) reported an internal consistency of .85, when reevaluating the MAAS with a college student sample and thus concluded that the MAAS is a valid instrument for adult populations.

The Clance Impostor Phenomenon Scale (CIPS; see Appendix G; Clance, 1985) is a 20-item questionnaire, concerning participants' fear of evaluation, of not being able to repeat success, and being less able and capable than other people. In order to avoid social desirability answer effects on participants' answers, the items are formulated in which they constantly acknowledge participants' success (Schubert & Bowker, 2019). Items are evaluated on a 5-point Likert scale (1 = not at all true, 2 = rarely, 3 = sometimes, 4 = often, 5 = very true) adding up to a total score ranging from 20 to 100 points. If the total score calculates to 40 points or less, the participant has few impostor characteristics; a score between 41 and 60 points indicates moderate IP experiences; if the total score comes out to be between 61 and 80 points, the participant encounters frequent impostor feelings; and lastly, a total score higher than 80 indicates intense IP

experiences. Thus, the higher the score, the more frequently and seriously the impostor phenomenon interferes in a person's life. Example items involve "When I've succeeded at something and received recognition for my accomplishments, I have doubts that I can keep repeating that success" (Clance, 1985). The scale shows a high level of internal consistency with alpha level between .84 (Prince, 1989) and .96 (Holmes et al., 1993) for adult populations. The CIPS has been used in regard to college STEM degrees prior to this current study. For example, the CIPS was utilized by Chakraverty (2019), who looked at female STEM graduate students.

The Emotional Self-Awareness Scale (Kauer et al., 2012) is a 33-item questionnaire that covers the five areas of emotional self-awareness, which are recognition, identification, communication, contextualization, and decision making. It includes some negatively worded items to keep the attention of the participant. All items are individually evaluated on a 5-point Likert scale (0 = Never, 1 = Very Little, 2 = Sometimes, 3 = Often, 4 = A lot). The total ESAS score ranges between 0 and 132, with higher scores showing more emotional self-awareness. Example questions are: "I usually know why I feel the way I do", and "I usually have a clear idea about how my feelings affect my behavior". The ESAS showed high internal consistency with a Cronbach alpha of .83 (Reid et al., 2011).

The What I AM Like Scale (WIALS) was originally developed by Susan Harter (1992) to create a self-perception profile for children ages 8-13 years old. It was selected for this research because it a) assesses many diverse domains of self-efficacy, b) versions of this instrument have been previously used to inquire academic self-efficacy (e.g., Bouchey & Harter, 2005), and c) Harter (2012) adjusted the WIALS for college students.

The scale approaches a forced-alternative inquiry in order to limit socially desirable answers. Thus, the students were given a series of statement sets and were asked to select which of the two statements they would identify with. For example, one item in the scholastic domain says: “Some students sometimes do not feel intellectually competent at their studies BUT Other students usually do feel intellectually competent at their studies.” The participants indicated which above description is “Really True” or “Sort of True” for them. The scores range from 0 to 4 for each statement set and higher scores indicate stronger self-efficacy. Four specific WIALS domains were chosen for this study: Intellectual Ability (perceived general intellectual competence), scholastics competence (perceived competence in mastering academic work), job competence (perceived self-efficacy related to job skills), and Global Self-Worth (general perception about the self). The instrument is applicable to Bandura et al’s. (2001) approach to self-efficacy that concerns mastery of educational subjects and coursework. Furthermore, and in line with the current research, Global Self-Worth scale addresses students’ general self-efficacy and how much they approve of themselves in a personal sense. MacPhee, Farro, and Canetto (2013) used the instrument to inquire academic self-efficacy and performance of underrepresented STEM students. The study calculated Cronbach's alpha range from .76 to .86.

Data Analysis

In order to corroborate and validate the findings, I triangulated the data by comparing the qualitative findings with the quantitative statistical results (Creswell et al., 2003), while putting primary weight on the qualitative data.

Qualitative Data

The qualitative data included the journals, drawings, and interviews. All interviews were digitally recorded via Zoom and transcribed verbatim by using the transcription program Express Scribe. The quality and reliability measures are further addressed in a future section. The initial interview transcription and analysis process was conducted after each round of interviews. To analyze the journal entries, weekly coding sessions were set up, once the journal entries of all students were received by the end of each week. This allowed the researcher to explore and code each students' journal individually and then view all examples across each other to make connections.

To analyze the interview and written journal data, an exploratory approach was utilized, as described in Saldaña (2016) as “exploratory and preliminary assignments of codes to the data before more refined coding systems are developed and applied” (p.165). Thus, an inductive process was chosen that allowed labels and codes to emerge throughout the investigation of the data, and for tentative labels to be revised and/or made more focused throughout later review cycles (Saldaña, 2016). Through this, it was aimed to understand how the participants created understanding of and experienced mindfulness, in their own words, and changes they may have noticed through and from it. In addition, the constant comparative method by Glaser (1965) added to the qualitative data coding and analysis. In this process the data were continually coded and analyzed simultaneously. For this current study, a combination of exploratory analysis and constant comparative analysis throughout numerous rounds of data coding and analysis resulted in the data continuously made sense of and organized. The first rounds of coding

involved creating initial codes that emerged from the data. Here, the findings were largely organized by each research question.

Yet, after several rounds of coding and analyzing, overlaps and layers of impact were identified that complicated the initial thoughts of data organization. For example, self-compassion seemed to have influence on a) managing IP feelings (RQ1), and b) improving on the self-authorship trajectory (RQ2). Additionally, it became apparent that some aspects, including self-compassion, were established as a base for further mindfulness developments. Through this observation, the Mindfulness Foundation and its shared components for each research question, was developed (see Figure 4.1). From there, each research question and how the data addressed them in a unique way (or did not address them) was reconsidered, which resulted in reporting the findings in two parts: 1) the mindfulness foundation and, 2) how the foundation influenced each research question.

The drawings were used as interview conversation-starters, additional reflection opportunities for the participants, as well as to create follow up questions. I coded the drawings and their descriptions using a combination of Saldaña's (2016) and Glaser's (1965) approaches, as explained above. To do this and to follow a similar coding regime for the drawings as for the interviews and journals, I described each drawing in relation to the prompt and its attached written journal. I used the following guiding questions:

- What had been drawn and how did it answer the drawing prompt?
- How was the drawing expressed on paper (e.g., colors, size, etc.)?
- Was the drawing fitting or contrary to what the participants had stated in the written journal?

- Did the drawings differ and/or show similarities over time in case of reoccurring drawing prompts?

This gave me an overall impression of how the drawings could be organized into the written data (interview transcripts/journals) and gave each drawing a detailed written description. For example, the drawing prompt from intervention week four says: *Draw a picture of how you balance internal and external expectations (as you perceive them) right now. Include how you go about academic challenges.* Here, I looked a) at the drawings from the prompt's perspective (e.g., how the participant showed how to balance internal and external expectations), b) how the images related to the participant's mindfulness journey (e.g., using mindfulness practices to manage expectations), c) how the self-authorship trajectory may be addressed (e.g., questioning external expectations). I then conducted multiple rounds of coding and analyzing for each set of drawings.

Since the drawings, journals, and interviews were code and analyzed at the same time, all three data sources informed the coding process and thus, the resulting code book.

To clarify the data analysis process, a codebook was created using the data analysis software Dedoose (Dedoose, 2021); this provided stronger transparency and reliability (see 3.2).

Table 3.2 Code Book Descriptions and Examples

Placement in Findings	Code	Description	Example
Mindfulness Foundation	Self-Awareness	The intentional recognition of present feelings, emotions, and physical sensations that result from mental turmoil. → supports awareness of impostor and self-authorship feelings and their impact	“I wouldn't have that realization, or I guess, I wouldn't have found better ways to get through it without the mindfulness activities, because really, the mindfulness activities were what made me realize what I was doing” (Beret, I3).
Mindfulness Foundation	Self-Compassion	Creating understanding toward oneself in troubling situations → helps to manage impostor feelings and other stressors through a mindful self-image/narrative	“I was kinder to myself and I acknowledged my hard work, instead of dwelling on what more could be done. Even when I spoke with my advisor about the paper, I spoke optimistically and confidently that I could finish it and that it was going well” (Gabby, I3).
Mindfulness Foundation	Emotion Regulation	Mindfully taking action and control over overflowing emotions. → fosters ways to mindfully manage IP and grow self-authorship	“I'm not only gonna ignore my feelings that are bad. [...] I'm gonna acknowledge those feelings, but I also acknowledge that it's not what it truly is” (Ingrid, I3).
RQ1	Academic Self-Efficacy	Individuals are confident in their ability to plan, conduct and succeed in academic endeavors.	“[Mindfulness will] keep me more engaged with that goal, not allowing everything that comes up to be like, okay this is it I'm dropping out. [...] Mindfulness is going to keep me focused on why I'm here, what I actually want to do, and what I can do for this field” (Fiona, I3).

RQ1	Emotion and Impostor Awareness	Individuals acknowledge general academic emotions but especially impostor feelings and notice how they affect them.	“I’m seeing now how much I’ve been plagued with self-doubt throughout my grad school and for some reason, I was living in this myth that I had left that behind after undergrad” (Gabby, I2).
RQ1	Academic Presence and Performance	Academic Presence describes the ways individuals mentally engaged in and focus on their work. Academic Performance relates to how individuals are working toward achieving a goal.	“Academic work has been very scattered and all over the place lately with too many projects going on at once. The mindful exercises help me focus on one thing at a time without feeling overwhelmed” (Hannah, J4)
RQ1	Belonging	Describes the participants’ perception of value and respect toward being part of the science community, that is created through their individual experiences, beliefs, characteristics.	“I’m good at it [her research] and enjoy it. Yeah, so I’m really looking forward to being a scientist. I feel very prepared for it now” (Beret, I3).
RQ2	Channeling Growth	Growing awareness for opportunities to grow personally/ professionally and take advantage of them.	“[Mindfulness] was what encouraged me to make an appointment with a trauma counselor [...] And I know for a fact I would not have been ready or able to make that step without going through the mindfulness program [...]” (Beret, I3).
RQ2	Interpersonal Relationships	Navigating, growing, and/or limiting interpersonal relationships.	“[mindfulness] helped me to realize the importance of having a healthy relationship with others. That might mean that if there are people I don’t have a healthy relationship [with] to distance myself. [...] Their negativity or their lack of [...] encouragement or

			positivity for what's going on [is difficult for me] and it's hard when I'm around certain people like that. (Anna, I3)
RQ2	Challenging External Formulas	Realizing, articulating and challenging inside and outside expectations and their influence.	"I'm going to [...] to make use of the mindfulness to make my graduate school experience my own experience, not what my co-workers are doing, because that's all it is. And that's kind of where I can at least visualize what I need to do" (Fiona, I3).
RQ2	Science Identity	How the individuals see themselves as scientists and how they want to be part of the science community.	"I've learned that I carry so much of the status of my work into my own emotions. If my calculations are going well, then I can be happy. If my calculations are not going as I want them to, I'm sad or frustrated. Science is about trying new things, some of which work and some of them don't, and I don't need to hold onto those outcomes as my own emotions" (Gabby, J3).

Quantitative Measures

The quantitative data drawn from the MAAS and the CIPS, as well as the ESAS and the WIALS pre- and post-measures was entered into and analyzed using the statistical software package IBM SPSS Statistics for Windows, Version 25. For each quantitative measure set a repeated measures *t*-test was calculated to examine changes in students' self-reported levels of impostor feelings and mindfulness, as well as changes in

self-awareness and academic self-efficacy across the two assessment points (prior and after program completion). In both research questions, the independent variable was the treatment condition. The independent variable was conceptualized through the regular mindfulness practices, drawn from the MBSR program and the L2B curriculum. The dependent variable in question 1 was the students' perception of impostorism and in question two, it was the students' perception of self-authorship. The quantitative data is used to quantify the progress of participants and to cross check the participant's interview and journal data to look for similarities and differences.

Subjectivities

I, as a researcher, aimed to be aware of my own biases towards experiences with impostor feelings as well as mindfulness. The link between both has only recently been granted attention in the literature and the literature is limited. Thus, for transparency reasons I must acknowledge that it may be my inherent hope that a link will exist, and positive results will emerge. Nevertheless, an initial connection has been outlined in detail in the foregoing literature, which shows that my hopes are reasonable to follow. Additionally, I must be transparent about my own experiences with IP as well. As a young woman, a non-native English speaker, and as a first-generation college student and graduate, I am also bringing my own experiences with IP into this study. While I have been treated as a confident female for most of my life – one who has received awards in different areas, from sports to academics – I cannot say that I was always personally confident about my abilities, nor can I say that I always feel worthy of my accomplishments. Over the years I was able to build a façade of strength and self-efficacy in order to avoid the fear of being questioned and judged by others. For example, like

many impostors, I created excuses for my success. I convinced myself I was accepted into academic programs because of my status as an international student, which could 'look good' for the department.

In sum, I have had many experiences with IP, which might help me connect with the participants on a closer level. However, I need to be aware that my personal experiences with IP can cause me to hold bias as well. This is especially important to acknowledge, when it comes to the data collection, encoding, and analysis process. Nevertheless, in practicing self-reflection and regular self-check-ins – also a way of practicing mindfulness– I aimed to limit this bias. Additionally, the measures taken to strengthen the quality of this study, as explained in the following section, will support the limitation of researchers' bias.

To work through impostor feelings, over the past years I have engaged in a great deal of self-reflective practice that has helped me to become aware of my impostor struggles. This allowed me to realize that if I am in balance with my own self, I can detect impostor feelings much quicker and can use certain tools to limit such feelings from taking over. I have been regularly practicing mindfulness exercises for over a year, but I am by no means perfect or an expert in mindfulness. More often than I should, I make mistakes and fall into old habits. But as I am addressing in this current study, mindfulness is a journey and ups and downs are part of it. Nevertheless, the more dedicated I am to my own mindfulness practices, the better I feel about my personal and academic self. I drew empathy and understanding from my own experiences in order to understand the experiences of my participants.

While my experiences with IP and mindfulness allowed me to have a deeper connection to my participants and see their journey through the eyes of understanding and empathy, I continue to be aware that I might be prone to see, analyze, and interpret what I inspire because these topics are very personal to me. I realize that when something seems to ‘work’ for someone, in this case, mindfulness helps me to manage my impostor, one might assume it will work for everyone. However, I believe my ‘insider’ status in the realms of IP and mindfulness is a strength. Further, I took measures to ensure rigor and credibility, which some of them have been suggested above. A more detailed description of what these measures are, how and why I enforced them, is stated in the following section.

Measures Taken to Support Quality

In order to uphold and support the quality of this study, I am using Tracy’s (2010) *Eight “Big Tent” Criteria for Excellent Qualitative Research* to frame measures to support the quality of this study. The criteria are:

- Worthy topic
- Rich rigor
- Sincerity
- Credibility
- Resonance
- Significant contribution
- Ethical
- Meaningful coherence (p. 840)

In terms of the research being on a worthy topic and making a significant contribution to the field, the study's background and purpose justification have been grounded in an extensive literature review. Thus, the current study was not the result of an arbitrary information collection but built upon prior studies and fills gaps in the literature.

To address issues of rich rigor and credibility, a mixed method design was conducted in order to diversify the data collection sample and be able to triangulate the findings. This supported the detection of possible ambiguities and intriguing connections, while allowing for different voices to come to the surface. Further, in order to address validity in the data analysis process, I used member-checks, and requested independent coder checks from knowledgeable colleagues. The drawings were used as reflection and conversation starters in the interviews as well as add to the cross analysis of all data formats in order to create a more detailed picture of the participants' experiences and personal growth. The research did rely heavily on self-reported and interpreted data by both the participants and researcher. While this may be seen as a limitation, it can open up conversations to experiences and perspectives that would not have been possible in a one-sided way of collecting the data.

Finally, to support the ethical implementation of the study as well as the sincerity of the study, every week, I sent out reminders to the participants in order to stay on track with the program, as well as check in on their well-being. Check-ins aimed to keep the participants on track and limit drop-out rates but also to continue to build a researcher-participant relationship, which supported the quality of the study. I have also been transparent with my subjectivities and aware that I, as the researcher, have a certain

influence on the study. However, due to my multiple data sources and ways of checking my own interpretations, as described above, I took reasonable steps to reduce my potential bias. Additionally, I believe that the STEM context of my participants is separated from my own experience, which is rooted in a social scientific background.

CHAPTER FOUR: FINDINGS

Introduction

The purpose of this mixed-methods study was to explore and interpret how mindfulness affects female STEM graduate students' experience with managing IP. Furthermore, the study investigated the effects of mindfulness on participants' progress on the self-authorship trajectory. It was anticipated that coming to manage IP (RQ1) and the journey of self-authorship (RQ2) share commonalities and are in some ways intertwined. The findings showed that this supposition is reasonable, and mindfulness supported both: decreasing IP and increasing self-authorship. Due to the overlapping nature of the findings, three main themes will be reported upon that created a 'Mindfulness Foundation'. These themes are Awareness and Presence; Emotion Regulation; and Self-Compassion. The Mindfulness Foundation supported each research inquiry in similar as well as unique ways and eventually encouraged the participants to create feelings of belonging as well as explore their science identity. The organization in this chapter is the following. First, to set the stage for the results, a short background concerning how the participants found their way into the STEM fields and what drives their engagement is provided. Second, each Mindfulness Foundation theme is outlined, followed by the findings of how the foundation influenced each research question according to their main areas of growth. Lastly, the outcomes (Belonging and Science Identity) and their impact are explained. Appropriate examples from the data collection will be offered to underline the results. It should be noted that while some statistical

improvements reported in the findings may not show a calculated significant progress, it must be kept in mind that changing patterns of the mind, as well as behaviors, are subject to time. Thus, general improvements can arguably be seen as trending in a positive direction, especially when supported by qualitative data.

Setting the Stage

To set the stage for the findings, I will outline the differences in experiencing and triggering IP among participants. This is important because it highlights the different ‘shades’ of IP and its triggers that impostors are perceiving. Next, it is necessary to understand that while the participants began their STEM degree paths with different backgrounds, they are united by their passion to have a positive impact on the environment and society. Both of these points will be further explained below.

IP Experience and Triggers

First, it is necessary to discuss why the participants a) said to experience IP, and b) what triggered it. In Chapter Two, IP was discussed as a feeling of phoniness in regard to belonging and intelligence (Clance & Imes, 1978); yet, if IP is continuously explained to students as a matter of not feeling intellectually sufficient, some students who have a different impostor experience may not become aware of their impostorism and continue to think of it as normalcy. The participants in this study demonstrate that their impostor feelings include more than the perception of inferior intelligence. IP here goes beyond the perceived level of intelligence and includes various fears of scientific inadequacy, which is defined as thinking that one does not fit into their academic environment for some reason(s). One example is Gabby’s story. She struggled with her work being primarily

computational, wherein she develops models and theories, because her collaborators are predominantly working in the laboratory. She said:

[...] whether it's true or not I have it in my head that they [collaborators] don't all appreciate my work since it comes out of a computer and isn't done in a lab. I just feel like I'm constantly trying to prove myself to them, and because of that, when I start presenting to them, I'm just like: 'this all is bad'. (Gabby, I2)¹

This is an example of stereotyping certain types of scientific work as more important or valid than others. Another example comes from Beret, who asserted that she had little to no impostor feelings anymore after dealing with them during her undergraduate degree. During the first interview, she described a past internship experience in an especially male-dominant field. She eventually said that she had to take on stereotypical masculine ways of expressing herself, such as lowering her emotional responsiveness as well as dressing differently in order to feel a sense of fitting in. After suggesting that this behavior may be a sign of impostorism Beret was surprised about this new learned IP characteristic. In the last interview she highlighted:

I'm not sure if you remember this, but it made a really big impression on me talking in the beginning, again, I felt like I did not struggle with imposter syndrome, I was like: No, I beat it, because I act like them [colleagues]. And I tried to act masculine because my coworkers are men. You said that that is a kind of impostor and I didn't see it this way before. But I realized now that that's really what I was thinking. I had made myself be hyper masculine really, [...] I had shut

¹ Excerpts from the qualitative data collection will be cited as follows: I=Interview, J= Journal, D=Drawing. Numbers will indicate the order of the data source (e.g., Gabby, I2 = Gabby's second interview)

down my emotions. [...] I felt like that was me beating the imposter syndrome.

(Beret, I3)

In the same vein regarding outward behaviors and appearances, Fiona worried frequently that she did not look like a “typical scientist”. She explained:

Even in the last week, one of my colleagues [...] said: “You're so nice, but you don't look like you would be”, and I'm like: “Why?”, and they're like: “You have dark hair and you have tattoos” [...] That's what is sometimes forgotten, like THAT imposter syndrome of how people are looking at you and thinking something about you as a woman and researcher. (Fiona, I3)

In addition, for Dana, Gabby, Anna, and Fiona, the fear of not wanting to invest as much time into their studies compared to what their peers said they would invest, became a certain feeling of time-dedication inadequacy. They identified that a tacit competitive environment - especially in terms of how much study time each student reports - is an IP concern. Gabby said: “I often struggle with seeing some of my peers work longer hours than me. And I feel like I'm not being a good grad student because I'm not working that many hours” (Gabby, I1). This is not to say that these participants did not work and study long hours, nor does it show that they were less passionate about their research. As Fiona mentioned:

I work really hard, but people show up at 6 am and I'm not gonna do that. I'm gonna go in [...] when I'm most productive. I'm going to do my work. And that's it. [...] I'm going to try to just focus on being really engaged in work and home life, because I think it'll help me improve my work life too. (Fiona, I3)

Study and work time comparison was noticed as a frequent IP trigger. However, many participants, including Dana, Gabby, Anna, and Fiona questioned the mentality to ‘work the most and sleep the least’. Dana said:

So many people in academia seem to live to work, especially PhD students, which I think definitely contributes to imposter syndrome. I definitely am not here to work for the rest of my life. I don’t want to be here 70 hours a week. (Dana, I2)

Anna acknowledged this:

I want to have a balance. I want to be able to learn and I want to do research as a living, but I also want to have a family one day and be active and not feel guilty if I want to take a week off of work to travel or something like that. (Anna, I2)

Thus, the students found themselves caught between tacit social expectations (to work the most) and their personal aspirations (to balance their schoolwork and free time). This added to their feelings of inadequacy and not belonging to the community.

Some participants who were English as a second language speakers encountered this as English fluency inferiority, which increased impostor feelings. All of their resumes show a high level of accomplishments in their field of study. However, the added difficulty of writing or reading academic papers that are not in their mother tongue led to further feelings of not belonging or scientific inadequacy. The bottom line of these examples is that in this study, IP is seen as a multifaceted phenomenon. Contrary to the bulk of literature on IP, belonging issues cannot be reduced to fears of intelligence deficits.

STEM Motivation

The three major reasons why the participants chose to begin a STEM degree and career were: a family connection, an excitement for the subject throughout their formative schooling, and coming to the content later in their career. In terms of a family connection, many participants became involved in STEM because a close family member was already involved and instilled early curiosity. Second, some participants discovered a high interest and passion for STEM in their early school years. Most participants in this category said that they enjoyed math or other science subjects and perceived a sense of belonging and comfort in their success. Third, other participants began their STEM journey well into their school and even higher academic career. Mostly, this came to be due to being confronted with contemporary challenges, such as climate change or advancing information technology. These students described feeling a sense of responsibility for the environment and society. A smaller number of participants received their previous higher education degrees outside of the STEM environment and chose a career path change because they were looking for a challenge or they wanted to create a greater impact on their community.

The passion and care each participant showed for their research was rooted in the primary driving factors for further pursuing a career in their STEM field, despite facing numerous hurdles, including impostor feelings, gender discrimination, and financial instabilities. This is important to acknowledge because it underlines the necessity for this research, which is first and foremost, to support women and potentially other minority groups in academic STEM environments on an intrapersonal level. Gabby, for example, says:

I've learned about alternative energy, and just how much using fossil fuels is just not doing good things for our planet. I feel like I can't really turn away now because I feel like if I left now, I would know that there's this massive problem in the world and I'm going to turn my back on trying to help. [...] I can't just pretend I don't know I just, I don't think I can pretend anymore that I could just go about a job and ignore that our world's probably going to look a whole lot different soon. [...] And if I just didn't try to help, I don't think that would really align with my goals and just who I think I am. (Gabby, I1)

This mindful support aims to reinforce accessible and equitable learning spaces, which can lead to supporting a multitude of diverse voices and ideas in academia and the workforce. Through this, mindfulness may also help to serve the students in fostering their motivation and help them to develop a larger purpose that supports their enthusiasm to succeed in the program. As Fiona explained, strong learning environments are necessary to preserve passion. She says: “It makes me sad that people are being so competitive here [...], you don't choose to get a PhD if you don't care, [...] but their passion is diminishing [through competition].

With these observations in mind, the following will address the findings and demonstrate how mindfulness supported the female STEM graduate student participants in this study to manage impostor feelings and support them on their way to self-authorship.

Findings Part 1: The Mindfulness Foundation

It became clear from the data that the findings of both research questions are in many ways intertwined and share a Mindfulness Foundation rooted in three overarching

mindfulness themes. The three themes that were observed (Awareness and Presence, Emotion Regulation, and Self-Compassion) built the foundation for the participants' individual mindfulness journeys as they relate to both research inquiries. Figure 4.1 visualizes this process. It shows that the areas of growth for the first research question were IP Awareness, Academic Presence and Performance, as well as Academic Self-Efficacy. For the second research question, the following areas were observed as necessary to explore: Channeling Growth and Challenging External Formulas.

Figure 4.1 Visual of the Findings for Each Research Question

The first guiding research question was: How does mindfulness support female STEM graduate students in terms of managing the impostor phenomenon? Based on the literature, mindfulness was predicted to have a positive influence on how the participants deal with impostor feelings by providing ‘tools’ to support the management of negative IP effects. As outlined previously, the current study is based on the proposal that mindfulness can support people with impostor feelings by first and foremost fostering self-awareness and academic self-efficacy (see Figure 2.1). This link was proposed because the literature states that those with IP lack self-awareness and academic self-efficacy, but mindfulness is said to help instill such aspects. The data that support this particular inquiry are derived from the qualitative and quantitative sources, which included for each participant ten journal entries and drawings, three interviews (pre-, during, post-), as well the pre- and post-intervention data points from both, the Mindfulness-Attention-Awareness Scale (MAAS) and the Clance Impostor Phenomenon Scale (CIPS).

The second research question was: How does mindfulness help people advance on the intrapersonal self-authorship trajectory (SAT), as seen through self-awareness and academic self-efficacy? As outlined before in more detail, the levels of self-authorship are first, Following Formulas; second, Crossroads; third, Author of One’s Life; and fourth, Internal Foundation. In order to advance on the SAT, the individual needs to be supported in three dimensions that are intrapersonal, interpersonal, and epistemological. Self-Authorship here focuses on the academic SAT in particular. Mindfulness was anticipated to help the participants advance their experience of self-authorship. Self-Authorship was investigated through the interviews, the written journal entries and

drawings, as well as the Emotional Self-awareness Scale (ESAS), and certain domains of the What I am Like Scale (WIALS). The WIALS domains include the following:

Intellectual Ability, Scholastic Competence, Job Competence, and Global Self-worth.

Self-Authorship was connected to the mindfulness and impostor elements of this study through self-awareness and self-efficacy, which are addressed in the ESAS and WIALS.

For both research questions, it is necessary to state that the participants began the intervention at different starting points concerning their IP levels and SAT status. The only participants who indicated to have purposefully practiced some mindfulness before the intervention were Anna, Dana, and Gabby. The other seven participants did not purposefully practice mindfulness before participating in the current study. The participants entered the study at different levels on the self-authorship trajectory. Some participants, such as Jessica, Ella, and Ingrid, for example, initially presented very few components of self-authoring characteristics such as actively working on making sense of their identity and place in STEM. However, all three individuals were highly dependent on external formulas, including others' approval and encouragement. Other participants, including Anna, Dana, and Beret, demonstrated a higher level of self-authorship initially but allowed inner turmoil and intrapersonal difficulties to get in the way of stabilizing their self-authorship. Overall, all participants started somewhere between the first trajectory stage, Following Formulas, and the second level, Crossroads. Additionally, the data made clear that, similar to dealing with IP in the first research question, establishing self-authorship takes time. The literature indicated that improving on the SAT is a lifelong progress, and so is cultivating mindful habits. Therefore, even though only minimal statistically significant changes could be noted in the participants' perceptions of

self-authorship, they reported qualitative adjustments via the interviews and journals. These qualitative changes point towards the participants moving forward on the SAT and creating ways of further improving on the trajectory.

In the following, each of the three mindfulness themes that built the foundation for the participants' mindfulness will be addressed. Then, there is an explanation of how this mindful foundation trio supported the participants in each research question particularly. It is again necessary to state that the findings for both questions grew out of the same Mindfulness Foundation, which supported each inquiry in unique but also partially similar ways.

Theme 1: Awareness and Presence

The study showed that mindfulness enhanced the participants' awareness and emotional presence, which supported them in managing IP feelings and growing self-authorship. Here, awareness concerns the intentional recognition of current feelings, emotions, and even physical sensations (such as headaches and stomach issues) that can often be results of mental turmoil. Awareness of emotional sensations will be addressed further in the following. In terms of physical sensations, the fifth statement on the MAAS states as follows: *I tend not to notice feelings of physical tension or discomfort until they really grab my attention*. On average, the participants were able to improve their perception of this statement from 'somewhat frequently' to 'somewhat infrequently'.

Presence refers to being emotionally attentive more generally, but especially during trying situations and with other individuals. Graduate school results in a great deal of stress and expectations. For some participating students, the amount of stress began to take over their mind and emotions which led them to become numb to what was

happening within and around them. An extreme example of this is Beret's story, in which she reflected on a recent time when she found herself lost in anxiety and stress about writing her dissertation and fulfilling expectations. Eventually, Beret lost awareness of time and to her knowledge, cannot recall what she did during this period of two weeks. This depressive and self-numbing mode, as she described it, coincided with the beginning of mindfulness intervention and she acknowledged that: "I wouldn't have that realization or I guess, I wouldn't have found better ways to get through it without the mindfulness activities, because really, the mindfulness activities were what made me realize what I was doing" (Beret, I3).

Ingrid said that she had always struggled with writing grants or other applications, but her high expectations and suppressed impostor feelings prevented her from asking for support. She reflected in an interview on this issue:

"Prior to the program I would say: Oh my gosh, I suck at writing grants or applications. I used to be very sad about it, but now that this happened with the mindful [intervention] and [being aware of the] imposter syndrome and all of these [reflective journal] drawings...it's like: Okay maybe I don't like writing, but I can research about it, and now I started having conversations with people about it and it is much better" (Ingrid, I2).

Further, awareness and presence encouraged engagement in interpersonal and intrapersonal matters. For Ella, for example, this meant that she enjoyed being a graduate student more, which she elaborated on in the following:

[...] during the study I learned how to navigate stress better, and how to not lose myself in the process. [...] I can now observe the indicators that tell me that I am

on the verge of losing it. So, I step away, and then come back and I wouldn't do that before but now I can sense those things, because maybe I'm more mindful.

(Ella, I3)

Also, Fiona acknowledged that she often felt overwhelmed by her emotions, which produced anxiety:

As a rather emotional and reactive person, the way of responding to issues at work has always been a source of anxiety for me. I fear that I will get too emotional or angry, or frustrated that I will say something that might jeopardize my long term success. (Fiona, J8)

After the intervention, however, Fiona said that she is often able to take a step back and observe her mind before responding to a situation. Also, some participants, like Beret and Gabby, mentioned that the mindfulness intervention supported them in realizing that emotions and feelings are not their enemies or weaknesses. Gabby said:

It has been very relieving for me to realize that I am human and have emotions. They will not be permanent, and I can feel them [and] allow them to pass more quickly instead of suppressing them and causing them to stick around longer. (Gabby, J8).

Realizing that emotions are temporary relieves stress and opens up room for more awareness.

The findings suggest that being unaware of the present is hindering individuals from living their lives to the fullest and jeopardizing their feelings of capability and growing self-authorship. The first theme of the Mindfulness Foundation, Awareness and Presence, helped the participants to detect emotional turmoil such as impostorism and

research anxiety (RQ1). The theme also encouraged a reflection on the status of their emotional as well as personal lives (RQ2). As participants became more aware of the present, they became acquainted with mindful ways of how to deal with newly acknowledged feelings through Emotion Regulation.

Theme 2: Emotion Regulation

The next theme is Emotion Regulation, which here focuses on mindfully taking action and control when emotions run high. Being able to get ahold of how one is dealing with feelings and potentially find a more mindful way of going about them helped the participants to not only manage IP but also to take action toward their own aspirations in their academic and personal life for more self-authorship.

An impactful component of Emotion Regulation became differentiating between real and imagined feelings. Ingrid explained in an interview that separating her “feelings from what reality actually is” (Ingrid, I3) had been really helpful to manage graduate school stress and the feeling of extreme comparison. She added that her new mindset helped her to brave the turmoil: “It's like: No, I'm not only gonna ignore my feelings that are bad. [...] I'm gonna acknowledge those feelings, but I also acknowledge that it's not what it truly is” (Ingrid, I3). This example also suggests that mindful emotion regulation can help students to find more practical and kind ways of acknowledging their feelings. Gabby explained in an interview:

If I'm doing some kind of work activity and I start going on a negative spiral of all the things that are wrong, I start to say some compassionate things about the project and to myself. That's really been helpful in getting through my different work projects. (Gabby, I3)

In the previous theme (Awareness and Presence), mindfulness caused the participants to acknowledge troublesome feelings, including those related to IP, and hurdles concerning the SAT. Emotion regulation takes this state a step further and supports a) a non-judgmental and compassionate look toward how the participants can go about working through self-doubt or other overwhelming feelings, and b) offers ways to negotiate the different dimensions of self-authorship (intrapersonal, interpersonal, and epistemological).

Overall, the ability to better regulate emotions and stress offered new ways of both dealing with the present, as well as helping to form mindful habits to potentially prevent such occurrences, like Gabby realized:

You can use mindfulness as a preventative medicine. Instead of treating the [stress/IP] symptoms once you get them, I'm realizing instead of being like: I'm stressed, I'm anxious and don't know how to handle it. I can be like, how do I have a different dialogue with myself, so I don't become as stressed, and as anxious? (Gabby, J7)

To add to this, Ingrid confirmed her positive mindfulness experience especially in terms of emotion regulation and finding ways to deal with difficult emotions. She suggested that every graduate degree should include a mindfulness component in their first-year seminar and teach about mindfulness practices in order to be prepared for feelings like IP. She also puts a great deal of emphasis on the intrapersonal component that mindfulness offers as she explains here:

Sometimes the university offers some programs [to help manage IP], it's like: "Hey, let's sit together and talk". I know talking is good. But the thing is that us

grad students experience all of these [emotions] at different times, and it's gonna happen all of a sudden. It's like, they're not gonna wait for the next [group] meeting to come up. You're on your own and you feel awful. But if you teach everyone about mindfulness and its tools, it will be there for you. And I think this program is very helpful in those situations. (Ingrid, I3)

Having tools to form healthy and sustainable ways of thinking and behaving is helpful to avoid the emotional downward spiral, and support students *before* they find themselves lost in impostor feelings and other stressors also related to self-authorship. Observing the situation and mindfully considering how to go about emotions led students to realize that they have options they did not see before. For many participants, this observation led to the mindful response of increased self-compassion.

Theme 3: Self-Compassion

Cultivating self-compassion, also described as self-kindness, was one of the mindfulness themes that resonated with the participants the most. Self-compassion manifests as creating understanding toward oneself in difficult situations such as managing impostor feelings or other stress and anxiety, or while dealing with internal and external expectations. Stressors and expectations arose from personal responsibilities and other graduate school challenges such as complex collaborations and dissertation projects. In addition, the COVID-19 pandemic in 2020 and social justice movements left the participants with uncertainty and unfamiliar challenges (e.g., campus closure and isolation) that often limited compassionate feelings. However, mindfulness helped to address many of these stressors and expectations and gave the participants some sort of control such as Dana said “...it’s easier to stop and say “Hey, I’ll get through this. There’s

no reason to be anxious. It's going to be okay. Let's just keep plugging away at this task. Focus on the task" (Dana, J7).

Further, Self-Compassion made it possible to be more aware of personal and outsider expectations and address them. Beret stated: "I would say the biggest takeaway is self-kindness and recognizing how my expectations on myself affect my actions. Both positive and negative. Because when I don't expect anything of myself that's just as bad as expecting myself to do everything. So, managing my expectations was not something I've ever really addressed before" (Beret, I3).

Self-Compassion also suggests limiting critical self-talk and improving one's self-image. Both aspects created a positive difference for dealing with IP emotions and self-authorship improvement. Low self-compassion resulted in negative self-talk, which hindered the students from being mindful about their own abilities and strengths. In other words, it is hard to maintain confidence if the only focus is on what one is doing wrong or what one is not able to do. Additionally, a negative self-image, worsened by a negative self-narrative, was detrimental to the participants' evolution of their science identities. Conversely, a strong identification of being a scientist supported academic self-authorship.

It became apparent from the findings that negative self-talk and sense of self are harmful to the students' compassion and could even prevent them from being able to effectively work and study. Impostors tend to tell themselves that they are not good enough. The 'in what' is open to interpretation and could take the form of any variety of 'whats'. Once a 'not good enough in ____' is identified, often through comparison, it was hard for many participants to see beyond it. Mindfulness gave them a way of reflecting

on this behavior and reframing their internal dialogue. For Jessica, this was one of her main successes from the intervention. She found that improving her self-talk was improving her overall well-being and her academic processes. She was sure that a positive self-narrative influenced by her mindfulness journey would help her to cope with adversity.

Changing self-talk is a valuable outcome from cultivating mindfulness because it can offer a different way of approaching high stress environments and competition between individuals. Additionally, it highlights what one is doing well and instills a growth mindset rather than one of pure failure.

Gabby found through mindfulness that she had frequently been very unkind to herself prior to the mindfulness intervention. She called it ‘yelling at herself’ and she was taken aback by this reflection. Gabby acknowledged that she had “been aware of when [she] mentally yelled at [her]self excessively or just felt really defeated like during [her] dissertation proposal, but [she] wasn’t aware that this occurred on a regular basis for even little things” (Gabby, J8).

To visualize these observations, Beret drew a picture in her journal from week 6 (Figure 4.2). She describes that she had been plagued by overwhelming thoughts from the moment she got up in the morning, which led her to shut down. These thoughts were not limited to impostor feelings. They also included expectations she had placed on herself and others regarding the many roles Beret took on in her life, such as being a family member, a wife, a dog mom, a researcher, etc. Mindfulness, especially self-compassion, helped her to negotiate these roles and to acknowledge that she is allowed to set priorities and be kind to herself.

Figure 4.2 Beret's Drawing about Addressing IP with Compassionate Self-Talk

All in all, positive self-talk was a staple finding for instilling confidence, as Gabby explained:

Sometimes when I started to feel like the work was insignificant or not enough, I reminded myself how much time I've spent on the project. I remember how much progress I've made, even in the past few weeks on a project I've been working on for a couple of years. I was kinder to myself and I acknowledged my hard work, instead of dwelling on what more could be done. Even when I spoke with my advisor about the paper, I spoke optimistically and confidently that I could finish it and that it was going well. (Gabby, I3)

Through the data analysis, it became clear that a Mindfulness Foundation was created throughout the intervention. The three themes of the Foundation - Presence and

Awareness, Emotion Regulation, and Self-Compassion - build the basis for managing IP and SAT concerns. In both examples, the participants developed certain mindful mechanisms, described as areas of growth that were observed for each research inquiry. These are addressed in the following.

Findings Part 2: Impact of Mindfulness by Research Question

In the following, the findings for each research question will be described and demonstrated. The first research question asked for ways that mindfulness can help the participants deal with feelings of IP. The second question concerns participants' progress on the self-authorship trajectory (SAT) and how mindfulness can support it. As noted in Figure 4.1, the Mindfulness Foundation set the stage for areas of growth specific to each area of inquiry.

Research Question 1: How Mindfulness helped to manage IP

The mindfulness areas of growth that were collectively observed for the first research inquiry, are referred to as Emotion and Impostor Awareness; Academic Presence and Performance; and Academic Self-Efficacy. Together with the Mindfulness Foundation as described above, they facilitated the mindful development of Belonging. Each area of growth as well as the aspect of Belonging will be detailed in the following. Overall, mindfulness helped the participants to manage impostor feelings and ultimately decrease their perception of such feelings. To lay the groundwork for the qualitative data findings, Figure 4.3 demonstrates the participants' quantitative progress concerning the Clance Impostor Phenomenon Scale (CIPS) pre- and post-intervention levels.

Note: ≤ 40 = few IP feelings; 41-60 = moderate IP; 61-80 = frequent IP; ≥ 80 = quite

often IP.

Figure 4.3 Overview of Participants' CIPS Pre- and Post-Intervention Levels and Progress

The CIPS data points demonstrate that all ten participants reported a decrease in impostor feelings. This decrease was statistically significant, $t(10) = -4.513$, $p < .05$, with $p = 0.001$. Descriptively speaking, the participants decreased their CIPS levels on average by 18 points. Thus, the average IP frequency declined from 'frequent' (70.6) to 'moderate' (52.6) between prior and post intervention. The students with the largest decrease in IP perception were Gabby, Beret, Anna, and Clara.

Emotion and Impostor Awareness

The Mindfulness Foundation of Awareness and Presence helped participants to acknowledge their emotions and analyze how these emotions had often unknowingly

affected them. Here, awareness concerns acknowledging impostor feelings and noticing how they affect the individual. Being able to pinpoint how IP is influencing each participant, opened ways toward dealing with such emotions. Figure 4.4 shows an overview of the Mindfulness Attention Awareness Scale (MAAS) pre- and post-intervention levels for each participant. As shown by the MAAS data, the participants were collectively able to increase their mindfulness-attention-awareness level from 3.5 to 4.1 throughout the eight-week intervention. The increase was statistically significant, $t(10) = 2.641$, $p < .05$, with $p=0.027$. With the exception of Fiona and Jessica, all participants showed significant declines in mindfulness levels improved their perception of mindfulness. As the MAAS data demonstrate, greatest progress in mindfulness perception was recorded for Beret, Gabby, Clara, and Dana.

Note. Higher MAAS scores reflect a higher mindfulness level, with 6 being the highest possible.

Figure 4.4 Overview of Participants' MAAS Pre- and Post-Intervention Levels and Progress

While Emotion (or emotional) Awareness was an outcome that concerned any emotions that the participants experienced, it became especially useful when addressing suppressed impostorism. When asked about the main takeaways from the intervention, a frequently mentioned aspect was that mindfulness was a catalyst to becoming aware of suppressed impostor related feelings. Along the same line, more than half of the participants acknowledged that they thought they had learned to deal with such feelings of self-doubt in the past. One example of this is Gabby's recent award reception. She said in an interview:

I got a call that I had won an award [...]. When I got the call, my first instinct was to go to Google and check if the email was real and not a scam. And then after it was real, I was like I can't believe that my instinct was, when I just won

something for my work, that it would be a scam. I was sort of processing that I still had this self-doubt. Because, I mean, I'm seeing now how much I've been plagued with self-doubt throughout my grad school and for some reason, I was living in this myth that I had left that behind after undergrad. (Gabby, I2)

Helping students to become aware of such IP related feelings is the first step of dealing with them, which Clara acknowledged:

I think [being aware of IP feelings] helps or does a lot because if you aren't mindful or at least aware of when you're being detrimental to yourself, you can't succeed. Not that you can't, it just takes a lot more work, because you're always double guessing yourself and you're always guessing yourself at how you are making progress. (Clara, I3)

And although some may see the acknowledgment of IP as leading to stereotype threat, most participants did not perceive it this way. Rather, it was described as an eye-opening experience that brought to light issues which the participants suppressed before. Clara and Ingrid were both surprised and relieved about their newfound awareness. Clara said:

Once the study started, I was realizing that: Oh, I really didn't take care of any of this [IP and resulting anxiety feelings], it's just been shoved to the side. So a lot of this [journey] has really just been becoming more aware of how I'm feeling and how my self-doubt is doing and how my well-being is [...] I feel like it really did solidify that being aware, which I think is the first step. (Clara, I3)

IP, as shown in the literature, is a catalyst for many other psychological issues. Thus, IP may be the root of depressive episodes and at the same time, the episode symptoms may mask impostor feelings. Ingrid highlighted the following in the second interview:

Now that I kind of find that imposter thing going on in me, I'm very excited about my intentions [for the mindfulness intervention] because now they are mostly that I want to dig deeper and find out what's the reason for it [IP]. Because apparently, these three weeks I found out that there are so many hidden layers added to this problem, that I need to dig deeper into it. And maybe a big chunk of my anxiety or sometimes depression comes from this [IP] then. (Ingrid, I2)

Similarly, Beret wrote that the mindfulness exercises helped her to realize that the root of her underlying depressive feelings was her upcoming dissertation defense. This allowed her to get out of the “stress-spiral” (Beret, J3). These examples show that growth in the area of Emotion and Impostor Awareness generally led to higher attentiveness toward what is going on in the participants’ mind, body, and emotions. This then led to an increased calmness and a certain feeling of control and inner strength, as Anna outlined it: “I like the feeling that I'm strong, to feel like I have more control over my emotions” (Anna, J3). How Anna in particular learned to mindfully address the emotion spiral can be viewed in her drawing from her seventh journal (Figure 4.5, D7). Her picture shows that mindfulness taught her how to respond to overwhelming situations, such as IP. First, she acknowledges what is going on in and around her. Second, she responds accordingly by choosing from three options: letting it be since it is not necessary or out of her control, breathing and redirecting focus to something else and coming back to the issue later, or taking action right away and ‘detangle[ing] the mess’. In order to reinforce this behavior, she indicated that keeping up with mindfulness activities, such as yoga, helps her to further this process.

Figure 4.5 Anna's Visualization of How She Addressed IP Feelings Mindfully

Overall, the ability to better regulate emotions and stress offered new ways of going about emotional turmoil that was building up. The improvements in regard to Emotion and Impostor Awareness made it possible for the participants to acknowledge emotional issues, practicing presence, and suggests to be attentive to all feelings, and surroundings.

Impostor feelings, as it was observed in this study, were partially ignited from the sense of being stressed about deadlines, juggling many projects, and potentially lacking

academic progress. Mindfulness helped to combat these stressors by supporting awareness. This encouraged an increased ability to become fully engaged in academic endeavors and thus, also supported academic performance.

Academic Presence and Performance

Academic Presence here describes how an individual is mentally engaged and focused on their work. Academic Performance relates to an individual working toward achieving a goal in a successful manner. A major take away from this study is that through cultivating a Mindfulness Foundation, the participants were able to concentrate more on their research instead of being held back by impostor feelings, negative emotions about their work, or the urge to procrastinate. This led to them being more present and connected with their research, which complemented increased enjoyment and productivity. More productivity allowed for more satisfaction with their progress, which again helped to limit impostor feelings. The reasons for this progression are rooted in the Mindfulness Foundation: 1) participants ignored their emotions less (Awareness and Presence), 2) participants learned how to get through difficulties emotional situations and not get hung up by them (Emotion Regulation), and 3) participants developed self-compassion that helped establish a positive relationship to their academic self (Self-Compassion). For example, Anna writes in a journal reflection:

[Because] I understand myself better I feel like I have a greater appreciation for my abilities which will help me with my confidence moving forward and help me to be sure of myself regardless of the negative people or situations I encounter.

(Anna, J8)

In addition, Hannah points out that her “Academic work has been very scattered and all over the place lately with too many projects going on at once. The mindful exercises help me focus on one thing at a time without feeling overwhelmed” (Hannah, J4). Motivation and losing connection to her work by being too overwhelmed were the primary issues for Jessica. These aspects gave her trouble before, but the 2020 COVID-19 pandemic threw off her routine again and left her with limited workspace at home, while also having to provide child care. Being more mindful of the situation and how out of control it made her feel, allowed her to work on priorities and boundary setting. These strategies supported her engagement and eventually her performance. She referred to this sense of control as peacefulness, which she explains here:

When you get lost in your mind, but you have a lot of things to get done, you come back to [the task] at a worse state [of mind]. Then you lose the interest in studying or some other work that you're doing. That way, you get more frustrated because the due date is coming closer and you're wasting time and you need to finish the work. Peacefulness helps you to have a stable mind and you can stay focused on the task, finish the work, and feel much better about it. (Jessica, I3)

On the same note, in the third interview, Ella shared that she used mindfulness practices to help her during her research writing progress. She was able to recognize that while writing a literature review, she was lacking structure and could not see any progress. With writing being her least favorite part of her research, she became even more discouraged. Ella elaborated on her decision to take a break and meditate:

I don't know why I decided to just sit and meditate. I think I used the kindness [meditation]...After that I felt like okay, I'm doing better. I just went back to

writing and did it. So that really helped, like it kind of unblocked my mind and I was able to get the writing done. (Ella, I3)

She adds in her journal that practicing mindfulness gave her a “boost [that she needed] to finish some of the most stressful tasks and continue to be productive without losing [herself] (Ella, J8).” Being more engaged with their research had positive effects on how the participants looked at their work and how much they doubted their abilities. In addition, Gabby said that she was able to become aware of the root of her academic struggles and how to overcome them better. She talked about a meeting with her advisor in which they discussed paper revisions. Such meetings, she said, would usually make her feel emotionally attacked. Yet, this time, she did not bury her feelings and let them keep her from focusing on her goals. Gabby said: “With mindfulness I was able to acknowledge my feelings and let them be. I was also able to continue my work, where in the past I might have given up for the day” (Gabby, J5). Moreover, Fiona addressed how mindfulness has helped her become aware of her own research processes and of the importance to be present while doing it:

... [we think that] we have to be superior but we're just human beings, and that's kind of going back to being mindful like you have to acknowledge that a human is doing this [research], and you need to address that human beings need to be operational to do good science. It is so important to be aware of emotions and the imposter syndrome. (Fiona, I2)

This statement from Fiona is important because it touches on Self-Compassion but also the importance of being mindful of their research and the responsibilities that come with it.

Presence as Research Engagement

Besides being able to focus more and set aside distractions, many participants said that mindfulness helped them to be better researchers overall and be present in the process. This helped to manage research-related IP emotions as well and supported belonging. Hannah pointed out in the second interview that being non-judgmental, a key aspect of mindfulness, is a primary necessity for producing good research. Good research, she indicated, also depends on if one can go into an experiment with an open mind and limit presumptions concerning how the results may turn out. Thus, being able to plan and conduct experiments without strong expectations of what will happen is key. She said that this characteristic is strengthened by the non-judgmental notion of mindfulness. Similarly, Fiona reported: “I think mindfulness kind of helped me be a better scientist and a better worker through the course of the eight weeks” (Fiona, I3). She talked about her recent achievement of conducting a high number of experiment samples without making any mistakes. Fiona contributed this toward her growing ability to focus and stay in the present, instead of being distracted by thoughts about the past or future. Further, Clara was reflecting on herself as a person and researcher in comparison to her peers and was pleased with the progress she had made throughout the intervention:

I think that it [mindfulness] has helped me to be a better person just because it's helped me to kind of start to push past that self-doubt, whereas where I see a lot of my [male] peers [...] just have that kind of self-assuredness of the path that they're taking, but I've never had that. I think that I'm finally starting to get to that point. (Clara, I3)

Being a scientist also includes interpersonal relationships, which for participants like Anna, Ella, and Jessica, meant to not only leave their comfort zone but it was also a trigger for IP feelings. Yet, Jessica talked about how mindfulness has improved how she interacts with her professors and peers during their weekly meetings. Jessica said that prior to the intervention, she would be stressed about the meetings, which prevented her from being attentive, and answering or asking questions. Here, Jessica talked about stereotypical impostor thoughts because even though she might have known the answer to a question, she was afraid of sharing it. Mindfulness helped her to conquer these fears and become more engaged in scientific conversations with her peers and professors.

Similarly, Ella acknowledged that she was able to increase her involvement in research meetings. She said:

I was able to listen and take notes and I even talked to them [research group] after the meeting to make sure what I wrote was correct and was what they meant. And so, I think I have never done that before. [...] I'm definitely more attentive and able to focus on things that I'm not good at. (Ella, I2)

Finally, Gabby said that she was able to free up her mind from negativity and became more creative in her work:

With less anxiety on my mind, I'm able to work more creatively, or like outside of my current reasoning, what I could do differently for my paper. So, I definitely noticed in the middle of the summer and throughout the summer, that by having this weight lifted off of my mind, I was actually doing better at my work, because I was able to think differently and advanced my calculations, my writing and my

understanding of a project because I wasn't so narrowed in on: Oh wow, these things are going bad. (Gabby, I3)

Academic Presence and Performance to Manage Expectations

Comparison to others and inability to manage expectations was one of the main triggers for IP in this study. What the participants failed to realize or bring to the front of their thoughts was that circumstances including academic background, personal characteristics, and support systems, are not the same for each individual. This can create a feeling of loneliness, or not belonging compared to their peers. Further, it takes away from the individual journey each participant was creating while engaging in their academic paths, which in turn then limits academic presence. Dana wrote in her second journal: “Even though I’d been working hard, I was particularly crushed by my environment - seeming to never know or understand HOW the people around me seemed to never struggle” (Dana, J2). Mindfulness reminded the participants that their personal academic journey may be different, but not less important, from another student’s path. For this, Academic Presence in particular can help students to deal with comparison induced IP, while encouraging them to pay close attention to what they are accomplishing and to their future goals.

Clara was able to manage her own expectations toward learning new things in times of shortcomings. When the intervention took place, she was struggling with a complicated project that had both Clara and her advisor challenged for some time. After trying multiple ways to solve the project’s issue, she decided to leave it be. Instead of falling into negativity, she was able to use the event as a learning opportunity. She said:

In the end, I didn't succeed but I don't feel like a failure, because before, if I didn't get something done, I failed. And now it's not so much that, but what came from it? Did I produce something? I can now say that there are outside factors beyond my control as to why sometimes things just don't work (Clara, I3).

What Clara's example alludes to is not only developing a self-compassionate way of living, but it also suggests that a positive self-dialogue is necessary to succeed: Did I learn something? Did I still try, even if it's not the way I wanted it to be? Did I still get something from this experience?

There are numerous stressors related to expectations and graduate school that led the participants to doubt their ability to succeed and lose sight of their academics. One frequent example was the pressure to publish their work in academic journals. To complicate this stressor, some participants' progress regarding publishing their work was dependent on their progress in the labs. However, during the COVID-19 pandemic most campus labs were closed or only open periodically for several months. For some participants, this delayed their research progress and heightened their already-existing academic anxiety. The added uncertainty concerning when they could go back to some sense of normalcy laid heavily on their already-laden shoulders. One example came from Fiona, who had an immunocompromised family member, which made being exposed to a possible COVID-19 infection very difficult. Fiona exclaimed:

I don't feel comfortable working [due to COVID], it's made me feel bad. And that happens a lot but now I'll be like, I need to do this, and I have not taken days off in months. But I still feel really self-conscious, because I'm not at work, and there are other people at work. (Fiona, I2)

The mindfulness activities gave her the ability to work through these thoughts and create an action plan of how she could make progress and also limit exposure to the virus. To be sure, personal expectations constructed by the participants – in addition to expectations placed upon them by others – complicated their dealing with such stressors. For example, Gabby's picture (Figure 4.6) from her journal in week 4 shows the imbalance of her personal aspirations (left side) and the external expectations that she has to uphold (right side). The external expectations such as, keeping her funding and publishing her work took more of her time and attention than personal goals, like challenging the status quo and learning for discovery would be able to receive.

Figure 4.6 Gabby's Drawing about Internal and External Expectations

In a similar fashion, Anna drew her fight of navigating between external and internal expectations as being in a boat on the stormy sea (see Figure 4.7). She had to navigate

through the waves, her internal focus, and the surrounding storm (external responsibilities).

Figure 4.7 Anna's View of Navigating Internal and External Responsibilities

In addition, Hannah summarized that there

... are a lot of [mindfulness] exercises here that tell us that to be mindful of your accomplishments, being mindful of your emotions, being mindful of yourself.

Those exercises definitely helped me stop comparing or just stop overthinking, so I don't get too much into that. Because I think we all know at the end of the day it's not a big deal, but it's just said in that moment when you are self-doubting, it's when you're spiraling down in that moment that it becomes a problem. (Hannah, I3)

Academic Presence and Performance allowed the participants to become more engaged with their research, progress, and goals. This encouraged them to become more productive and increase their performance. Before, IP feelings would take much of the

participants' mental capacity and would take away the needed strength to accomplish projects and work through research problems. The Mindfulness Foundation helped to acknowledge this dilemma and facilitate growth in Academic Presence and Performance, which also encouraged more Academic Self-Efficacy.

Academic Self-Efficacy

Lacking academic self-efficacy is one of the primary reasons why some people struggle with IP. Academic self-efficacy here meant for the participants to be confident in their ability to plan, conduct and succeed in academic endeavors. The level of academic self-efficacy varied amongst the participants. Statement 14 on the CIPS scale states: *I'm often afraid that I may fail at a new assignment or undertaking even though I generally do well at what I attempt*. This statement reflects low academic self-efficacy and academic confidence. For the pre-intervention quantitative measures, Ella, Dana, Clara, and Anna showed the lowest efficacy levels. This was supported by the journals and interviews. However, the other six participants also reported that they felt this way at least sometimes and reported difficulties concerning academic efficacy in the qualitative data. In general, the quantitative data shows that with mindfulness, the participants were able to reduce their agreement with this statement by 1.2 points on a scale of 6, from 'often' to 'sometimes', with $t = 2.79414$ and $p = 0.05993$.

Mindfulness helped the participants to improve their belief that they can plan and reach academic goals in two ways. First, it supported the women's sense of academic confidence, as Beret said: "It [mindfulness] had a really positive impact on how I see myself and how I see my competence level and my intelligence" (Beret, I3). Being aware

of one's abilities to succeed and to be more confident has helped Fiona to explore her own worth in her department. She said:

I think a lot of the time, in engineering as a whole, it's like we're going to weed you out because there are all these people who want to be in engineering. But it's like 'No', I am not a replaceable person. I am the only person who is going to see my skills and their value. So, I think that that has helped me to realize my worth and sticking with it. Because I feel that I can benefit the STEM fields. So, in the long term, it'll keep me more engaged with that goal, not allowing everything that comes up to be like, okay this is it I'm dropping out. [...] Mindfulness is going to keep me focused on why I'm here, what I actually want to do, and what I can do for this field. (Fiona, I3)

Furthermore, Gabby took a confident approach as well. She wrote in her last journal about her newfound mindset that helped her to acknowledge what she has already accomplished and focus on future challenges with efficacy in mind: "Now, I feel that of all the obstacles I'm going to face moving forward in my career, one of them will not be me (or at least not to the same extent)" (Gabby, J8). Gabby added that mindfulness gave her the outlet and tools to cope with work anxiety and stressors, which will help her to find emotional balance again and find confidence. Similarly, Ella suggested that she is not as afraid of getting held up by thoughts of a deadline anymore. Before her mindfulness journey, deadlines would make her 'freeze' and they would block her ability to work. Now, she says:

I think [a main take away] would be that deadlines don't make me panic as much anymore when I know I have to get a lot done. Because I know I get it done by

this certain day. And then I am doing it. But I'm also aware in the back of my mind that, okay, I have to do this by this time so I should finish it right now. But that's not making me panic or rush it. (Ella, I2)

In addition, Hannah highlighted that mindfulness helped her not drown in the impostor spiral and become aware of what mattered in the moment. She said that:

... are a lot of [mindfulness] exercises here that tell us that to be mindful of your accomplishments, being mindful of your emotions, being mindful of yourself.

Those exercises definitely helped me stop comparing or just stop overthinking, so I don't get too much into that. Because I think we all know at the end of the day it's not a big deal, but it's just said in that moment when you are self-doubting, it's when you're spiraling down in that moment that it becomes a problem. (Hannah, I3)

The second way that mindful academic self-efficacy helped the participating women to manage IP was by helping them learn about unfamiliar research domains or new research topics in general. Learning about new and unfamiliar topic domains sparked self-doubt in nine of the participants. Not knowing or understanding answers right away had a large negative impact on their confidence and it made them very uncomfortable. Especially the women who started with a stronger sense of IP struggled when they encountered unfamiliar topics with which they had a hard time because a) they would have to ask someone, but that could mean that they would be found out as “not smart enough,” or b) they could continue to try and figure it out themselves but will likely run into frustration and failure, which also enhanced IP feelings. Mindfulness was able to take the edge off of this difficult situation. This was especially insightful for Clara who said in the beginning

of the study that if she has trouble with comprehending new topics, she has fear creeping in, as she explained here:

I feel like I need to pick up on things quickly; and with the [current project], I didn't pick up on it quickly. It was not the kind of thing where it just snapped in my brain and I was ready to go. So a lot of that was like, well if you can't pick this up what else are you not doing right? Why are you not working harder? Why isn't this clicking? (Clara, I1)

After the intervention she was able to reflect on this particular journey of hers:

I feel more confident that I can do the things that I am new to and that cover a new domain and I don't see that fear of the unknown as much. [...] [The fear of the unknown] is not made of my capability, but it's made of the fact that it's new. I'm new to it. That has very little to do with what I'm capable of doing. [...] So, it makes me less fearful, and more confident. (Clara, I3)

Another example comes from Gabby, who said this:

With less anxiety on my mind, I'm able to work more creatively, or like outside of my current reasoning, what I could do differently for my paper. So, I definitely noticed in the middle of the summer and throughout the summer, that by having this weight lifted off of my mind, I was actually doing better at my work, because I was able to think differently and advanced my calculations, my writing and my understanding of a project because I wasn't so narrowed in on: Oh wow, these things are going bad. (Gabby, I3)

Lastly, Dana writes: “The practices made me feel relaxed, leveled, like I could handle this (whatever “this” is in the moment)” (Dana, J2). Mindfulness gave the participants an

avenue to reevaluate their academic self-efficacy and become confident in their abilities again. While new and unfamiliar topics still caused feelings of uncertainty, the participants learned how to deal with them better through a foundation of mindfulness and adopting mindful ways of thinking and behaving.

In sum, mindfulness helped to manage IP by building a Mindfulness Foundation that laid the groundwork for growth in the areas of Emotion and Impostor Awareness, Academic Presence and Performance, and Academic Self-Efficacy. All of these growth areas together made it possible for the participants to increase their perception of belonging to their research field due to their abilities and achievements.

Belonging

Mindfulness was able to support female STEM graduate students in dealing with IP in many ways. It became apparent that mindfulness supported the participants in growing both emotionally and academically, areas which are interconnected and mutually supportive. Together, all growth areas encouraged a perception of Belonging in the STEM community. Belonging here reflected Mahar, Cobigo and Stuart's (2013) concept, where belonging is described as a "subjective feeling of value and respect derived from a reciprocal relationship to an external referent that is built on a foundation of shared experiences, beliefs or personal characteristics" (p.6). Thus, belonging in the STEM community describes the participants' feelings of value and respect toward being part of their STEM community, which is fostered through their experiences, beliefs, and individual characteristics. Looking at belonging from a different perspective, non-belonging is one of the main outcomes of IP, but has also been studied as a predictor for impostor feelings (e.g., Peteet et al., 2015).

A strong feeling of belonging is supporting the management of IP feelings because it challenges excessive self-doubt. Conversely, strong impostor feelings challenge feelings of belonging. For example, Ingrid described this in the following: “I think those impostor feelings for me at least, they tell me that I want to quit. And I need more time, although everything is good, I can’t do it. It's like I don't belong in this research, because it's too challenging and everything.” (Ingrid, I3). Nevertheless, mindfulness provided her with opportunities to overcome these thoughts: “Being mindful about it [IP feelings], it helps you to see that yes, this is challenging research but it's challenging for everyone. [...] I wanted the challenge and now this is the challenge so being mindful of the initial intentions helps a lot” (Ingrid, I3). She added that especially the meditation practice and the S.T.O.P. exercise had given her tools to address such feelings in the moment, including a stronger sense of self-efficacy and self-awareness.

Participants stated that creating a forward-looking, growth mindset encouraged their sense of belonging. Thus, the participants highlighted that their academic journey may be different than others’ and is dependent on their circumstances and background. One example of this is Anna’s story. Prior to the intervention, she had been plagued by self-doubt and feelings of not being good enough for the STEM fields on a frequent basis. With creating mindful habits, she was able to focus on her own path more. She said:

I think just focusing on myself and my journey or giving myself affirmation for not thinking about what other people have accomplished just like focusing on me and what I've accomplished because we've all had our own sets of adversity.

(Anna, I3)

Along these lines, Gabby used the mindfulness journey to reflect on how she sees herself as a scientist and could see positive changes:

I just didn't realize how much it has changed, until I was filling out the survey earlier today like especially the one that's like, do you like yourself as a researcher, as a person, etc. and this time I was putting “yes” and I was just like: Whoa, that is not what I put last time. [...] I'm definitely feeling good about the progress that I've made. (Gabby, I3)

Beret took this further and said that with the help of mindfulness, she found joy in her profession again. As she is at the finish line of her degree, she is enjoying her new discovered feeling of belonging: “I'm good at it [her research] and enjoy it. Yeah, so I'm really looking forward to being a scientist. I feel very prepared for it now” (Beret, I3).

Beret was introduced in this study previously in terms of how she felt the need to take on stereotypical masculine ways, such as appearance and how she was dealing with emotions. Throughout the intervention, she was able to unpack this experience and now says that she is happier with the person she is and that this will help her to stay in touch with herself in future work environments where she may be in a (gender) minority.

Further, Anna says that she often second guesses how others treat her in the department due to her gender, but mindfulness helps her to let go of this nagging feeling more. She says: “There are a lot of experiences too where it's like, is this happening to me or do people talk to me like this because I'm a girl? [Being mindful is] helping me to not think about that and to think like if it's because I am a girl, that's on them, I belong here” (Anna, I2).

Dana was struggling with resisting the stereotype of having to work constantly on her projects to be a good graduate student by wanting to balance her personal and her academic life as demonstrated in Figure 4.8 drawn in week one. She lamented the pressure of being expected to put extreme hours into her research and feeling burned out.

Figure 4.8 Dana's First Drawing About Where She Sees Herself in the STEM Community (week 1)

Throughout the intervention, as seen in her drawing from week eight (Figure 4.9), mindfulness helped her to give herself the permission to grow as a person outside of STEM and find her own compromises. Interestingly, this helped her to find joy in being a scientist again, after wanting to give it up for a long time.

Figure 4.9 Dana's Second Drawing About Where She Sees Herself in the STEM Community (week 8)

Clara summarized her experience with mindfulness and how it helped her feel part of the STEM community this way:

Half the battle is putting yourself out there. Half the battle is having the confidence to actually ask the questions. Even if you don't know the answers. I feel like, especially with mindfulness, being able to be mindful with yourself and not having that self- doubt, and to actually confidently ask a question, knowing that you're either going to get: Oh, this has already been answered or the: I don't know, what do you think? back at you is, like, half the battle, just getting yourself out there. (Clara, I3)

Mindfulness provided the opportunity to open doors for her and the other participants to stand up for their own belonging in STEM.

In addition, being the only computational scientist in her research group of lab scientists, she often felt like she did not belong or that her work was not as valuable. With mindfulness, she was able to change this perspective: “Instead of thinking, wow, I’m the only person here that’s not an experimentalist, and they probably all think that I don’t contribute anything, I can be like I am the only person here with knowledge of how to use these [computational] tools to move this research forward” (Gabby, I3). Anna had a similar thought in her last reflection. She noted: “I have noticed a significant difference in how I view myself and my own work. I think in the future, I will encounter challenges via being compassionate towards myself and realistic and understanding about where I am in my journey” (Anna, J8).

All in all, mindfulness helped to instill a sense of self-awareness that brought impostor and other difficult feelings to light and offered ways to go about them. It strengthened academic self-efficacy and provided the needed confidence to conquer strenuous graduate school challenges. Self-compassion supported the management of interpersonal and external expectations by facilitating compromises and boundaries. The ability to be more productive and perform at a higher-level limited self-doubt and instilled a sense of pride in the participants' work.

Many stress factors can be identified when talking about STEM graduate school. They are heightened by responsibilities outside of academia (e.g. family life), and a pool of remarkable peers and professors, which can become intimidating and create feelings of non-belonging. As the many examples demonstrate, the participants learned how they can become aware of their IP triggers and how to deal with them. Mindfulness created a sense

of belonging and overall increased the participant's sense of self in the STEM community and beyond.

Research Question 2: How Mindfulness helped to Improve Self-Authorship

The second research question asked for the possible effects of mindfulness on the participants' growth on the self-authorship trajectory (SAT). Two main areas of growth could be identified that grew out of the Mindfulness Foundation as it relates to this particular inquiry: Channeling Growth, including progress in terms of interpersonal relationships, and Challenging External Formulas that touch on confronting stereotypes about STEM students and gender stereotypes. Similar to the first research question, one overarching finding could be observed as growing out of the Mindfulness Foundation and the two areas of growth. This overarching finding is called Science Identity, where the participants generally touched on all three dimensions of self-authorship through exploring a) their own identity in negotiation with other individuals in STEM (interpersonal), b) how they saw themselves in their STEM environment (intrapersonal), and c) how they faced ambiguity and diverse interpretations of their STEM involvement (epistemological). Establishing identity is the second highest step in self-authorship development, the first being the internalization of such identity.

Channeling Growth

The Mindfulness Foundation helped the participating women increase awareness of growth opportunities and take advantage of them as well. This awareness built a foundation for more self-authorship because it encouraged the participants to reflect on the present and take action. Being able to grow on a personal level is also necessary to instill happiness and satisfaction in a person's life, which according to this study is very

important for the participants' overall well-being, success in STEM, and interpretation of self-authorship.

All participants were able to report personal growth in different ways. For example, Anna and Jessica learned to become more comfortable with themselves, their body image and personalities; Dana, Beret and Fiona explored how they will address experiences of gender bias in the future; and Ingrid, Gabby and Hanna saw improvements in their relationships with other people. These reports of growth are important because they point toward individual successes. Mindfulness was able to support each participant and helped them grow as a person, regardless of where they started on the SAT. Generally, growth through mindfulness supported the participants in creating space for intrapersonal and interpersonal growth.

No statistically significant changes could be observed in the participants' Emotional Self-Awareness Scale (ESAS) pre- and post-intervention (Figure 4.10). However, eight of ten participants were able to increase their emotional self-awareness levels, and the collective average score of the women increased from 105.7 to 107.9, where higher numbers show higher emotional self-awareness.

Note: The total ESAS score ranges between 0 and 132, with higher scores showing more emotional self-awareness.

Figure 4.10 Overview of Participants' ESAS Pre- and Post-Intervention Levels and Progress

Further, no statistically significant changes were noted concerning the global self-worth domain on the What I am Like Scale (WIALS) (Figure 4.11). Yet, improvements in emotional self-awareness as well as sense of self-worth, which are seen as indicators of personal growth, could be noted through the qualitative data collection.

Figure: The individual scores range from 0 to 4 for each statement set; higher scores indicate stronger perceptions of the domain.

Figure 4.11 Overview of Average WIALS Domain Pre- and Post-Intervention Levels and Progress

From a qualitative data perspective, Channeling Growth enhanced overall well-being and happiness, which eased the stress and feelings of not living up to internal and external expectations. Fiona wrote in a journal entry:

In regard to work, I had a few new meetings that went well. I feel more on track with my research, and the stuff I have to do. And when I finally compiled my data and the results looked promising, I was able to spend some extra time on the mindfulness activities, which I really enjoyed. Overall, I felt in peace with myself, and actually really happy. (Fiona, J4)

In addition, Channeling Growth involves dealing with intrapersonal states of mind and personality. Dana said to this aspect: “I’ve always found solace in exercise and it’s only

been recently that I'm finding solace in my own mind" (Dana, I2), summarizing one of the primary goals for reaching self-authorship on the intrapersonal level. Also, Beret was encouraged through her mindfulness journey to address intrapersonal issues from her past with professional help:

[Mindfulness] was what encouraged me to make an appointment with a trauma counselor [...] And I know for a fact I would not have been ready or able to make that step without going through the mindfulness program because it felt like there are quite a few things that had to kind of break down and happen before I even realized that that was something that needed to be addressed. (Beret, I3)

Making space for personal development includes confronting issues from the past and the present. Beret sets an example for how one can slowly take the future in their own hands again, which was supported by Awareness and Presence.

Another example came from Fiona and her concerns about her lack of emotional awareness. She had a hard time addressing difficult feelings at work, which was intensified through gender biased comments from her peers that she was 'too emotional'. Fiona acknowledged that her work-life was taking over her private spheres: "I would let these emotional responses [...] from my day at work, my coworkers and my experiments ruin my at-home life" (Fiona, I3). She said that the longer meditations gave her space to explore these issues and address them with being more present with her academic feelings and in her private life. The first level on the trajectory toward self-authorship includes relying on outside formulas (e.g., family, friends, society) and how they see the world. In order to move toward self-authorship, one must become aware of how, in this

case, academic formulas influence one's decisions. The examples above show signs of this particular transition (to become aware of academic's influence).

Interpersonal Relationships

It became apparent from the data that the first level of self-authorship, Following Formulas, can be challenged by learning how to set boundaries between one's academic and personal life. This included navigating and/or growing interpersonal relationships as well. For example, Anna made intentional decisions to surround herself with people who support her and let go of toxic relations. She wrote in her sixth journal: "I'm trying to focus on the relationships that help me grow and trying to distance myself from the ones that prevent growing" (Anna, J6). She elaborates on this in the last interview:

I like to think about how to articulate it, but I think it's [mindfulness] helped me to realize the importance of having a healthy relationship with others. That might mean that if there are people, I don't have a healthy relationship [with] to distance myself. Because I think doing this journey has really helped me and I've felt a difference in how I see myself. [...] Their negativity or their lack of [...] encouragement or positivity for what's going on [is difficult for me] and it's hard when I'm around certain people like that. (Anna, I3)

Hannah talked in the first interview about how she wanted to make new friends with people who are not in her field or work or research. She acknowledged that it would be fulfilling to learn about new perspectives on life and take a break from the world of science now and then. This statement came to be after a discussion concerning her satisfaction with the status quo of her life. Using a mindful interviewing approach and encouraging Hannah to reflect on herself continued to be a very fruitful tool for her.

For all participants, being a researcher involved a collaborative component that was often a trigger for doubting their perception of self-authorship. Being able to work effectively with other people was a main concern for the participants, especially in terms of finding their space in STEM. The intimidation and pressure of saying something incorrect led six of the participants to fall back into Following Formulas behaviors. Fiona realized early on in the intervention that her emotions and anxiety influence her own work and work with others. She wrote in a reflection:

My internal dialogue greatly influences my external behaviors, and any external problem has the ability to impact how I feel about the people involved. [...] The practices from this study have made me realize how important it is to not get caught up in my emotions or my immediate reaction to a situation. (Fiona, J8)

She adds that being a senior student in her lab makes her want to be a good mentor for less experienced peers. Fiona said in the third interview that she was worried to step on her peer's toes when she tried to support them. However, her mindfulness journey taught her ways to reframe these thoughts. She adds: "I feel like this [mindfulness journey] has made me realize like I'm not doing that (being in the way of her peers). I have skills, and I've been here longer and that's just helping me help them. So, in that sense, I think it helps me be a better mentor too" (Fiona, I3).

Another aspect concerning fruitful interactions that the participants stressed was listening. Many participants wanted to become better listeners to be more present in conversations and to minimize misunderstandings. Ingrid mentioned: "Now I'm trying to have conversations where I just think about the conversation. And not think about the work that you're going to do after or before" (Ingrid, I2). Anna agreed with the

importance of being present in conversations and acknowledged that being aware of other peoples' situations also made dealing with comparison more attainable: "The listening practice is a reality check. So, like, being more mindful of other people and what's going on in other people's lives and you won't find that out unless you're practicing generous listening" (Anna, I2).

Taking care of issues with misunderstandings, poor communication and relationship management increased abilities in the interpersonal dimension and widened the possibilities to intentionally making sense of diverse sources of knowledge (epistemological dimension). Further, growth awareness laid the base for reflection and encouraged a growth mindset (intrapersonal dimension). In addition, these progresses fostered the urge to find their own way of navigating expectations and stereotypes.

Challenging External Formulas

The participants found themselves caught between tacit social expectations and stereotypes (e.g., what should a scientist look like and what are the characteristics?), and their personal aspirations for their life and career. Once the participants realized how this issue impacted them and how they could successfully articulate it, they were able to engage in deep reflection and challenge how they saw themselves in the science community. One aspect that was frequently brought to the forefront was challenging the expectations put on science graduate students. This was often interchangeably addressed in the context of stereotyping STEM students. The participants addressed many stereotypes that they had to handle when engaging in research. Not all stereotypes were seen as a threat but the more mature the participants became as researchers, the more they felt the urge to find individual ways of writing their science journey. This step is arguably

a vital part of self-authorship because it shows the necessity of negotiating different responsibilities by also valuing one's own. Mindfulness helped to facilitate this negotiation toward self-authorship. For instance, Anna said that she “reevaluated whether this stress that I’m placing on myself to publish a paper is because I think it is very important to publish, or because other people say it is very important to publish” (Anna, J3). Similarly, Fiona struggled with how, as she described it, different she was in appearance and going about her research:

The self-love meditations are really good. You know, just kind of like, focusing on your experience because that's all you get, you know, and enjoying it.

Acknowledging that you're the only person you're going to be responsible for.

Obviously, I could change hundreds of things about myself, but it's like at the end of the day is it worth it to focus on that? It's not worth it. (Fiona, I3)

She adds that:

I think that long term or like short, long term so the next few months, I'm going to really try to do this and try to make use of the mindfulness to make my graduate school experience my own experience, not what my co-workers are doing, because that's all it is. And that's kind of where I can at least visualize what I need to do. (Fiona, I3)

Jessica made progress concerning her independence from external approval as well when she talked about revision processes: “Before, I think, I used to have a lot of frustration. Maybe this time I'll not get that much frustration. So that's kind of a change, I will say, you know, I'm expecting criticism, I should say. Maybe it will not hurt that much” (Jessica, J8). This is an important finding because it underlines that she is able to begin to

distinguish herself from the level of her success and the expectations to be always successful.

The participants who challenged the thought of being defined by their work became more comfortable with their resistance. Fiona said that she was able to feel less guilt when it came to work hours and how she was going about her studies compared to her peers. She said: “I am passionate about my research. I'm not obsessed with it. I'm not absolutely defined by my research, like some people are. That's okay” (Fiona, I3). These examples show that the participants began to formulate their own ways of thinking about and engaging in science, apart from social expectations. Dana explained that she noticed a shift in how she goes about communicating with her peers: “I stood up for myself a little bit which is unusual. I'm not very good at standing up for myself. So that was a difference that I noticed” (Dana, I2).

To add another example, even though Hannah was skeptical about the impact of mindfulness prior to the intervention, she talked about how it helped her stay confident in her current journey on the job market. She just defended her dissertation and is now applying to a multitude of organizations, which left her to challenge her self-authorship. Hannah mentioned that the wait time between the interviews and the approval or rejection phone calls made her think that “Oh, they just found somebody better or, I don't know, maybe I wouldn't fit in there anyway” (Hannah, I3). Hannah demonstrated a high level of self-authorship in terms of her academic journey, but she got seemingly unsure about herself outside of the campus walls as the waiting period went on. Mindfulness helped her to navigate through her feelings and reassure her of her abilities and goals.

At the crux of this theme is balance. Finding balance between wanting to fit into the STEM community and leaving one's own personal mark. Anna pointed out that “I want to have a balance like I want to be able to learn and do research as a living, but I also want to have a family one day and be active and not feel guilty if I want to take a week off of work to travel or something like that” (Anna J3). Finding balance and negotiating expectations demonstrates self-authorship. Gabby addressed this topic in her eighth drawing (Figure 4.12). She shows herself as a member of the STEM community with ideas and contributions to support “cleaner power” but her scale is balanced with her personal interest on the other side.

Figure 4.12 Gabby's Drawing of Balance between STEM and Her Life

Another drawing example that touches the aspect of balance was made by Beret in journal number seven (Figure 4.13).

Figure 4.13 Beret Demonstrates Her New Priorities

As the picture shows (Figure 13) Beret was able to set boundaries and priorities of what she wants to accomplish daily to satisfy both internal and external expectations. This is something she had great issues with before the intervention and which led her into burnout like symptoms. Besides navigating stereotypes concerning professionalism as outlined above, expectations regarding gender were another threat that was mentioned.

Challenging Gender Stereotypes

To be clear, not all participants dealt with feelings of non-belonging due to gender discrimination. However, those who did feel that they had to reach different standards than their male peers, felt their self-authorship was threatened. Clara said: “I feel like in general, there's an expectation of what you should be for a computer scientist, but then I feel like there's more of an expectation of what you should be for a female in computer

science” (Clara, I1). Similarly, Fiona stated that in STEM fields “where there are less women [...] you feel the need to prove yourself more because there's less of you [women] and so more is expected of you” (Fiona, I1). Nevertheless, it became also clear that most participants did not want to put gender differences to the forefront of their thoughts, even though it was a widespread and influential aspect. Dana touched on this double-sided issue in her first journal:

I don't think about my gender on a day-to-day basis, but everyone around me seems to do so, whether or not I wish for it. It's hard being a woman in STEM... Even if the people around me are supportive, there's always the underlying “you can improve,” and “good enough” is not enough (Dana, J1).

While gender discrimination was pushed to the background by most participants, many still struggled with this topic. When Dana was asked if she thought that mindfulness can support her as a woman in STEM, she answered: “Oh, yeah, definitely. It can be hard to feel like maybe I don't have a voice. Like all of my colleagues, all the people that I've worked with are men. And so I can feel a little out of place despite my qualifications” (Dana, I3). Fiona addressed her issue with doing outreach in schools: “As current women in STEM a lot of the times we're encouraged to work at those STEM camps and promote the field. But all the time it's like, I don't want to bring girls into a field that I'm not making better [...] and that is not ready for them” [Fiona, I3]. She explained further that there are a lot of heightened stigmas around women and emotions in STEM that can make it difficult to find their own way by being themselves: “I feel like as women you're kind of looked down on like you're dramatic or you're emotional or whatever. My male co-workers can get mad, and they can curse all the time but if I get upset, I am called a

drama queen” (Fiona, I3). However, she realized that she wants to make STEM more equitable and inviting for future and current female researchers and mindfulness, she said, will help her make sense of her own emotions and stand up for their validation as well. She summarized: “[...] by excluding half of the population by a hostile workspace. It's not doing anything and not producing the best that science there can be" (Fiona, I3). In addition, she spoke up about gender discrimination that she experienced in her department and STEM in general. She said:

“A lot of people didn't take me seriously that these people were sexist. Now, I'm just owning it. That's my experience and I deserve to be able to say that that happened to me. And when I see someone else acting like that, I feel like that I absolutely am allowed to say that that's not okay. Especially because it's bettering our whole field and supports recruiting women” (Fiona, I3).

Channeling Growth and Challenging External Formulas concern gender and professionalism, which were important for the participants to make sense of and to establish the way of taking on more Self-Authorship by managing Crossroads. It also helped to form a sense of urgency to make the STEM fields more equitable for other women and encouraged them to rethink who they are in STEM and who they want to be, including their Science Identity.

Science Identity

Science identity is how the participants see themselves as scientists and how they want to be part of the STEM community. In terms of how they see their competency as a researcher, the pre-and post-intervention measures of the WIALS job competency domain shows a statistically significant effect, with $t = 3.250$, and $p = .00999$. No

statistically significant changes could be identified from the WIALS domains of intellectual ability and scholastic competence. This links to the previous finding that the issues female STEM graduate students face in trying to establish themselves in STEM may not merely concern their perception of intelligence or general belief that they can complete research work. Improving on the SAT is a long-term process that cannot be expected to be completed within a short period of time.

Self-authorship entails the management of emotions and feelings one has about their identity - in this case, science identity. Dana and Gabby could utilize their growth awareness to explore who they want to be in STEM and move toward a stronger ownership of their STEM identity. As Dana was able to analyze with mindfulness: “I have been recognizing like I would not have done this [degree], if I wasn't, not only good at it, which is important like I'm good at what I do, but I enjoy it” (Dana, I3). Gabby adds: “I don't want to rely on external recognition to have confidence in my work, I want to be able to recognize its significance myself” (Gabby, J3).

Self-authorship was strengthened by working through internal and intrapersonal effects on Science Identity. As such, participants recognized that other people helped them to get where they are but that they had their own fair share of involvement that primarily shapes who they are today. As Clara explained:

I used to see my successes in how other people contributed to them. I still think it's very important to acknowledge when someone has helped you, I really do. I wouldn't say that like I got into research on my own. I was not like a large player, that was my advisor [who took me on]. I still think it's really important to look at those measurements, but I took the chance. BUT I'm slowly describing my

accomplishments more of what I did, than what others did, even though, generally you don't get to where you're going, in a vacuum. Other people are gonna have a part. It is a big step for me. (Clara, I3)

Also, Ingrid continually questioned herself as a scientist. Ingrid said:

I used to believe that I was gonna succeed as a scientist, because I wanted to be a scientist since I was like, very young. And maybe I used to believe it like a year ago. But after all those rejections from PhD programs and everything, I don't anymore. So now I'm [lost] --when I was very young, I had a very clear path when this happens and this happens, and kind of like the last PhD part that didn't happen [like I planned it]. It kind of messed up my plan. And so now I don't know where I'm going or what I'm doing. (Ingrid, I3)

Further, Ingrid continuously compared her work, and especially her knowledge in new-to-her topics, to other students and even professors. When asked what she thought the characteristics of a scientist were, she responded that they are someone who is researching something. The irritated look on her face when she answered the question indicated that she thought the answer was obvious. I asked her in return, “But aren’t you researching something? Aren’t you a scientist then by its key definition?” Ingrid agreed reluctantly and a little surprised with: “Yeah, I haven’t thought about it this way” (Ingrid, I3). Discovering and redefining their science identities became an impactful journey that was fostered by self-authorship and catalyzed by exploring the status quo of their interpersonal and intrapersonal ways of living, as well as challenging threatening stereotypes. Creating a steady science identity is a matter of time and ongoing experiences, but mindfulness added to the foundation for such endeavors.

In terms of how personal lives and academics often collide, the participants were able to let themselves be less defined by their research progress. Gabby responded that mindfulness helped her to acknowledge small accomplishments but not let hiccups interfere with her positivity outside the lab. She further reflects on her new emotional balance:

I've learned that I carry so much of the status of my work into my own emotions. If my calculations are going well, then I can be happy. If my calculations are not going as I want them to, I'm sad or frustrated. Science is about trying new things, some of which work and some of them don't, and I don't need to hold onto those outcomes as my own emotions. (Gabby, J3)

Jessica suffered immensely from letting her research define herself prior to the study. She told the story about when she wrote the essay for her comprehensive exam:

"I felt my writing would make my committee members very unhappy and they would not understand the depth or meaning of my writing. I feared that I could not meet their expectations at all. Therefore, I thought I was going to fail. Then what would happen to my PhD-- to my dream? How I am going to survive being a PhD drop-out" (Jessica, J3)?

Jessica's life revolved around her research and her identity seemed to be wrapped up around her PhD, which placed high amounts of stress on her. Reflecting on her science identity through mindfulness made her rethink these behaviors and become more present in her personal life:

"After I do my mindfulness exercises, I feel really good. Now, I study some and I can actually focus more. I realized that I need to do meditation on an everyday

basis, not only for my studying but also for other things in my life, to stay focused and present, or at least just feel good when I'm doing it. Not feeling so much anxiety or feeling like I cannot do things, so it's better. It's nice to have these good feelings in my head, like being confident about my life" (Jessica, I2).

Moreover, Ella grew confidence in herself to succeed as a scientist. She said in the last interview: "I think I have more confidence and with that comes the motivation to explore new things, which could be like how probably I can find a solution to a problem I'm thinking about" (Ella, I3). Even Fiona, who had been critical about her future involvement in STEM remembered her enthusiasm for the field: "I can see myself long term benefiting science, both by my research because I do really care about that, but also by communicating with non-scientists, and maybe like bringing that to more people by making it more relatable" (Fiona, I3). The participants were able to become aware of their own strength and change their internal science narrative to further explore and foster their science identity. This allowed them to be more confident and prouder of who they are in STEM, which supported their science self-authorship.

Summary of Findings

The findings showed that mindfulness practice through this 8-week intervention was able to form a Mindfulness Foundation, including increased Awareness and Presence, Emotion Regulation, and Self-Compassion. This Mindfulness Foundation then supported the participants in unique and different ways and a connection between the journey to deal with IP and increase self-authorship was identified.

The first research question asked in what ways mindfulness can support female STEM graduate students manage the impostor phenomenon. For this, the Mindfulness

Foundation encouraged the participants to work on their Emotion and Impostor Awareness, Academic Presence and Performance, and Academic Self-Efficacy. These areas of growth supported each other and ultimately let the participating students feel a greater sense of Belonging in STEM, which all together helped to mitigate impostor feelings. The second research inquiry asked if mindfulness could support the participants to progress on the self-authorship trajectory. The findings show that the Mindfulness Foundation in this particular case supported the graduate students in terms of Channeling Growth, including the mindful negotiation of interpersonal relationships, and Challenging External Formulas. Mindfulness gave a sense of awareness toward how the participants saw themselves as part of the STEM field and what they ultimately wanted their impact to be. This linked to making progress in terms of reimagining their Science Identities and encouraged improvement on the SAT.

The next chapter will discuss these findings in various contexts and in light of the current literature as well as the limitations of this study, suggestions for future research, and conclusion.

CHAPTER FIVE: DISCUSSION AND IMPLICATIONS

Introduction

The purpose of this study was to investigate how mindfulness affects female STEM graduate students in managing impostorism and in what way mindfulness helps them to advance on the self-authorship trajectory. The justification for this research builds on a) the growing need to support diversity in STEM, b) the call for further research on the link between IP and intrapersonal development, and c) the gaps in literature on IP and mindfulness in graduate education compared to other education settings.

Gender enrollment imbalance is a particular issue in engineering and computer science graduate degree programs (National Science Foundation, 2019). Several reasons can be listed to explain this imbalance, including IP. Research has shown that IP is a critical factor when it comes to female student retention, student well-being, and success in STEM (Dahlvig, 2013; Sakulku & Alexander, 2015; Parkman, 2016). IP includes highly intrapersonal issues at its root and thus, shows compatibility with the practice of mindfulness that can be practiced individually. Similarly, self-authorship has been called a valuable characteristic for graduate students in terms of their personal development and academic success (Baxter-Magolda, 2014). While recent literature has begun to inquire about a possible relationship between IP and mindfulness (Zanchetta et al., 2020; Schmulian, Redgen & Fleming, 2020) the research in this realm is still in its infancy. Further, no previous literature was found that used self-authorship as the theoretical

approach for such an inquiry and prior studies have mostly utilized quantitative methodologies. Finally, the effects of mindfulness have not yet been examined in relation to advancement on the self-authorship trajectory. Therefore, this current study advances the previously published literature and its gaps, by: a) creating and administering a specifically designed mindfulness intervention; b) emphasizing the intrapersonal mindfulness development through (academic) self-authorship theory; and c) using a mixed-method approach.

This chapter will offer a discussion of the findings by putting them into the context of the existing literature and highlighting how this research can fill gaps and answer recent calls for further inquiry. The discussion is structured by observed themes and guided by the study's purpose as well as research questions. Moreover, the possible implications of this study to improve STEM graduate education and support female students to succeed as members of the STEM community are addressed as a call to action. Lastly, the study's limitations are discussed, suggestions for future research are stated, and a conclusion will provide final thoughts.

Discussion of Findings Part 1 - Managing IP for More “I can do this!”

The findings supported the current study's hypotheses that mindfulness helps female STEM graduate students deal with IP. This happened in numerous personalized ways. Prior research has focused on investigating a possible correlation between IP levels and components of mindfulness, such as self-compassion (Patzak, Kollmayer & Schober, 2017). Yet, the existing research called for more intervention-driven and qualitatively explored studies (Zanchetta et al., 2020; Schmulian, Redgen & Fleming, 2020). The current research contributed to answering this call. In order to make the case for

mindfulness as an effective way to address impostor feelings, it was argued that impostors' deficits in academic self-efficacy and self-awareness could be adjusted through mindfulness (see Figure 1). This assertion was grounded in previous research. Barry et al. (2018), for example, found that mindfulness increased efficacy and resilience in doctoral students. Further, Nedegaard (2016) stressed that in order to cope with IP, self-awareness must be improved. The findings of this study not only support Barry et al. (2018) and Nedegaard's (2016) previous findings, but also introduce the exciting finding of the Mindfulness Foundation as a cohesive foundational piece. The developed Mindfulness Foundation included self-awareness but also incorporated emotion-regulation and self-compassion. These latter two concepts are highlighted in prior research as positively related to mindfulness (Brockman, Ciarrochi, Parker & Kashdan, 2017; Patzak, Kollmayer & Schober, 2017). The foundation supported the development of academic self-efficacy as well in addition to IP Awareness, and Academic Presence and Awareness. Together, all these mindful characteristics eventually supported the participants' feelings of belonging in their degree field. Therefore, the findings not only confirmed a negative relationship between mindfulness and IP, but they also gave a more detailed insight into the complex processes of the participants' journey toward growing from "I don't know if I belong" (higher IP) to "I can do this because I belong here." (lower IP).

The cumulative observation for the first research question was that mindfulness supported feelings of belonging in STEM. Previous research suggested that a sense of belonging, especially in terms of belonging into an academic context, influences people's academic motivation, achievement, and overall well-being (Anderman & Freeman,

2004). The findings in this current study support these results. Belonging supported the participants in finding their own place in their field and realizing how they could contribute to it. Belonging has been negatively correlated to the impostorism (Sakulku & Alexander, 2011; Chapman, 2017; Roskowski, 2010; Parkman, 2016). Since higher IP relates to lower belonging, increasing belonging can arguably offer a way of counteracting impostor feelings. Thus, the finding that highlights how mindfulness induced belonging is an important contribution to the literature. Belonging fosters well-being and satisfaction and is positively linked to retention and success in schooling (Knifsend, 2018; Ahn and Davis, 2019).

Furthermore, mindful belonging addressed another issue that some participants brought up, which was the impression that they must alter or change their behavior, demeanors, or look in order to fit in with their peers and department social norms. It can be argued that such social environments must become more inclusive and welcoming to all individuals. Mindfulness and a mindfulness-induced sense of belonging helped the participating students to reflect on this notion. It not only gave students permission to be upset about such impressions, but with establishing awareness, self-compassion, and emotion regulation, mindfulness supported the realization that the participants could indeed belong in their field if they are themselves. While these findings are exciting, certainly more research is needed to explore the relationship of mindfulness and belonging in female STEM graduate students and across higher education in general to confirm these relationships and outcomes.

Mindfulness and IP as Multifaceted Phenomena

The holistic and open-minded approach towards mindfulness in this study may be one of the factors that led to these promising results. The multifaceted nature of mindfulness has been addressed in the literature (Kabat-Zinn, 1990; Leary & Tate, 2007). In these terms, mindfulness provides numerous diverse practices and provides support for many different intrapersonal concerns. Similarly, IP is a multidimensional concept as well that affects individuals in many different ways (Parkman, 2016). Prior studies focused on either certain mindfulness practices or mindfulness concepts, such as self-care (e.g. Moore, Jeglum, Young, & Campbell, 2019) to investigate their influence on IP related aspects (Barry et al., 2018; Lee, Tseng, & Liu, 2016).

Along the same lines, previous research defined IP as the fear of being intellectually incompetent and fraudulent (Clance & Imes, 1978; Bernard et al., 2017). However, the present study sees value in addressing mindfulness and IP both as multifaceted phenomena. The findings demonstrate how students may experience IP and why these experiences can vary. An intervention focused on only one area of mindfulness (e.g., self-compassion) or one practice (e.g., yoga) may not be able to fully address IP for people's diverse needs. As previously discussed, Gabby concurred and emphasized how important the intrapersonal journey had been for her confidence and feeling of belonging. Yet, Fiona highlighted that she profited especially from the new knowledge of how to regulate her emotions. Anna said she needed to sort out relationships that made her feel incompetent and she built boundaries as to what extent she allowed others to influence her. Ingrid, for example, highlighted that group interventions did not help her as much as the self-lead mindfulness program did. The intrapersonal factor of mindfulness

established preventative behaviors and a more stable mindset that helped her to manage IP feelings before they spiraled out of control. Group interventions on the other hand, only helped her in the moment of the intervention itself. Gabby concurred and emphasized how important the intrapersonal journey had been for her confidence and feeling of belonging. Had the study focused on only one or a limited number of these mindfulness aspects, any of these participants may have been left out. Thus, it can be argued that incorporating mindfulness into previously established interventions (e.g. group discussions and panelist talks) will be able to reach a broader range of IP affected students.

Uncovering IP in Graduate School

An overwhelming response from the participants concerned the positive impact that mindfulness had on them to become aware of their impostor feelings and be able to address them. This is in line with previous literature that stated the importance of people to realize their impostor to become prepared and open-minded for coping strategies (Hutchins & Rainbolt, 2017; Vergauwe et al. 2015). The majority of participants, including Beret, Dana and Gabby, did not express strong concerns about IP feelings in the beginning of the study. In fact, they said that they were certain to have left such feelings behind after receiving their undergraduate degree. Yet, the stories they told during the first interview, as well as their CIPS levels uncovered that they were actually dealing with impostor related issues. Beret, for example, struggled with taking on a masculine way of performing to fit into her research group, indicating that she wasn't fit for the position. Gabby knew that she was intelligent but had a hard time with seeing her accomplishments as they relate to her peers or receive compliments for her work. Dana

struggled with comparison and not fitting the stereotypical STEM culture in academia. These findings implied that the participants were highly impacted by the thought that graduate students should be beyond impostor feelings. While no evidence of this message was found in the reviewed literature, it was a popular idea throughout the participant sample. This particular assumption invalidates the participants' feelings of IP and can increase their feeling of not belonging, which threatens their personal success and retention. Ingrid indicated in an interview that IP became actually stronger in her graduate career. She explained the feeling as the more she knows, the more she realizes that she doesn't know much. This created anxiety and uncertainty in terms of knowing the 'right' things and possibly not meeting standards.

The extent to which silencing and suppressing IP feelings can be harmful became especially clear once the participants unpacked these feelings in their mindfulness journey. The need to fit into the STEM community in their department or science workplace left no space for addressing IP feelings. Even though IP was talked about frequently in conferences, classes, and workshops, the participants did not think much of it because a) their IP was suppressed and hidden behind other challenges, b) IP was mainly thought of as not feeling one is not intelligent enough, which did not always apply, or c) the participants thought that they had already overcome IP in their undergraduate studies. The harm that was caused ranged from feelings of anxiety to, thoughts of dropping out of the program, hindering productivity, emphasizing a negative self-talk and image, feeling uncomfortable in research meetings, as well as other psychological and interpersonal issues.

Dana might have undergone the greatest realization of IP. In order to fit into her male-dominant research group, she partially-unconsciously started to take on stereotypical masculine ways of dressing, behaving, and dealing with stressors. When realizing that this could be due to IP, she was able to put more pieces together and deeply reflect on her current state of self. Further, she was able to overcome a depressive self-numbing phase by becoming aware that her upcoming dissertation defense was creating these feelings. In another example, Anna learned how much of an impact comparison to other peers had on her. She would get lost in the thoughts of not being good enough or not fitting into her research group. Being a victim of gender stereotyping comments, she started to believe that she did not belong in STEM. Yet, mindfulness helped her to detangle the involved emotions, and to organize her relationships to be less IP inducing.

Simply having the ability to acknowledge IP was a great success in this particular study and the Mindfulness Foundation played a significant role in facilitating this aspect. Some critiques may say that becoming aware of IP can create stereotype threats (Inzlicht & Schmader, 2011). Yet, overall, nine out of ten participants disagreed with this notion and emphasized how helpful it was to not only become aware of their IP but at the same time, receive the tools to process it through mindfulness. Even Clara, the one participant who considered it difficult to become aware of IP, reflected that after becoming aware of it, she was glad to know about her impostorism. Otherwise, she said, she would have continued to ignore IP as a trigger for her anxiety and depression. This observation challenges the findings by Barr-Walker, Werner, Kellermeyer, and Bass (2020), who imply from their online survey study that intrapersonal strategies, including reflection and mindfulness would not ameliorate IP but heighten it. The reason for this disconnect may

be that the present study helped to facilitate mindfulness as it relates to IP. In addition, practical tools were offered to deal with impostorism through intrapersonal strategies.

Academic Engagement

Mindfulness became a positive influence for the participants when it came to Academic Presence and Performance. After learning about the ways in which the impostor phenomenon is affecting them personally, the participants collectively reported that they were more productive when it came to research and other schoolwork. Motivation has been negatively correlated with IP in that IP can reduce motivation in women in higher education (Vaughn, Taasobshirazi, & Johnson, 2020). In the current study, the mental space that IP-induced negative thoughts and a harmful academic self-image took up was decreased. This created room for more concentration and productivity. These findings concur with previous research that correlated mindfulness with increased concentration and productivity (Kersemaekers et al., 2018; Sweeney & Howell, 2017). In the present study, Jessica was surprised to discover that her issues with productivity and motivation were not only catalysts for IP, but they were also outcomes of it. The less productive and motivated she felt, the more she felt like an impostor; also, the more like an impostor she felt, the less productive and motivated she was. It became a seemingly endless cycle. Once Jessica realized that these behaviors and ways of thinking could be related to IP, she was able to tackle the issue with help of mindfulness. In fact, IP has been linked to procrastination efforts in prior literature inquiries (Chandra et al., 2019). In another example, Gabby did not realize before how much her impostorism was holding her back from being more creative and enjoying her research more. She was too wrapped

up in self-doubt feelings and had little patience with her own learning, especially when she compared herself to her peers.

This is an important finding because it underlines the effectiveness of mindfulness beyond this research mindfulness also supported the participants in becoming more productive and satisfied researchers. Thus, even if IP may not be an issue for other students, being engaged with one's work and mentally able to keep working on projects are necessary characteristics that can be supported with mindfulness (Becker & Whitaker, 2018; Butzer, Ahmed, & Khalsa, 2016). This is an under-researched topic in STEM education, where performance and productivity are arguably key aspects for success. Hagness, Crone, Kesebir (forthcoming) investigated the effect of mindfulness training on the well-being and creativity in engineering students. The authors argue that graduate student's well-being, creative thinking, as well as intellectual courage can together support them in their efforts to plan and administer innovative research. The present research supports this hypothesis and also supports the arguments that more research must be conducted.

In addition, the findings suggested that academic engagement supported academic self-efficacy and helped the participants believe in their abilities to be a (successful) scientist. This in turn, also helped to deal with impostor related doubt. Chakraverty (2019) calls for "improving student mental health and retention rates, alleviating some of the PhD training stressors by designing interventions that improve students' mindset and self-efficacy" (p.159). Believing in themselves helped the participating students to negotiate their struggles getting through academic challenges such as writing and publishing research papers as well as being motivated and engaged enough to continue to

face these challenges. Ella, Ingrid, and Clara in particular benefited from the mindfulness-induced academic self-efficacy, which made a great difference not only in their academic performance but also how they saw themselves as members of the STEM community.

Discussion of Findings Part 2 - Academic Self-Authorship for More “This is me and I earned this”

The second research question explored the impact of mindfulness on the participant’s self-authorship trajectory. As Fiss et al. (2019) note, self-authorship “requires the individual to shift from uncritically depending on external authorities for values, beliefs, identities, and loyalties to defining these elements internally” (p.2). The theoretical framework of self-authorship has shown in this study to be a relevant approach for exploring the impacts of mindfulness on female STEM graduate students. Additionally, it was clear early on in this research that mindfulness and self-authorship share possible links through their intrapersonal and reflective nature that was again rooted in self-efficacy and awareness.

Through the literature, it became apparent that mindfulness can be an important factor in support of self-authorship: the “internal capacity to define one’s belief system, identity, and relationships” (Baxter Magolda, 2007, p.69). In particular, the focus on science identity development became of high interest in this study. Science identity here is defined in line with Carlone and Johnson’s (2007) framework, which includes three elements that are first, recognition, where in this case, the participant is recognizing herself as a science person as well as other people recognize her as such. Second, competence, which addresses the knowledge and understanding a person has about

science. Third, performance means using tools and practicing science, often in a social environment. All three components show connections to self-authorship development that addresses how individuals see themselves (intrapersonal dimension), how they view knowledge (cognitive dimension), and their relationships (interpersonal dimension). Self-authorship does not only foster the development or thought of identity. It also challenges the individual to internalize this identity and the values that come with it. Similarly, Carlone and Johnson (2007) explain that a science identity cannot be merely based on the intentions and abilities a person has toward science, but it must include a certain extent of internalization. They explain:

[Science] identity is not just something an individual feels; it is not even what an individual does, although both feelings and actions are components of identity. A science identity is accessible when, as a result of an individual's competence and performance, she is recognized by meaningful others, people whose acceptance of her matters to her, [and herself] as a science person. (Carlone & Johnson, 2007, p.1192)

The authors add that science identity is dependent upon the situation and can change over time. Because of their conceptual similarities, the SAT and science identity are intriguing to discuss together. Both, the SAT and science identity, helped to make sense of the development the participants went through by acknowledging that the journey was influenced by the participants' environment as well as by themselves. The findings underlined that science identity development is a process that is also driven by experiences. Yet, it became clear that with increased mindfulness, the students became more attentive to who they were then, how they saw themselves, and who they wanted to

be eventually. This aligns with Cobb's (2004) argument that a student's developing science identity can eventually affect their sense of who they are personally and who they want to become. Encouraging the participants to explore and expand their science identities supported their sense of self and recognition of personal value in regard to STEM and beyond. Mindfulness helped to facilitate this evolution and became a supporting component of self-authorship and science identity development.

Challenging Stereotypes and Expectations – Gaining Academic Self-Authorship

The findings demonstrate that participants found themselves to be trapped between personal aspirations and visions of how they could be an effective scientist and how outsiders told them to perform. This was a clear example for navigating SAT stage one, Following Formulas and stage two, Crossroads. While the participants began their mindfulness journey each at a personal starting point, managing expectations (Formulas) was a difficult aspect for all students. Graduate education challenges students to move from being a dependent learner to being an independent individual, as they transition from classes to research (Lovitts, 2008).

It is necessary to become aware of such stereotypes, where they are coming from, and to address them. In a recent study by Ehrlinger et al. (2018), undergraduate students were asked to identify characteristics of computer scientists. The responses were overwhelming in terms of descriptors relating to male, highly intelligent, unattractive, low social skills, and computer obsessed. Study outcomes such as those described by Ehrlinger et al. are problematic on many levels, including diversifying the STEM culture. That is, if prospective students come to believe these stereotypes and if they cannot see themselves in this picture, they are more likely to shy away from pursuing a STEM

degree, let alone STEM graduate research. The participants in the current study mentioned their long paths of resistance against these stereotypes as well as resisting the urge to surrender to other people's opinions. Anna and Fiona, for example, stated multiple times that they were on the edge of dropping out of their program because they could not stand up to outsider expectations anymore. Further, the majority of participants relied heavily on faculty and advisor approval. Jessica and Ingrid were prime examples of how threatening this dependence can be for their own self-authorship development. Thus, the current study agrees that public stereotypes decrease a person's self-assessment and perception of competence (Marsh & Scalas, 2011), as well as self-authorship.

To further explore stereotypes in STEM and how they affect a students' self-authorship, they must be put into a larger context. Stereotypes concerning gender and STEM intelligence begin early on in a student's life (Tiedemann, 2000) and are also driven by messages published by media and politics (Steinke et al., 2007; Google-Gallup, 2015). A recent example to consider is the public message of who gets to be acknowledged for their doctoral research. In December 2020, then First Lady-elect, Dr. Jill Biden, was verbally attacked for using her doctoral credentials when being addressed in public (Alaimo, 2020, December 14). The reasons for this attack were based on her doctoral degree being an Ed.D and not an M.D. The criticism is arguably not as much about her achievements, that are indeed wide-spread and cannot be dismissed, but more about her identity as a person and female doctoral degree holder. Dahlvig and Longman (2020) note, "the extent to which societies at large (macro-level) perpetuate gender stereotypes impacts how organizations (meso-level) enact gender norms, and ultimately shapes the ways women envision themselves as leaders (micro-level)" (Dahlvig and

Longman, 2020, p.29). Here, this attack gives the impression for future academic female leaders that, however hard they may work, their award will be minimized (e.g. Chanderbhan-Forde et al., 2012; Hermanowicz, 2012; Helman et al., 2020). In the current study, Fiona addressed her irritation about this topic as well. She explained that she is often chosen to be her department representative for (female) high school students' college fairs or other recruitment events. However, while she enjoys the task and informing other young women about the possibilities in science, she does not believe that STEM is ready for an influx of women students yet. Fiona points toward previously discussed stereotypes, and conservative departmental community norms, potentially favoring men.

Unpacking Personal STEM Stories - Drawing Connections across the Elements

This study was able to discover a negative relationship between self-authorship and IP that was supported by the mindfulness training. Lifting the weight of constant struggles with IP and its repercussions off the participants' shoulders, opened awareness for personal development. This included progressing on the SAT. At the same time, the more self-authorship a participant gained, the more likely they were able to cope with upcoming IP situations. To be clear, the present study did not set out to specifically search for a link between both components. However, the connection became apparent by listening to the participants' stories.

Storytelling is a widely researched topic. Bruner (1990) noted that how stories are told emphasize the perception and experience of events; they are less focused on transmitting universal truth but emphasize the intentions and possibilities. Bruner stated that stories foster a forward-looking mindset by helping to navigate unexpected situations

and emphasize on what could have been instead of what was. It is thus unsurprising and interesting to find that storytelling through mindfulness had such a great impact on IP and SAT. Storytelling is a part of identity formation and fosters an established sense of self (Brown, 2014; Brown & Jones, 2000). Why students begin their STEM journey and the story behind it influences the roots of their STEM identity and drives their motivation to stay in the field to some extent. The stronger this part of their story is, the more they can use it as guidance in difficult situations. Yet, the strenuous environment of STEM graduate school may hinder or weaken this part of the student's story. That is, if they lose sight of their intentions and self-proclaimed purpose, or if they have not worked through them yet (with mindfulness), students may be closer to giving up in stressful times (Perez, Cromley & Kaplan, 2014).

Getting to know the participants' struggles with finding their place in STEM and observing how mindfulness helped them fill this void encouraged the storytelling. The more mindful the participants became of themselves and their environments, the more they started to question the story they had been telling about themselves. This was accompanied by adjustments in how they spoke to and thought of themselves. Altering the personal narrative toward self-compassion was an important process in moving on the SAT as well as dealing with IP emotions. Gabby said that through mindfulness, she stopped 'yelling at herself' when her work did not go the direction she wanted it to. Similarly, Jessica discovered how harshly she spoke to and about herself, undermining her many positive characteristics. Muindi, Ramachandran, and Tsai (2020) argue that the stories about scientists and who they are as scientists and human beings must receive a public outlet. They state that "Science is fundamentally about people – the people who do

science and the people who are affected by science” (Muindi, Ramachandran & Tsai, 2020). Thus, the authors make clear that the stories they are calling for are not necessarily about the science itself but about the human behind it. This, they argue, will help make science in general and science education more accessible for underrepresented student groups, such as women. Providing this study’s participants with space to explore their IP and self-authorship through mindfulness also opened space to explore their STEM story that overall became a holistic opportunity for establishing belonging and fostering science identity.

Limitations

The following limitations were identified in this study and should be considered. First, the participant pool was limited to ten participants who selected into the study. The delicate nature of the research focus, an already limited number of individuals that fit the target criteria, and other logistical reasons contributed to this issue. The small number made it difficult to draw some conclusions from the quantitative data collected and it can be hypothesized that the statistically insignificant results may be dependent on the small sample size. This is further explained in the following: The mixed methods approach allowed me to look at the participants' experience with IP and SAT from different perspectives. Yet, from the beginning of this study, the focus was placed on the qualitative data with quantitative results being used to highlight or further investigate an issue. It must be said at this point that while the qualitative data came out to be conclusive toward answering the research questions, the quantitative data was inclusive in regard to the second research inquiry. In addition to a small sample size, a possible explanation for this observation is that for research question one, it was possible to

choose established instruments to investigate the mindfulness and IP levels. However, for research question two, no instrument could be found that promised high validity. Thus, instruments that seem to be appropriate to measure the fine scales of self-authorship were utilized. Furthermore, improving on the SAT is a life-long approach and the limited time frame of this study could not justify the time needed for such an endeavor.

Yet, as one of the first intervention approaches in the literature, the smaller number of participants made it possible to collect an insightful mixed-method data set of descriptive quantitative results and very detailed qualitative data. Additionally, the study was able to be more personalized and a trusting relationship between the researcher and the participants could be developed more naturally. So, although a small sample size is a limitation in some instances, the small number of participants could also have contributed to a more substantial data collection.

Second, the findings are based on self-reported data by the participants. Therefore, a possibility exists that the data includes a bias due to the participants leaning on socially expected answers. However, the students were recruited on a voluntary basis and confidentiality was assured from the beginning. Consequently, participant bias is believed to be a low concern in this study. Further, the previously mentioned growth in self-reflection and honesty toward one's mindset is reflected in the data and suggests that bias is not a top risk factor.

A third limitation of this study is that intrapersonal changes take time. While the intervention duration of eight weeks uncovered promising results, the participants' long-term success will be determined by their continuous mindfulness practice. However, the

participants' positive experiences and new knowledge of mindfulness practices are encouraging.

Fourth, the researcher in this current research is not a certified mindfulness practitioner. Thus, the support for the participants concerning their mindfulness journey may have been more effective if a professional was present. Nevertheless, the entire study and its intervention was based on previous peer-reviewed literature and on other mindfulness programs that were developed by mindfulness professionals. Further, the literature on mindfulness acknowledges that different ways of being and practicing mindfulness exist and that one way cannot be placed higher than another approach as long as it follows its basic definition: living in non-judgmentally but intentionally in the present.

Lastly, the global COVID-19 pandemic as well as social justice movements in the year of study likely affected most lives and thus, also this research. Besides academic-related IP, the participants went through a multitude of partially unfamiliar emotions and life changes that only intensified potential anxiety and feelings of being overwhelmed. While the focus of the intervention was to explore its impact on IP and self-authorship, the extenuating circumstances that 2020 brought could not be ignored, nor should they have been ignored. An individual's life will have influence on their professional path and stressors outside of academia will continue to weigh on the students. It may have been more effective for the intervention and data collection to happen in person (but could not be due to COVID-19 concerns). Yet, an overwhelming response by all participants was their appreciation for learning about mindfulness in a time when their lives seemed the

most chaotic and this intervention helped to support them to still be the best scientists they could.

Implications and Call to Action

As the world becomes an increasingly complex place to navigate on its own, higher education is scrambling to support its students to learn the necessary skills and knowledge to be successful in the future workforce and society (Baxter-Magolda, 2014). In terms of STEM education, the pressure is increased by the push to support diversity and equity in STEM fields, to foster a creative and innovative workforce, as well as to combat gender inequalities (Shapiro & Sax, 2011). To underscore the importance of this, the US government has labeled STEM education and innovation as essential for the future of the country (White House, 2018). However, improving equity and inclusivity in STEM education cannot solely be based on economic motivations. The results of this study call for a heightened focus on the individual well-being and success for the individual's sake. Students need to develop appropriate mechanisms to help them to manage the psychological challenges they are facing while in graduate school and which will continue to grow beyond campus boundaries. This study provided a practical approach to supporting students in dealing with mental blocks that keep them from being well and successful. Further, self-authorship must become a primary goal of higher education programs. Baxter-Magolda (2014) stressed:

Today's college students are challenged to think critically in order to weigh relevant evidence to make sound decisions, craft a sense of identity that honors and balances their own and others' needs, and develop intercultural maturity to work interdependently with diverse others (p.25).

The present study builds on existing and limited research in new and exciting ways. First, its approach to consider mindfulness holistically rather than only looking at certain aspects of mindfulness breaks from existing literature and promises a fruitful approach for mindfulness work. Second, this study investigated *in what ways* mindfulness influenced IP feelings, whereas previous studies have primarily focused on simple correlations, thus adding a descriptive base for further studies. Third, the theory of self-authorship adds the investigation of how strengthening a science identity potentially mediates feelings of belonging to manage IP and at the same time, is linked to increased mindfulness. Fourth, an eight-week mindfulness program was specifically created and administered for this study to support the participants' IP and self-authorship journey; this demonstrates that a short, low-cost intervention can be impactful and easily disseminated.

The study showed that students who get the opportunity to discover their own efficacy to conquer overwhelming situations and hold a place in the STEM community may not only become better scientists, but they may also alter their story, tell it with confidence, and help to change the public ideas of who is a good scientist. This is important to note, as stories told by female students in STEM, good and bad, are part of the larger issue of recruitment. Fiona noted that she was the target of a great deal of gender stereotyping and sexism throughout her STEM career and recruiting other female students by telling bright stories therefore did not seem right to her. Higher education stakeholders and STEM industry members must reflect deeply on the message they are sending to the public versus the culture they are promoting in their organizations. The retention and well-being of female STEM graduate students must be of interest for higher

education stakeholders to do their part in providing equitable learning spaces and support diversity. Issues of equity aside, this study indicates that mindfulness could be an important component for *all* students and should be implemented with the aim to help students become mentally strong and self-authoring individuals.

More research is necessary to further explore in what ways individuals can profit from mindfulness in terms of IP and SAT. For this, long-term interventions that include multiple follow-up data points should be considered. Intrapersonal changes require time and continuous effort. Longitudinal study approaches can draw a more detailed picture of the participants' journey.

Further, a greater sample size can help to collect increased statistically significant results and support the triangulation of data. The combination of quantitative and qualitative data became a key part for this study, and it is suggested that future studies consider a mixed methods approach, especially if/when qualitative data can fill the holes of quantitative hunches and supply more information about intrapersonal concerns.

Moreover, the intervention could be administered by a certified mindfulness professional in a hybrid or all in-person format. The online intervention format was a well-calculated and appropriate approach in this research. Yet, offering in-person sessions may strengthen the participants' understanding of mindfulness. A mindfulness professional could also demonstrate and adjust certain practices so that they fit the individual's needs better.

Additional research is needed also to address the link between advancing in self-authorship and IP. Increased self-authorship may be hypothesized to decrease IP perception. Self-authorship is an important concept that should be utilized in higher

education settings to support their students in different domains of life. Its potential link to IP has not been investigated until this study. Consequently, in regard to measuring the SAT, future research could investigate a validated instrument that is specifically developed to investigate self-authorship. Also, future research should investigate how mindfulness training can support graduate students to be more productive and engaged with their academic work. The present study observed a positive relationship that needs to be further studied.

While this study intentionally focused on female STEM graduate students, mindfulness is a promising phenomenon that may support other populations as well. Thus, expanding the target population in terms of considering other marginalized groups in higher education STEM programs across advancement levels is suggested. Here, it is important to keep in mind that even though women may be reported previously to experience IP more frequently, IP is indeed targeting individuals from many different groups. Further, IP is not to be reduced to symptoms of low intelligence but needs to be studied as a multifaceted phenomenon.

Lastly, future research should continue to explore mindfulness as an entity of different practices, mindsets, and approaches. Participants will need to find their preferred way of practicing mindfulness to support their custom needs. For this, a variety of mindfulness examples need to be introduced and practiced.

Conclusion

The overwhelmingly positive response toward the intervention was rooted in the participants' need for emotion stabilization and stress support. This study reaffirmed that the STEM graduate school environment offers many impostor and self-doubt triggers for

female students that can jeopardize their success and psychological wellness. These triggers not only catalyzed impostor feelings, but they also limited self-authorship progress. Furthermore, this study observed a problematic language around the commonality of IP, especially for women in science degree environments. Addressing IP as a common phenomenon may help students to take the pressure of their own IP feelings, but it may also lead to the opposite. Most students in this study felt devaluated or emotionally threatened by IP stereotype for women in STEM. Thus, the current research wants to challenge IP narrative toward practical solution offerings that can support individuals rather than trapping them in the impostor corner.

Mindfulness offered individual support for all participating graduate students, based on their personal needs. The mindfulness intervention created a sense of increased belonging in science. In addition to belonging, academic adequacy was negotiated and fostered confidence in their abilities to succeed and contribute to STEM research. The Mindfulness Foundation also allowed participants to explore their science identity and with that, reiterate their purpose for and validity of being a scientist. To do so, the program challenged the students to reflect on areas of growth in their lives and rethink the status quo of their approach to life and career.

The relationship found in this study between IP and SAT has important implications for student development programming and mental wellness support in higher education. Female STEM graduate students face multi-dimensional issues and need support that goes beyond their academic skill set. This study contributes valuable information to the literature and offers practical strategies to support equity in STEM. Importantly, this study also introduced a new theoretical approach to investigate IP and

produced thick descriptions of what female students are dealing with interpersonally and how they need to be supported.

What all participants shared was an incredible drive to contribute to their fields and their passion for science. This was supported by their desire to tell and discover their STEM stories. Limiting or jeopardizing their voices cannot be accepted and the efforts to make STEM a more diverse field overall must be continued. The impetus for this must go beyond creating a successful workforce and focus on supporting minority scientists to be the scientists they ought to be. Fiona said it best when she summarized the impact of this study on her life:

I think a lot of the time, in engineering as a whole, it's like we're going to weed you out because there are all these people who want to be in engineering. But it's like 'No', I am not a replaceable person. I am the only person who is going to see my skills and their value. So, I think that that has helped me to realize my worth and sticking with it. Because I feel that I can benefit the STEM fields. So, in the long term, it'll keep me more engaged with that goal, not allowing everything that comes up to be like, okay this is it I'm dropping out. [...] Mindfulness is going to keep me focused on why I'm here, what I actually want to do, and what I can do for this field. (Fiona, I3)

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APPENDIX A

Mindfulness Program Framework

Week	Reflection Focus	Formal Practice 1	Formal Practice 2	Formal Practice 3	Informal Practice
1	Introduction – What is mindfulness?	Mindfully Eating a Raisin	Walking Meditation	Mindful Check-in	Mindfulness Every Day – Brushing your Teeth/Washing the Dishes
2	Mindful Body – What is my body telling me?	Body Scan	Yoga	Mindful Exploration: How your symptoms Affect your life	Mindful Listening
3	Reflection – Thought are just Thoughts	Mindfulness of Thoughts	Narrow-Gauge Walking Meditation	STOP Exercise	Mindful Drawing
4	Emotions – Surfing on the waves of emotions	Self-Compassion Meditation	Mindful Floor Yoga	Mindful Exploration: Wise nourishment for all levels of your being	Mindfulness Every Day – Folding the Laundry/Picking out clothes
5	Attention- Attention to the inside and the outside	Awareness of Feelings	Wide-Gauge Walking Meditation	Brief Body Scan in Mountain Pose	Mindful Reading
6	Tenderness – Be kind to yourself and take it as it is	Loving-Kindness Meditation	Yoga	Sitting Meditation	Mindful Listening
7	Habits- Practice Healthy habits of mind	Sitting Meditation	Mindful Walking	STOP Exercise	Mindfulness Every Day – Doing Your Hair/Washing Your Face
8	Empowerment – Gaining the inner Edge	Mindful Breathing	Mindful Standing Yoga	Checking in with Thoughts in Mountain Pose	Mindful Drawing

APPENDIX B

Recruitment Email

Greetings.

My name is Sarah Lausch and I am a doctoral candidate in the Ed.D. Curriculum and Instruction program at Boise State University. I am conducting a dissertation research study about the correlation of female STEM graduate students' experience with impostor feelings and mindfulness. I am emailing to ask if you would like to potentially be part of this research project.

The study will involve an eight-week mindfulness program, conducted between June 1st and August 3rd, 2020. You are asked to complete 3 self-lead weekly mindfulness practices, three interviews with myself throughout the program, and weekly journal entries. Your total weekly time commitment is anticipated to an average of 3 hours. Participation is completely voluntary, and your answers will be anonymous.

The first ten people to be accepted to participate in the study AND fully complete the program and data collection protocol will be rewarded with a \$200 Bronco Shop gift card.

If you are interested and can check off the following criteria, please click on the link to complete a contact survey:

Eligible participants must:

- Be currently enrolled in a doctoral or master's level engineering or CS program
- Be considered full-time students at the time of the study*
- Have completed at least one full semester (at least 9 credits) of their current graduate program

* Since the study will take place during the summer semester, participants will have to be enrolled in at least one 3+ credit course, independent study, fellowship, or internship in their major degree department during the time period of the intervention.

If you have any questions, please do not hesitate to contact me (sarahlausch@u.boisestate.edu). I will get in contact with you via email and invite you to an informal meeting to discuss more details about the study.

Thank you for your time.

Sarah Lausch
Ed.D. Curriculum and Instruction Candidate
Boise State University
sarahlausch@u.boisestate.edu

Faculty Advisor:
Julianne A. Wenner, Ph.D.
Assistant Professor
Curriculum, Instruction & Foundational Studies
College of Education
Boise State University
juliannewenner@boisestate.edu

APPENDIX C

Contact Survey

Link to the Google form: <https://drive.google.com/open?id=13j0wTe2x1B7UNbonfpkn-iOcgUN5-puLmS963oGHhel>

Introduction

Female STEM Graduate Students' Experience of Impostor Feelings

Hello.

Thank you for showing interest in being part of my dissertation research study about the correlation of female STEM graduate students' experience with impostor feelings and mindfulness.

The study will involve an eight-week mindfulness program, conducted between June 1st and August 10th, 2020. You are asked to complete 4 self-lead weekly mindfulness practices, three interviews with myself throughout the program, and weekly journal entries.

Your total weekly time commitment is anticipated to an average of 3.5 hours. Participation is completely voluntary, and your answers will be anonymous. The first ten people to be accepted to participate in the study AND fully complete the program and data collection protocol will be rewarded with a \$200 Bronco Shop gift card.

In order for me to determine if you are matching the participant profile to be part of the data collection, I am asking you to answer the following questions and the two attached surveys concerning your feelings about the impostor phenomenon and mindfulness.

If you have any questions, please do not hesitate to contact me (sarahlausch@u.boisestate.edu). If you are eligible for the study, I will get in contact with you via email and invite you to an informal meeting to discuss more details about the study.

If you have any questions or concerns about your participation in this study, you may contact me, the Co-Principal Investigator, Sarah Lausch: 208-985-3068 or sarahlausch@u.boisestate.edu, or the Principal Investigator and Faculty Advisor, Dr. Julianne Wenner: juliannewenner@boisestate.edu.

Thank you for your time.

Sarah Lausch
Ed.D. Curriculum and Instruction Candidate
Boise State University

This study has been reviewed and approved by the Boise State University IRB (IRB). If you have questions about your rights as a research participant, you may contact the IRB, which is concerned with the protection of volunteers in research projects. You may reach the board through the Office of Research Compliance by calling (208) 426-5401 or emailing humansubjects@boisestate.edu.

Personal Background

Name (first and last) *

Your answer

Preferred Email Address *

Your answer

Degree Program, Department and Semester (e.g. Material Science, Engineering, 3rd semester) *

Your answer

Academic Supervisor's Name *

Your answer

Are you enrolled in at least one 3+ credit course, an independent study, fellowship, internship or similar, in your major degree department between June 1st and August 3rd? Please specify below: *

Your answer

Are you employed by Boise State University as a graduate assistant, teaching assistant, lecturer or similar? Please specify below: *

Your answer

Contact Survey Mindfulness Attention Awareness Scale (excerpt)

Please complete the following short survey about your experience with impostor feelings. Please take your time to read the statements carefully. Try not to overthink your answers. The success of your participation in the study depends on your honest engagement. *

	1 - Almost always	2 - very frequently	3 - somewhat frequently	4 - somewhat infrequently	5 - very infrequently	6 - almost never
I could be experiencing some emotion and be conscious of it until some time later.	☐	☐	☐	☐	☐	☐
I break or spill things because of carelessness, not paying attention, or thinking of something else.	☐	☐	☐	☐	☐	☐
I find it difficult to stay focused on what's happening in the present.	☐	☐	☐	☐	☐	☐
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	☐	☐	☐	☐	☐	☐
I tend not to						

Contact Survey Clance Impostor Phenomenon Scale (excerpt)

Please complete the following short survey about your experience with mindfulness. Please take your time to read the statements carefully. Try not to overthink your answers. The success of your participation in the study depends on your honest engagement. *

	Not at all true	Rarely	Sometimes	Often	Very true
I can give the impression that I'm more competent than I really am.	☐	☐	☐	☐	☐
I avoid evaluations if possible and have a dread of others evaluating me.	☐	☐	☐	☐	☐
When people praise me for something I've accomplished, I'm afraid I won't be able to live up to their expectations of me in the future.	☐	☐	☐	☐	☐
I sometimes think I obtained my present position or gained my present success because I happened to be in the right place at the right time or knew the right people.	☐	☐	☐	☐	☐
I'm afraid people important to me may find out that	☐	☐	☐	☐	☐

APPENDIX D

Consent Form

Study Title: Using Mindfulness Practices to Support Female STEM Graduate Students
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Principal Investigator: Julianne Wenner

Co-Principal Investigator: Sarah Lausch

Sponsor:

**BOISE STATE
UNIVERSITY**

You are invited to participate in a research study. This consent form will provide you the information you will need to understand why this study is being done and why you are being invited to participate. It will also describe what will be expected of you as a participant, as well as any known risks, inconveniences or discomforts that you may have while participating. We encourage you to ask questions at any time. If you decide to participate, you will be asked to sign this form and it will be a record of your agreement to participate. You will be given a copy of this form to keep.

PURPOSE AND BACKGROUND

The purpose of this research study is to explore and interpret the effects of mindfulness on female STEM graduate students' impostor experience in computer science and engineering. You are being asked to participate because you are a female graduate student enrolled in a computer science or engineering related program.

PROCEDURES

If you agree to be in this study, you will participate in the following:

- Completing an eight-week mindfulness program, including at least 3 mindfulness activities per week
- Completing 8 weekly mindfulness journals using a weekly journal prompt
- Attending three interviews with the researcher throughout the study
- Completing pre- and post-surveys concerning impostor feelings, mindfulness perceptions, academic self-efficacy, and self-awareness (8 surveys total)

The mindfulness program will be administered via an online website. You will be asked to send me your weekly journals via Google documents by Sunday night of each week. If you are part of the interview group: For each interview (week 1, week 5, week 8) I will set up a time with you to meet me on the Boise State University campus. During the first interview you will first complete the academic self-efficacy and the self-awareness surveys followed by the interview for a total of 1 hour of participation. During the second and third interview you will not have to complete any survey. The interviews will be audio recorded and I will take written notes as well.

_____ *Initial to indicate your permission to be audio recorded during the interview.*

RISKS

The surveys will include some demographic information. However, due to the make-up of Idaho's population, if you believe the combined answers to these questions may make an individual person identifiable and you are uncomfortable answering any of these questions, you may leave them blank. I will make every effort to maintain confidentiality.

Some of the survey and interview questions might make you feel uncomfortable or upset. You are always free to decline any question, take a break, or stop your participation at any time. Should you feel discomfort after participating and you are a Boise State University student, you may contact the University Health Services (UHS) for counseling services at (208) 426-1459. They are located on campus in the Norco Building, 1529 Belmont Street, Boise ID, 83706. If you are not a Boise State University student, please contact your own health care provider or call the Idaho Care Line, 2-1-1 (a free statewide community information and referral service).

BENEFITS

This study aims to support you in your academic and personal growth by inviting you to engage in weekly mindfulness activities. You are able to complete the mindfulness activities at the location and time in the day of your convenience. In addition, the information that you provide may help develop improved graduate STEM programming and environments for future college students.

EXTENT OF CONFIDENTIALITY

Reasonable efforts will be made to keep the personal information in my research records private and confidential. Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. The data may be accessed by me, the researcher, and by the Boise State University Office of Research Compliance (ORC). The ORC monitors research studies to protect the rights and welfare of research participants.

The audiotapes from the interview will be transcribed without any information that would identify you. The tapes will then be erased.

Your name will not be used in any written reports or publications which result from this research.

Data will be kept for at least 3 years (per federal regulations) after the study is complete and then destroyed.

PAYMENT/COMPENSATION

Upon your successful completion of the study the first ten students who are successfully completing the requirement of this study, will be rewarded with a \$200 bronco shop gift card. Electronic time stamps will be used to determine the ranking. Successful completion is defined as completing the mindfulness program and all data collection

points: submitting eight weekly journal entries, attending three interviews (pre, during, post the intervention), and completing four quantitative measures (MAAS and CIP, pre and post intervention).

PARTICIPATION IS VOLUNTARY

Your decision to participate in this research study is entirely voluntary. You may withdraw from this research study at any time without penalty of any kind or loss of benefits to which you are otherwise entitled. Note that you will only receive a \$200 bronco shop gift card if you a) are part of the interview group, and b) successfully complete the research study. Successful completion is defined as completing the mindfulness program and all data collection points: submitting eight weekly journal entries, attending three interviews (pre, during, post the intervention), and completing four quantitative measures (MAAS, CIP, academic self-efficacy, and self-awareness; pre and post intervention).

QUESTIONS

If you have any questions or concerns about your participation in this study, you may contact the Co-Principal Investigator, Sarah Lausch: 208-985-3068 or sarahlausch@u.boisestate.edu. or the Principal Investigator and Faculty Advisor, Dr. Julianne Wenner: juliannewenner@boisestate.edu.

This study has been reviewed and approved by the Boise State University IRB (IRB). If you have questions about your rights as a research participant, you may contact the IRB, which is concerned with the protection of volunteers in research projects. You may reach the board through the Office of Research Compliance by calling (208) 426-5401 or emailing humansubjects@boisestate.edu.

DOCUMENTATION OF CONSENT

I have read this form and the descriptions of this research study. I have been informed of the risks and benefits involved and all of my questions have been answered to my satisfaction. Furthermore, I have been assured that any future questions I may have will also be answered by a member of the research team. I understand I can withdraw at any time. I voluntarily agree to take part in this research study.

Printed Name of Study Participant	Signature of Study Participant	Date

Signature of Person Obtaining Consent	Date

APPENDIX E

Interview Scripts

INTERVIEW SCRIPT INTERVIEW 1 (WEEK 1)

Investigator will have collected consent forms during initial information meeting.

“Thank you for agreeing to speak with me today.”

“The purpose of this study will be to explore the effects of mindfulness practices on how female STEM graduate students manage impostor feelings. Therefore, the first interview is for us to get to know each other better and learn about your experience with the STEM field, your impostor feelings, and similar topics. Specifically, I want to understand how you see yourself in the STEM field and prepare you for the upcoming weeks to successfully engage in the mindfulness program.”

“The interview will last about 1 hour, and I will audiotape the discussion to make sure that it is recorded accurately.”

“Do you have any questions for us before we begin?”

Interview topics/questions:

- Tell me about your STEM story (the participants will receive the following questions prior to the interview to self-reflect and write down their story. I will ask follow-up questions): How did you get into the field? What or who drives your motivation to stay in STEM and even pursue a graduate degree? Why did you choose it in the first place? Can you tell me about moments when you were especially proud of yourself and/or struggled in STEM? How do you see yourself in the STEM community/ how would you describe your role (as a female) in your STEM community? Where do you want to go with your STEM career/what is your goal and why? Tell me about what comes to your mind when you hear the phrase “impostor phenomenon”.
- You will engage in a mindfulness program, let us talk about your experience with mindfulness: Can you describe to me how familiar you are with mindfulness and/or its techniques? What are you personally wanting to get out of this program?
-

INTERVIEW SCRIPT INTERVIEW 2 (WEEK 4)

Investigator will have collected consent forms during initial information meeting.

“Thank you for agreeing to speak with me again today.”

“The purpose of this second interview is to understand your experiences with the mindfulness program thus far and how, if at all, it has impacted you during the past five weeks. I also would like to hear more about your current ‘STEM life’ and involvement, and of course about your feelings of impostorism and/or other related aspects that come to your mind.”

“The interview will last about 1 hour, and I will audiotape the discussion to make sure that it is recorded accurately.”

“Do you have any questions for us before we begin?”

Interview topics/questions:

- Let us talk about the mindfulness program you have been following: Please describe to me your experience with the program thus far. What has been challenging/ what positive change could you observe? What types of practices have been your favorites and why? Could you draw on some of the practices outside of the program?
- Let’s shift to your current study/work life in STEM: What are you working on right now? Have you noticed changes in your mindset/thinking/behavior? Now that you are more aware of the impostor phenomenon, please define again, what it means to you (answer will be compared to a scholarly definition)? How have impostor feelings impacted you since we met last time? What did you do to manage these feelings? What was still difficult? How do you see yourself and your role in the STEM community currently?

INTERVIEW SCRIPT INTERVIEW 3 (WEEK 8)

Investigator will have collected consent forms during initial information meeting.

“Thank you for agreeing to speak with me one more time today.”

“The purpose of this third interview is to review and reflect on your experiences with mindfulness activities over the time of the study. Specifically, I want to learn more about possible changes that occurred in your state of mind, your behavior in STEM (and possibly private) spheres, and where you see yourself going with your mindfulness journey.”

“The interview will last about 1 hour, and I will audiotape the discussion to make sure that it is recorded accurately.”

“Do you have any questions for us before we begin?”

Interview topics/questions:

- Tell me about your mindfulness journey and how it affected your life: How would you summarize your mindfulness experience in one word? Can you tell me of an event that had been influenced by your mindfulness journey? Can you tell me about your main take-aways from the program? Let’s look at your first reflection and tell me how you think about mindfulness today?
- Let’s talk about your STEM experiences and feelings of impostorism: In what ways, if any, do you believe mindfulness practices supported you as a female STEM graduate student in terms of impostor feelings? Do you believe that you are able to succeed as a scientist and why? How would you describe your accomplishments? In what ways, if any, do you believe mindfulness practices supported you as a female STEM graduate student in terms of believing in your ability to succeed?
- What could you not manage yet in terms of Imposter feelings? What tools could you add that help you deal with impostor feelings? How will you further your mindfulness journey beyond this study?

APPENDIX F

Mindfulness Attention Awareness Scale

Mindfulness Attention Awareness Scale (Brown & Ryan, 2003)

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

	1	2	3	4	5	6
	almost
always	very
frequently	somewhat
frequently	somewhat
infrequently	very
infrequently	almost never
_____ 1.	I could be experiencing some emotion and not be conscious of it until some time later.					
_____ 2.	I break or spill things because of carelessness, not paying attention, or thinking of something else.					
_____ 3.	I find it difficult to stay focused on what's happening in the present.					
_____ 4.	I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.					
_____ 5.	I tend not to notice feelings of physical tension or discomfort until they really grab my attention.					
_____ 6.	I forget a person's name almost as soon as I've been told it for the first time.					
_____ 7.	It seems I am "running on automatic," without much awareness of what I'm doing.					
_____ 8.	I rush through activities without being really attentive to them.					
_____ 9.	I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.					
_____ 10.	I do jobs or tasks automatically, without being aware of what I'm doing.					
_____ 11.	I find myself listening to someone with one ear, doing something else at the same time.					
_____ 12.	I drive places on 'automatic pilot' and then wonder why I went there.					
_____ 13.	I find myself preoccupied with the future or the past.					
_____ 14.	I find myself doing things without paying attention.					
_____ 15.	I snack without being aware that I'm eating.					

Scoring: To score the scale, simply compute a mean (average) of the 15 items.

APPENDIX G

Clance Impostor Phenomenon Scale

Clance Impostor Phenomenon Scale (CIPS, Clance, 1985)

Instructions: For each statement, please put the number in the box that best indicates how true the statement is of you. It is best to give the first response that enters your mind rather than dwelling on each statement and thinking about it over and over.					
STATEMENT	1 Not at all true	2 Rarely true	3 Sometimes true	4 Often true	5 Very true
1. I have often succeeded on a test or task even though I was afraid that I would not do well before I undertook the task.					
2. When people praise me for something I've accomplished, I'm afraid I won't be able to live up to their expectations of me in the future.					
3. I sometimes think I obtained my present position or gained my present success because I happened to be in the right place at the right time or knew the right people.					
4. I'm afraid people important to me may find out that I'm not as capable as they think I am.					
5. I tend to remember the incidents in which I have not done my best more than those times I have done my best.					
6. It's hard for me to accept compliments or praise about my intelligence or accomplishments.					
7. At times, I feel my success has been due to some kind of luck.					
8. I'm disappointed at times in my present accomplishments and think I should have accomplished much more.					
9. Sometimes I'm afraid others will discover how much knowledge or ability I really lack.					
10. I often compare my ability to those around me and think they may be more intelligent than I am.					

APPENDIX H

Mindfulness Attention Awareness Scale

Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003)

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

	1	2	3	4	5	6
	almost
always	very
frequently	somewhat
frequently	somewhat
infrequently	very
infrequently	almost never
_____ 1.	I could be experiencing some emotion and not be conscious of it until some time later.					
_____ 2.	I break or spill things because of carelessness, not paying attention, or thinking of something else.					
_____ 3.	I find it difficult to stay focused on what's happening in the present.					
_____ 4.	I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.					
_____ 5.	I tend not to notice feelings of physical tension or discomfort until they really grab my attention.					
_____ 6.	I forget a person's name almost as soon as I've been told it for the first time.					
_____ 7.	It seems I am "running on automatic," without much awareness of what I'm doing.					
_____ 8.	I rush through activities without being really attentive to them.					
_____ 9.	I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.					
_____ 10.	I do jobs or tasks automatically, without being aware of what I'm doing.					
_____ 11.	I find myself listening to someone with one ear, doing something else at the same time.					
_____ 12.	I drive places on 'automatic pilot' and then wonder why I went there.					
_____ 13.	I find myself preoccupied with the future or the past.					
_____ 14.	I find myself doing things without paying attention.					
_____ 15.	I snack without being aware that I'm eating.					

Scoring: To score the scale, simply compute a mean (average) of the 15 items.

APPENDIX I

What I am Like Scale

What I AM Like Scale (WIALS; Harter, 2012)

Instructions for students:

As you can see from the header where it says “What I am like”, I am interested in what you are like as a person. This profile contains statements that allow you to describe yourself. This is not a test. There are no right or wrong answers. Since individuals are very different from one another, each person will be marking something different.

Let me explain how these questions work. Please look at the first item in the example below. This question asks about two different kinds of students, and I want to know which student is most like you.

(1) What you need to first is deciding whether you are more like the students on the left side who feels it's important to be good at athletics, or whether you are more like the students on the right side who does not feel athletics is all that important. Don't mark anything yet, but first decide which kind of student is most like you, and go to that side of the statement.

(2) Now I want you to think about whether that is only sort of true for you, or really true for you. Please mark the appropriate box.

(3) Important: For each statement, you only check one box. Do not check both sides, just the one most like you.

	Really True for me	Sort of True for me				Really True for me	Sort of True for me
1	☐	☐	Some students like the kind of person they are	BUT	Other students wish that they were different	☐	☐
2	☐	☐	Some students are not very proud of the work they do on their job	BUT	Other students are very proud of the work they do on their job	☐	☐
3	☐	☐	Some students feel confident they are mastering their coursework	BUT	Other students do not feel so confident	☐	☐

4	☐	☐	Some students feel like they are just as smart or smarter than other students	BUT	Other students wonder if they are as smart	☐	☐
5	☐	☐	Some students are often disappointed with themselves	BUT	Other students are usually quite pleased with themselves	☐	☐
6	☐	☐	Some students feel they are very good at their job	BUT	Other students worry about whether they can do their job	☐	☐
7	☐	☐	Some students do very well at their studies	BUT	Other students don't do very well at their studies	☐	☐
8	☐	☐	Some students do not feel they are very mentally able	BUT	Other students feel they are very mentally able	☐	☐
9	☐	☐	Some students usually like themselves as a person	BUT	Other students often don't like themselves as a person	☐	☐
10	☐	☐	Some students feel confident about their ability to do a new job	BUT	Other students worry about whether they can do a new job they haven't tried before	☐	☐
11	☐	☐	Some students have trouble figuring out homework assignments	BUT	Other students rarely have trouble with their homework assignments	☐	☐
12	☐	☐	Some students feel they are just as bright or	BUT	Other students wonder if they are as bright	☐	☐

			brighter than most people				
13	☐	☐	Some students really like the way they are leading their lives	BUT	Other students often don't like the way they are leading their lives	☐	☐
14	☐	☐	Some students are not satisfied with the way they do their job	BUT	Other students are quite satisfied with the way they do their job	☐	☐
15	☐	☐	42 Some students sometimes do not feel intellectually competent at their studies	BUT	Other students usually do feel intellectually competent at their studies	☐	☐
16	☐	☐	Some students would really rather be different	BUT	Other students are very happy being the way they are	☐	☐
17	☐	☐	Some students question whether they are very intelligent	BUT	Other students feel they are intelligent	☐	☐
18	☐	☐	Some students are often dissatisfied with themselves	BUT	Other students are usually satisfied with themselves	☐	☐

APPENDIX J

Emotional Self-Awareness Scale

Emotional Self-Awareness Scale (Kauer et al., 2012)

Emotional Self-Awareness Scale (ESAS)

All items are on a 5-point likert scale ranging from zero to five (0 = Never, 1 = Very Little, 2 = Sometimes, 3 = Often, 4 = A lot). Subscales range from 0 to 20. Total scale ranges from 0 – 132.

Subscales

Recognition: Items 4, 18, 20, 21, 22, 24. Divided by 6.

Multiplied by 5.

Identification: Items 1, 3, 8, 17, 29. Divided by 5. Multiplied by 5.

Communication: Items 6, 12, 13, 15, 27, 30, 3. Divided by 7.

Multiplied by 5.

Contextualisation: 5, 7, 10, 11, 14, 16, 19, 28, 32, 33. Divided by 10. Multiplied by 5.

Decision-Making: 2, 8, 23, 25, 26. Divided by 5. Multiplied by 5.

Total ESA score: The sum of all subscales.

Item	Question
1	My moods are hard to describe (<i>reverse</i>)
2	I examined my feelings and then decided what to do
3	It's important to me to understand what my feelings mean
4	It's hard for me to tell what mood I'm in (<i>reverse</i>)
5	I analyse my personality to try to understand why I'm upset
6	Expressing emotion is easy
7	I usually know why I feel the way I do
8	I often have trouble deciding what will improve my mood (<i>reverse</i>)
9	I know how I feel about most things
10	I don't know why I feel the way I feel (<i>reverse</i>)
11	I go away by myself and think about why I feel a certain way
12	I like to write down what I'm feeling and analyze it
13	I can talk about mood to others
14	I don't really think about why I behave as I do (<i>reverse</i>)
15	I often 'self-talk' to think about feelings
16	I'm often confused about how I feel about things (<i>reverse</i>)
17	I'm often aware of being emotional, but I can't describe the emotion
18	I frequently take time to reflect on how I feel

APPENDIX K

Weekly Journal Reflection Questions and Drawing Prompts

Week	Journal Reflection Question	Drawing Prompt
<p>1</p> <p>Why you have chosen to join this project</p>	<p>Think about what is going on in your life that made you want to join this project and start your mindfulness journey.</p> <p>What are you hoping for as a result of this experience?</p> <p>What have you experienced during this week while engaging in the mindfulness practices?</p>	<p>Draw a picture of how you see yourself within the STEM community (your cohort, classrooms, STEM workplace, study group, etc.) right now. What is your place/role? How does it make you feel?</p>
<p>2</p> <p>How Impostor Feelings Affect Your Life</p>	<p>Take some time to look back and think about a situation or time, when your impostor feelings were especially present - perhaps a social event, a class project, or a presentation. How did you feel? What made you feel this way? Spend a few moments describing the situation and how your mind, body, and thought reacted.</p> <p>Now, think about the last week of your mindfulness journey. What have you learned about yourself, your mind, body, and your thoughts? How did the practices make you feel? In what way could you feel a difference about how you experienced your everyday life? Take a few moments to write down your thoughts.</p> <p>Think back to the impostor situation you described above, how could you have used the mindfulness practices from this week to be present in the moment? How could it have helped you to become aware of what is happening while it is happening, internally and externally? Write down your</p>	<p>Draw a picture of how you see yourself mindfully reacting to impostor moments in the future. Don't put too much pressure on yourself if you think you cannot follow through each time. Take this drawing as an invitation to be present and forward looking.</p>

	thoughts.	
3 Emotions and what they are telling me	<p>Think about the past week. How did your mindfulness practices support you? Could you practice mindful drawing? How did it go overall?</p> <p>Since beginning this journey what have you learned about your impostor emotions? Have you encountered an impostor incident this week? How did you react and what did your emotions tell you?</p>	Draw a picture of your impostor self (mind/body/emotions) and of your non-imposter self. What would they say to each other? What would you tell each of them? Add your thoughts to your drawing.
4 Feeling What is Called for in the Moment	<p>How did week 4 go for you? Reflect on what you could discover about yourself and this journey. Describe how you are feeling right now in this moment: Are you relaxed, short in time, anxious, excited? How are you going about these feelings?</p> <p>How did you experience your college work this week? Could you focus on the moment and take one feeling and emotion at a time? Could you take advantage of your mindful mind?</p>	Draw a picture of your self-authorship as you perceive it right now. Include your academic self-efficacy and your self-awareness in the picture.
5 Examining your Lenses	You have complete week 5 of this journey. Reflect on how mindfulness practices have changed and/or influenced your perception of yourself and your impostor phenomenon thus far.	Draw a picture of the different angles and perspectives you see your everyday life through. Where are you in this picture? Where can you expect your impostor phenomenon?

	What stood out to you? What has happened in your mind, body and emotions?	
6 Wise Nourishment for All Levels of Your Being	Take a few moments to practice some free writing. How did your week go? What is on your mind? What is your body telling you? How were your emotions treating you this week? Reflect on your practices and on your level of mindfulness this week.	Think about a situation in your STEM environment. Draw a picture of how you see yourself when you are in total piece and balance. How do your body, mind, and emotions express this moment? How do you see yourself react? How can you store this moment?
7 Continuing to Grow Your Mindfulness Practice	How did your week go in terms of your academics, mindfulness, emotions, body and mind? In what ways will you continue to practice mindfulness beyond this study? How would you like to grow your mindfulness?	Draw a picture about how you see your self-authorship (the ability to practice self-awareness and balance internal/external expectations) unfold in your life right now? What are you doing to reinforce this?
8 My Impostor and I	Reflect any differences in your personal and academic life that have resulted from your practice. What has been the most surprising and or intriguing? How has your relationship to your mind, body and emotions changed? In what way do you think you are equipped for reaching your goals in the future?	Review your drawing from week 1. Draw a second picture of how you see yourself within the STEM community (your cohort, classrooms, STEM workplace, study group, etc.) right now. What is your place/role? How does it make you feel? Can you add details that connect your STEM self/identity to your personal life?

APPENDIX L

Mindfulness Program Website

The mindfulness program website entails the mindfulness activity descriptions, activity schedules, weekly journals, study background, background of the researcher, contact information, and additional material.

Link to the Website: <https://sites.google.com/boisestate.edu/mindfulness-intervention/home>

Screenshot of Mindfulness Program Website Front-page

Screenshot of Mindfulness Program Activity Introduction Page

I ask you to work through the schedule and weekly activities sequentially. Both are organized based on well-established programs and the order is significant to the outcome of the study. You are asked to complete 3 formal practices per week and also take advantage of the informal practice suggestion.

Formal practices vary between 15-30 minute time commitment and should be thoughtfully scheduled into your preferred day of practice. After each formal practice you will be asked to shortly reflect on 1-2 questions regarding your experience. This will help you work through the practice and will prepare you for your weekly journal entry, which you are asked to share with me by Sunday of each week. Initially the practices are shorter and pick up in duration as you become more familiar to them.

Informal practices invite you to practice your mindfulness in every day situations and tasks and can be applied at any time.

Click on the appropriate calendar week and your practice instructions will unfold. Make sure you review the [suggestions](#) about how to prepare for your journey and practice time.

Screenshot of Mindfulness Program Week 1 Schedule Page

Mindfulness Interventi...

Home About ▾ Mindfulness Intervention ▾ Additional Information ▾

Week 1

Introduction - What is Mindfulness?

Scope of this week

This week, you will learn more about what mindfulness means and encompasses. Attitudes that are important in developing a mindfulness based lifestyle, including to be accepting of yourself and your abilities, even while facing impostor feelings and other self-doubt. You will engage in three formal practices:

- Mindfully Eating a Raisin
- Walking Meditation
- Mindful Check-In

In addition, you will start to explore how to incorporate mindfulness into your daily life in order to form a strong mindset and tools to help you deal with difficult situations, such as doubting your success. Thus, one informal practice will be introduced:

- Mindfulness Every Day - Brushing your teeth/ Washing the dishes

Formal Practice 1 - Mindfully Eating a Raisin, ca. 20 minutes

Formal Practice 2 - Walking Meditation

Formal Practice 3 - Mindful Check-In

Informal Practice - Mindfulness Every Day - Brushing your teeth/ Washing the dishes