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The Practice Effect: The Relationships among the Frequency of Early Formal Mindfulness Practice, Mindfulness Skills, Worry, and Quality of Life in an Acceptance-Based Behavior Therapy for Generalized Anxiety Disorder

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THE PRACTICE EFFECT: THE RELATIONSHIPS AMONG THE FREQUENCY OF EARLY FORMAL MINDFULNESS PRACTICE, MINDFULNESS SKILLS, WORRY, AND QUALITY OF LIFE IN AN ACCEPTANCE-BASED BEHAVIOR THERAPY FOR GENERALIZED ANXIETY DISORDER

A Thesis Presented

By

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ABSTRACT

THE PRACTICE EFFECT: THE RELATIONSHIPS AMONG THE FREQUENCY OF EARLY FORMAL MINDFULNESS PRACTICE, MINDFULNESS SKILLS, WORRY, AND QUALITY OF LIFE IN AN ACCEPTANCE-BASED BEHAVIOR THERAPY FOR GENERALIZED ANXIETY DISORDER

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Mindfulness- and acceptance-based treatments are currently being used to treat a variety of medical and mental health difficulties. Most of these treatments teach formal mindfulness practices which aim at developing mindfulness skills. However, little is known about the relationships among amount of formal mindfulness practice, changes in mindfulness skills, and changes in outcome variables. An acceptance-based behavior therapy (ABBT) has been shown to be particularly effective in the treatment of Generalized Anxiety Disorder (GAD; Roemer & Orsillo, 2007; Roemer, Orsillo, & Salters-Pednault, 2008). This study explored the relationships among formal mindfulness practice, skills, and outcomes in the context of an ABBT for people with GAD using latent growth curve modeling. Across treatment, participants reported significant improvements of large effect size in measures of mindfulness skills, quality of life, and

worry. However, latent growth curve analysis failed to show relationships between the frequency of formal practice reported during the first quarter of treatment and changes in these variables. Residual gains of mindfulness skills were significantly positively correlated with residual gains in quality of life, and significantly negatively correlated with residual gains in worry. The results highlight the complexity of the relationship between formal mindfulness practice, mindfulness skills, and outcome variables. Study limitations and future directions are discussed.

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CHAPTER 1

SPECIFIC AIMS

Mindfulness is a concept derived from Buddhist psychological theory and meditation practice that has been shown to have useful application to the treatment of mental disorders. It is defined as a purposeful awareness oriented to experiences of the present moment in an accepting, allowing, or non-judgmental way. It also refers to informal and formal meditation practices aimed at developing this type of awareness. Acceptance is considered to be a fundamental component of mindfulness, and interventions incorporating these ideas are often referred to as mindfulness- and acceptance-based treatments or interventions (Roemer & Orsillo, 2009). Over the past decade there has been a dramatic increase in research on mindfulness- and acceptance-based treatments targeted at a variety of populations and presenting problems.

One of the commonalities among many of these treatments is an emphasis on learning and practicing mindfulness through formal or informal mindfulness meditation practices. A formal mindfulness practice may be seated mindfulness meditation while an informal practice may be attending mindfully to the sensations on one's hands while washing the dishes—both being activities consciously engaged in for the purpose of practicing mindfulness. This emphasis on practice is tied to the assertion that

mindfulness can also be conceptualized as a skill that can be built through such practices. In contrast to practices, applying mindfulness skills in daily life is done when faced with unexpected events, whether external or internal. The more one practices, the better one may be able to meet anxiety, self-criticism, or conflict in a mindful way, and thus be aware of his or her habitual reactions and work towards choosing to act in a value-consistent way, rather than acting habitually.

It is theorized that mindfulness practice leads to improvements in mindfulness skills, which in turn underlie many of the positive outcomes observed in studies of mindfulness- and acceptance-based treatments (Kabat-Zinn, 1990). However, the relationships among mindfulness practice, mindfulness skills, and outcomes such as symptom reduction and quality of life are not well understood (Vettese, Toneatto, Stea, Nguyen, & Wang, 2009). While associations among mindfulness practice, levels of mindfulness skills, psychological functioning, and well-being have been found, evidence is inconsistent and most studies have been cross sectional or at best have measured mindfulness skills and outcome variables at pre and post-intervention (Brown & Ryan, 2003). Neither design addresses how practice, skills, and outcomes in mindfulness- and acceptance-based therapies change and are temporally related across the span of the intervention, and whether increases in mindfulness skills is a clear mediator of the relationship between mindfulness practice and outcomes. To date, no mindfulness- and acceptance-based clinical trials have looked at the relationships among mindfulness practice, skills, and outcome using a longitudinal design allowing for the establishment of temporal precedence of mindfulness practice. If mindfulness practice is prescribed in

therapeutic settings as a way of learning new skills and habits of relating to and interacting with negative internal and external experience, we need to understand how mindfulness practice is related to improvements in mindfulness skills, and if this relationship leads to desired changes in symptoms and improved quality of life. The longitudinal nature of this study allowed us to look at how mindfulness practice early in treatment related to skill changes and symptom improvement across treatment. The present study had the following specific aims.

1) **Examine the relationship between frequency of formal mindfulness practice over the first four sessions of treatment and the trajectory (*slope*) of change in mindfulness skills across treatment.** It was hypothesized that higher total levels of mindfulness practice in the first four weeks would predict greater increases in mindfulness skills across treatment.

2) **Examine the relationships between frequency of formal mindfulness practice across the first four sessions of treatment and trajectory of change in worry and quality of life across treatment.** It was hypothesized that higher total frequency of mindfulness practice across the first four sessions of therapy would predict greater improvements in worry and quality of life across treatment.

3) **Examine the relationships between trajectory of change in mindfulness skills with worry and quality of life across treatment.** It was hypothesized that larger trajectories

of change in mindfulness skills would predict greater improvements in worry and quality of life across treatment.

4) **Examine trajectory of change in mindfulness skills as a mediator for the relationship between frequency of mindfulness practice during the first four sessions of treatment and worry and quality of life.** It was hypothesized that increases in the rate of change in mindfulness skills would mediate the relationship between frequency of mindfulness practice across the first four sessions of treatment and changes in symptom variables across treatment.

CHAPTER 2

BACKGROUND AND SIGNIFICANCE

Mindfulness, with roots in Buddhist psychology and meditation dating back over two and a half millennia, has been increasingly applied in Western therapeutic contexts over the past few decades (Deatherage, 1975; Hayes, Follette, & Linehan, 2004). Modern conceptualizations distinguish between mindfulness practices and skills. As a practice, secular mindfulness is functionally derived from Buddhist meditation practices and systems of mental training including *Vipassana, Anapanasati,* and *Satipatthana* (Analayo, 2003; Kuan, 2008; Rosenberg, 1998). Jon Kabat-Zinn, one of the early pioneers who integrated secular mindfulness meditation practices into the medical and behavioral health realms, describes such practices as the intentional and repeated bringing of present-focused awareness to internal or external experiences non-judgmentally (Kabat-Zinn, 1990). In the context of contemporary mindfulness-based programs, formal mindfulness practices may take the form of the more traditional time-delineated seated meditation as well as mindful yoga and other specific exercises.

Mindfulness skills are defined as the degree to which one is able to apply this type of awareness spontaneously to situations and experiences in everyday life. While precise operationalizations of mindfulness skills may vary between different investigators and

clinicians, there is general agreement that this skill is composed of at least two main factors: an intentionally applied clear awareness attuned to what is occurring in the present moment; and an attitude toward that experience that is often described as accepting, non-judging, allowing, de-fused, or decentered (Bishop et al., 2004; Brown & Ryan, 2003; Roemer & Orsillo, 2009). Thus, a person with "high" mindfulness skills might be expected to be able to notice their negative internal experiences (like anger, fear, or guilt) in their daily life more frequently and be able to approach them with a higher degree of acceptance and nonjudgment compared to someone with "low" mindfulness skills. Acceptance is often considered to be a fundamental component of mindfulness, and interventions incorporating these ideas are often referred to as mindfulness- and acceptance-based treatments or interventions (Roemer & Orsillo, 2009).

Mindfulness- and acceptance-based interventions have proliferated in the past few decades, and have shown promising results with clients in treatment for a variety of issues (see Baer & Krietemeyer, 2006; Germer, Siegel, & Fulton, 2005; Grossman, Neiman, Schmidt, & Wallace, 2004 and Hayes, Follette, & Linehan 2004 for reviews). Such interventions have shown specific efficacy in the treatment of anxiety disorders in adults (Miller, Fletcher, & Kabat-Zinn, 1994; Kim et al., 2009; Evans et al., 2008; Goldin & Gross, 2010; Hoffman, Sawyer, Witt, and Oh, 2010). Of the anxiety disorders, Generalized Anxiety Disorder (GAD) is historically one of the least responsive to treatment, and is characterized by intense, chronic, pervasive worry (Brown, Barlow, & Leibowitz, 1994). Theoretical conceptualizations of GAD suggest that mindfulness- and

acceptance-based treatments may be useful in treating GAD and comorbid disorders (Orsillo, Roemer, & Barlow, 2002; Orsillo & Roemer, 2005). These models describe experiential avoidance as an unwillingness to experience distressing internal experiences, including physical sensations, emotions, thoughts, and memories, which results in efforts to avoid or escape them. Efforts to avoid distressing thoughts or body sensations may be internal—such as trying to suppress thoughts—or external, manifesting in behaviors that facilitate distraction or reduce the perceived probability of encountering stimuli that trigger distress. Behaviors that help a person avoid unwanted internal experiences may be reinforced by their immediate short-term reduction or prevention of negative internal experiences but lead to long-term restrictions in behavior and reductions in quality of life (Roemer, Salters, Raffa, & Orsillo, 2005). As a central feature of GAD, worry may facilitate and maintain experiential avoidance and be reinforced by short-term decreases in distress and autonomic arousal (Borkovec, 1994). Worry may thus inhibit exposure to feared internal experiences and prohibit the learning of new non-feared associations, which maintains threatening associations and increasing distress in the long term (Roemer, Salters, Raffa, & Orsillo, 2005).

For people diagnosed with GAD, experiential avoidance may also prohibit engagement in valued life actions that are potentially emotionally threatening, or inhibit emotional engagement in actions that are undertaken (Roemer & Orsillo, 2007). This behavioral restriction and emotional distancing may contribute to the substantial reductions in subjective quality of life reported by people diagnosed with GAD (Hoffman, Dukes & Wittchen, 2008). Mindfulness skills, defined as present-focused

non-judgmental awareness of experience, would appear to be specifically appropriate for addressing central maintaining features of GAD. By developing the ability to engage non-judgmentally with internal experience, experiential avoidance would be expected to decrease, making space for new ways of relating to uncertainties and fears (Hayes, Strohsal, & Wilson, 1999; Roemer & Orsillo, 2007). Based on this conceptualization, cultivation of mindfulness skills by people with GAD would be expected to lead to reductions in worry and increases in subjective quality of life. Specifically related to the current study, two previous studies of an acceptance-based behavior therapy (ABBT) for GAD that incorporates mindfulness, an open trial and a randomized-control trial, revealed significant improvements in functioning for participants following the 16 week treatment (Roemer & Orsillo, 2007; Roemer, Orsillo, & Salters-Pednault, 2008). Results from both studies showed large magnitude improvements at post treatment and follow-up time points for worry, GAD symptoms, anxiety, depressive symptoms, and quality of life. While previous studies of ABBT have shown improvements in mindfulness skills, quality of life, and worry in people with GAD, the relationships between the acquisition of mindfulness skills and symptom improvement across treatment have not been investigated. The present study aims to investigate the relationships among frequency of mindfulness practice, acquisition of mindfulness skills, and improvements in worry and quality of life over the course of ABBT for GAD, using longitudinal analyses to examine the temporal relationships between these variables.

Mindfulness as Practice and Assigned Homework

The use of practice and between-session homework assignments in the context of therapy for the development of specific skills is not new to the mental health field. The concept of self-help assignments in psychotherapy emerged in the literature as early as the 1930's (Burns & Spangler, 2000). Between-session homework assignments are still a cornerstone of many cognitive-behavioral treatments (CBT), and are conceptualized as practices that lead to the development and utilization of specific health-promoting skills (Dozois, 2010**)**. Activities commonly assigned for homework, including techniques such as cognitive restructuring, behavioral activation, exposure, self-monitoring of mood, thoughts, and specific symptoms, are all considered skills that clients can develop through practice that in turn will become tools that can be implemented by clients to address their symptoms (Beck, 1995**)**. The rationale is that by providing training in skills that promote flexible and adaptive functioning, clients will be able to generalize and implement such skills in diverse contexts and beyond treatment termination, continuing to work through their difficulties without permanent dependence on therapy (Kazanzis et al., 2010).

While homework has been a central component of CBT's for many years, research investigating the effects and mechanisms of homework has been relatively slow to emerge. Kazantzis et al. (2010) performed a meta-analysis comparing effect sizes for CBT studies that used homework compared to similar treatments that did not assign homework (46 studies, N = 1,072). They found significantly larger pooled effect sizes for therapy conditions with homework. However, the authors did not specify either the

outcome measures used to determine pre-post effect sizes or the populations treated, and therefore only very general conclusions about the benefits of homework can be drawn. The authors note that while homework has been studied more than any other therapeutic component in CBT research, very little has been done to investigate the mechanisms by which homework may lead to positive therapeutic change. Similarly, Dozois (2010) summarized the gaps in our knowledge regarding homework in CBT research, and suggests researchers invest more effort studying homework effects among clients with more diverse presentations, examine the mechanisms of action underlying the positive effects of homework, and develop evidence-based measures to assess homework compliance.

Measuring Mindfulness Practice

Formal and Informal Practices

As a form of homework, mindfulness practice is conceptualized, assigned, and measured in different ways across different mindfulness- and acceptance-based intervention studies. Mindfulness as a practice can be conceptualized as formal vs. informal practice. Formal practice includes intentionally setting aside a period of time to engage in mindfulness meditation, and may include sitting or walking meditation, body scan, and mindful yoga (Kabat-Zinn, 1990). Informal practices involve intentionally bringing mindful awareness to everyday normally automatic activities such as washing the dishes, driving, and eating. Informal practice is planned and can be scheduled into one's daily routine, like formal meditation. Informal practices can be thought of as a

bridge between engaging mindfully in formal practice and applying mindfulness skills spontaneously to activities of daily life (Roemer & Orsillo, 2009). Theoretically, as one continues to practice formally and informally, and one's mindfulness skills increase, moments of mindfully engaging in daily life will become more frequent, and become a more "natural" and effortless response to experience.

Amount of Assigned Practice

Many of the most-studied mindfulness-based interventions assign relatively large amounts of between-session formal mindfulness practice. Mindfulness-based stress reduction (MBSR) and interventions modeled closely after the structure of MBSR, like Mindfulness-based cognitive therapy (MBCT), typically assign 45 minutes of formal practice per day, 6 to 7 days a week (Kabat-Zinn, 1990; Segal et al. 2002). Other treatments are less directly focused on the practice of formal mindfulness meditation, assign less formal between-session practice, and may incorporate more informal mindfulness practices into between-session homework. Such interventions, including the acceptance-based behavior therapy (ABBT) for GAD being investigated in this study, and Acceptance and Commitment Therapy (ACT), may assign 15-30 minutes of daily practice to clients (Hayes & Smith, 2005), offer a wide range of informal practices, and may attempt to flexibly tailor practice levels and activities to match client skill levels, preferences, and life contexts (Roemer & Orsillo, 2009).

Quantifying Practice

Regardless of the type of mindfulness intervention being studied, tracking and quantifying mindfulness practice has presented researchers with considerable challenges, and currently there are no standardized methods or guidelines for measuring the amount of mindfulness practice completed by participants or clients. Vettese et al. (2009) conducted a meta-analysis looking at mindfulness practice in treatment studies, specifically limited to group interventions with high levels of assigned practice, such as MBSR and MBCT. The authors found a wide range of methods used to record home mindfulness practice, ranging from daily practice diaries and daily phone practice checks, to weekly report forms and single or multi-item retrospective estimates given at the end of treatment. One possible reason for the range of practice tracking techniques is that practice measures are often one of many self-report questionnaires given to participants in clinical studies, and investigators may differ as to how much emphasis is placed on collecting detailed practice information. When questionnaire burdens on clients in treatment studies are of concern, and mindfulness practice is not a primary variable of interest, investigators may choose less intensive forms of estimating home practice amounts. Investigators have the difficult job of balancing data collection with burdens on clients, and potentially risk higher rates of non-compliance, inaccurate reporting, or treatment dropout if clients are asked to do more than they feel able to do. As a result of this inherent tradeoff between precision of data collection and desire to reduce potentially aversive client reactions and reporting burdens, as well as the relatively recent interest in

measuring mindfulness practice, tracking methods vary across studies, and data are often retrospective, incomplete, or unreported (Vettese et al., 2009).

Practice and Outcomes

Because mindfulness practice is an important component of most if not all mindfulness- and acceptance-based treatments, an important preliminary question is whether or not the amount people practice has been found to be associated with relevant psychological and health-related measures. Perhaps surprisingly, only a small proportion of such treatment studies have asked this question. The meta-analysis of mindfulness-based group intervention studies mentioned previously found that fewer than 25% of the 96 mindfulness-based group intervention studies included in their analysis provided data on practice amounts in relation to outcome (Vettese et al., 2009). Vettese et al. (2009) note that while 13 of the 24 studies that analyzed practice amounts in relation to outcomes found significant associations in the expected directions, the remaining 11 studies that conducted these kinds of analyses did not. In other words, only a little over half of the studies analyzing the relationship between reported amount of practice and outcome variables supported the clinically espoused benefits of practicing mindfulness. The authors note that mixed findings may not be very surprising, given the often underpowered, secondary, and unsystematic nature of practice-outcome analyses. Samples in studies where no relationships were found were more likely to consist of corporate employees, healthy adults, students in non-health related fields, and patients with anxiety or pain conditions in studies conducted in the late 1980's and early 1990's.

In contrast, samples in the studies that found significant associations between practice and outcomes were more likely to consist of students or employees in health fields, people self- or physician-referred for stress management, or people with more clinically significant presentations. Vettese and colleagues (2009) speculate that the groups where significant associations between practice and outcomes were found may have been more familiar with mindfulness prior to treatment, which could have influenced their practice and use of mindfulness. They also mention the inherent difficulties in measuring the "quality" of practice in addition to quantity, a factor that we currently have no way of assessing, although it must undoubtedly contribute to the effects of mindfulness practice on other variables.

Importantly, none of the studies included in the meta-analysis investigated individual treatments, and none were specifically focused on treating clients with GAD. One study investigating the ABBT treatment for GAD being discussed in this paper reported significant relationships between the amount of reported formal mindfulness practice and maintenance of gains following treatment. At both 3 and 9-month follow up time points, participants' frequency of mindfulness practice was significantly associated with improvements in current GAD severity, worry, and quality of life (Morgan, Graham, Hayes-Skelton, & Roemer, 2010).

Inconsistencies and difficulties in measurement of mindfulness practice remain a significant problem for the field, and data linking amount of mindfulness practice and improvements on outcome measures are limited and inconclusive. An important limitation of the studies that found significant relationships is that cross-sectional, pre-

post designs and correlational analyses do not establish temporal precedence of the mindfulness practice, and therefore cannot determine if mindfulness practice leads to changes in symptoms or whether symptom improvement due to other factors increases peoples' willingness to engage in formal practice.

If indeed practicing mindfulness can lead to positive outcomes, an important question is *how* mindfulness practice may be leading to positive changes during therapy. Theoretically, as mentioned above, practicing mindfulness may lead to improvements in people's mindfulness skills, and this improvement in skills may be contributing to positive changes across therapy. In other words, if mindfulness practice does lead to improvements in outcomes, the acquisition of mindfulness skills as a result of practice may mediate or explain that relationship. To address this question, researchers must have valid and reliable methods for quantifying levels and changes in mindfulness skills, a relatively recent endeavor in the field and one that, like measuring mindfulness practice, is still in the early stages of development and refinement.

Mindfulness as a skill

A number of self-report measures of mindfulness skills have emerged over the past few years and have become more widely used in research, and they draw from both state and trait definitions of the construct (Baer, Smith, Hopkins, Kreitemeyer, & Toney, 2006; Brown & Ryan, 2003). Most contain subscales within the broad construct of mindfulness. As mentioned above, there is some agreement that mindfulness contains at least two main components: a clear and present-focused awareness of experiences, and an

accepting or non-judgmental attitude regarding those experiences. The Five Facet Mindfulness Questionnaire (FFMQ) was recently developed using a factor analytic approach combining five different mindfulness questionnaires (Baer et al. 2006). Interestingly instead of two main factors, the factor loadings indicated that the best fit for the relationship between items was a five-factor structure of mindfulness. The five subscales of the FFMQ are: *observing, describing, acting with awareness, nonjudging of experience,* and *nonreactivity to inner experience*. The *observe* factor ("*Observing/noticing/attending to sensations/perceptions/thoughts/feelings"*) consists of items that ask to what degree the participant is aware of or notices sensations (covering all five senses), emotions, and thoughts, such as "I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing". The *describe* factor ("*describing/labeling with words"*) items ask participants about the degree to which they feel they are able to find words to adequately describe their thoughts and feelings, such as "I can easily put my beliefs, opinions, and expectations into words". The *acting with awareness* scale ("*acting with awareness/automatic pilot/concentration/nondistraction"*) asks about the degree to which participants pay attention to what they are doing, for example "I do jobs or tasks automatically, without being aware of what I'm doing". The *nonjudging of experience* subscale items ask about the degree to which participants judge or find their reactions to things good or bad, acceptable or unacceptable, for instance "I criticize myself for having irrational or inappropriate emotions". The *nonreactivity to inner experience* factor asks participants about whether they are able to notice internal experiences as "things", and not necessarily react to their arising, such as "I watch my

feelings without getting lost in them". These five components are hypothesized by the developers of this measure to be important yet distinct factors of the general skill of relating to experience mindfully.

The measure has been found to have good construct validity, with all subscales except for *act with awareness* correlating cross-sectionally with amount of meditation experience in people with a mindfulness meditation practice, and correlated in expected directions with measures of psychological symptoms and well-being in samples of non-meditating students, people with regular meditation practice, and matched non-meditators (Baer et al., 2008). The one exception was that in the non-meditating sample of the study by Baer et al. (2008), the *observe* factor was negatively correlated with the *nonjudging of experience* factor and with psychological symptoms and well-being, while the opposite was true for the sample with meditation experience. A negative relationship between the *observe* factor and the *nonjudging of experience* factor has also been found in non-meditators but not in meditators (Baer et al., 2006). The authors speculate that these relationships may be explained by how self-focused attention associated with negative judgment of a person's experience can be maladaptive (Mor & Winquist, 2002). In other words, someone who is highly aware of their distress may also be highly judgmental of it, and may experience even greater distress and a decreased sense of well-being. Thus, the *observe* factor may be positively or negatively correlated with well-being, depending on the quality of that observation. The functioning of the *observe* factor among meditation naïve people has not otherwise received much empirical investigation, but may indicate that using all five facets to measure mindfulness skills in people with little or no

mindfulness practice experience may provide a misleading total score estimating mindfulness skills and underlines the importance of reporting scale scores in addition to full scores on the FFMQ.

While this measure has demonstrated good psychometric properties and is commonly used in mindfulness studies, other measures, including the Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003), the Kentucky Inventory of Mindfulness Skills (KIMS; Baer, Smith, & Allen, 2004), Freiburg Mindfulness Inventory (FMI; Buchheld, Grossman, & Walach, 2001); the Toronto Mindfulness Scale (TMS; Davis, Lau, & Cairns, 2009), the Cognitive and Affective Mindfulness Scale—Revised (CAMS-R; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007), and the Southampton Mindfulness Questionnaire (SMQ; Chadwick et al., 2008) are also used, and there is currently no consensus or standard regarding the use of mindfulness measures in research on mindfulness practice or interventions. The FFMQ was used for this study because it was developed using an exploratory factor analysis based on a combined pool of 112 items made up of 5 of the aforementioned mindfulness scales (the MAAS, FMI, KIMS, CAMS-R, and SMQ; Baer et al. 2006) and is one of the most commonly used mindfulness scales.

Theoretically, the construct of mindfulness as a skill or subset of skills describes a momentary quality of consciousness or way of relating to experience that can be applied by a person, regardless of whether the person has had formal mindfulness training or not (Brown & Ryan, 2003; Walsh, 2009). Supporting this assertion, correlational studies looking primarily at individuals with no mindfulness training have found that higher

levels of mindfulness skills are associated with overall lower levels of depression, anxiety, psychological symptoms, neuroticism, unpleasant affect, negative affectivity, rumination, experiential avoidance, difficulties in emotion regulation, and higher levels of pleasant affect, positive affectivity, life satisfaction, self-esteem, optimism, competence, autonomy, and relatedness (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Brown & Ryan, 2003; Coffey & Hartman, 2008; Frewen, Evans, Maraj, Dozois, & Partridge, 2008). These findings indicate that mindfulness skills can be measured in people who have no formal mindfulness training, and that it is correlated in the expected directions with a wide variety of psychological constructs associated with mental health and well being.

A number of studies have shown significant increases in mindfulness skills during or following participation in mindfulness- and acceptance based treatments (Brown & Ryan, 2003; Carmody & Baer, 2008; Carmody, Baer, Lykins, & Olendzki, 2009; Carmody, Reed, Kristeller, & Merriam, 2008; Frewen, Evans, Marj, Dozois, & Partrige, 2008; Pradhan et al., 2007). With specific relevance to the current study, Roemer, Orsillo, and Salters-Pednault (2008) found that among the 26 clients with GAD who completed treatment with the acceptance-based behavior therapy (ABBT) used in the current study, mindfulness skills (as measured by the MAAS) significantly increased from pre to post therapy. Importantly, mindfulness skills gains were maintained across 3, and 9 month follow up time points. Such studies document increases in mindfulness skills over the course of such therapies, but do not allow inferences as to what components of treatment contributed to the increases in skills.

Importantly, a handful of studies have looked at how increases in mindfulness skills in the context of mindfulness training or treatment studies are related to important health-related variables. Mindfulness skill increases have been found to be associated with decreases in rumination and negative automatic thinking for university students with clinically elevated depression, anxiety, and stress symptoms participating in mindfulness-training (Frewen et al., 2008). In the context of MBSR studies, increases in mindfulness skills have been found to predict decreases in both mood disturbance and stress for cancer patients (Brown & Ryan, 2003), as well as improvements in psychological symptoms, psychological well-being, psychological distress, reported medical symptoms, and perceived stress in clinical samples (Carmody & Baer, 2008; Carmody, Reed, Kristellar, & Merriam, 2008). Similar to studies mentioned in previous sections, these studies cannot determine if increases in mindfulness skills preceded symptom improvement, making it impossible to rule out the possibility that symptom improvement precedes and contributes to an increased ability to relate mindfully to experience, rather than the other way around.

Practice and Skills

As discussed above, while quite limited, some studies have found that formal mindfulness practice is associated with improvements in outcome variables, and that gains in mindfulness skills from participating in mindfulness-based treatments also predict improvements in outcomes. The final component in the relationship among mindfulness practice, skills, and outcomes concerns the association between amount of

formal mindfulness practice and gains in mindfulness skills. The primary purpose of in- and between-session practices in the context of therapy is for the development of skills thought to be particularly relevant to treatment and improved functioning. The development of skills in treatment can be considered similar to learning and mastering skills of other kinds, as divergent as driving a car, juggling, or learning a new language. Through conscious application of instructions and practice, a skill becomes much more natural and effortless to apply. Driving, a skill that usually takes large amounts of conscious effort in the beginning, in time becomes almost second nature. The development of abilities that foster mindful engagement in life and in difficult situations can be conceptualized in the same way (Lazar et al., 2005). Through conscious and continued practice, mindfulness skills—including increased awareness of subtleties of experience, acceptance or allowing of those observed phenomena, and the freedom to choose how to act despite difficult situations or experiences—should become more effectively and intuitively applied over time. As practioners' mindfulness skills increase and their application becomes more effective, any positive correlates of higher levels of mindfulness skills would be expected to increase. Mindfulness- and acceptance-based interventions, most of which can be considered as sharing certain structural and theoretical components with more traditional cognitive and/or behavioral treatment designs, have incorporated the practice of mindfulness exercises in much the same way that CBTs have used homework assignments as key components of treatment. As clients repeat exercises designed to develop mindfulness skills within and between therapy sessions, their ability to relate to experiences in life mindfully should increase.

Only a handful of studies have yet tried to quantify this proposed relationship. Cross-sectional studies looking at people with previous mindfulness meditation practice have found that meditators have significantly higher average levels of mindfulness skills as measured on the FFMQ compared to matched controls, on four of the five facets (all except *acting with awareness*; Baer et al., 2008; Lykins & Baer, 2009). In addition, among meditators, amount of total practice or years of meditation experience reported significantly positively predicted levels of mindfulness on all (Lykins & Baer, 2009) or most of the scales of the FFMQ (all except *act with awareness*; Baer et al., 2008).

The relationship between amount of mindfulness practice and changes in mindfulness skills in the context of treatment has not been well studied. However, studies have found that amount of formal practice significantly predicts increases in three facets of the FFMQ (*observe, act with awareness,* and *non-react* subscales) from pre to post-treatment in an MBSR program for a large mixed non-clinical sample (Carmody & Baer, 2008), and that number of days reportedly practicing mindfulness was significantly related to increases in mindfulness skills as measured by the MAAS for primary care staff participating in a mindfulness-based cognitive attitude training (Schenstrom, Ronnberg, & Bodlund, 2006). However, formal mindfulness practice was not found to be associated with observed increases in either state or trait mindfulness skills (as measured by the MAAS and Toronto Mindfulness Scale (TMS), respectively) for a different sample of non-clinical participants in an MBSR program (Carmody, Reed, Kristeller, & Merriam, 2008).

Skills Change as a Mediator Between Practice and Outcomes:

Although research is limited and most studies discussed here contain methodological characteristics that limit conclusions that can be made, there is evidence that mindfulness practice, skills, and clinically important outcomes are related to each other in meditation naïve individuals, people with non-therapeutic mindfulness meditation practice, and in the context of mindfulness- and acceptance-based treatments. The current study attempts to investigate the interrelationships of these three components using a longitudinal design. However, though this may be the first study to look at the relationship between practice, skills, and outcomes longitudinally, using a latent growth modeling approach, a handful of studies have in fact asked this question using more traditional mediation designs.

Studies have found that cross-sectionally, in large mixed non-clinical samples of meditators and non-meditators, mindfulness skill levels mediated the relationship between meditation experience and levels of fear of emotion, rumination, and behavioral self-regulation (Lykins & Baer, 2009), and psychological well-being (Baer et al., 2008). In the context of a treatment study, Carmody and Baer (2008) found that increases in mindfulness skills from pre- to post- 8 week MBSR course mediated the relationship between total minutes reportedly spent doing formal mindfulness meditation during the course and three different outcome variables. Full mediation by mindfulness skills change for the relationships between mindfulness practice and the outcome variables was seen for decreases in psychological symptoms and perceived stress, while partial mediation was observed for increases in psychological well-being. While the findings of these

studies support the hypothesis that increases in mindfulness practice lead to increases in mindfulness skills, which then facilitate improvements in treatment outcome variables, they all fail to establish temporal precedence, and so are missing a fundamental piece of the mediation model. The present study, using a longitudinal framework, explored the relationships among mindfulness practice, mindfulness skills, worry, and quality of life for subjects with a principal clinical diagnosis of GAD using latent variable growth curve modeling. This study contributes to our knowledge of the relationships between these variables by allowing questions of temporal precedence and change across treatment to be asked—critical components of mediation analyses absent from such studies to date. In order to further our understanding of these processes, analyses aimed at testing the following hypotheses were done:

1) It was hypothesized that higher mean levels of mindfulness practice in the first four weeks would predict greater increases in mindfulness skills across treatment.

2) It was hypothesized that higher frequency of mindfulness practice across the first four sessions of therapy would predict greater improvements in worry and quality of life across treatment.

3) It was hypothesized that larger trajectories of change in mindfulness skills would predict greater improvements in worry and quality of life across treatments.

4) It was hypothesized that increases in the rate of change in mindfulness skills would mediate the relationship between frequency of mindfulness practice across the first four sessions of treatment and changes in symptom variables across treatment.

CHAPTER 3

RESEARCH DESIGN AND METHODS

Sample

The data analyzed in this study are part of a larger investigation comparing the efficacy and mechanisms of ABBT and Applied Relaxation for people with a principal diagnosis of generalized anxiety disorder (GAD). Data include only those randomly assigned to treatment with ABBT. Participants were enrolled, screened, and treated at the Center for Anxiety and Related Disorders (CARD), in Boston, MA. All potential participants were screened using the Anxiety Disorders Interview Schedule for DSM-IV-TR—Lifetime Version (ADIS-IV-L; DiNardo, Brown, & Barlow, 1994). Participants were admitted to the study if they were at least 18 years of age, had a principal diagnosis of GAD, denied current suicidal intent, and did not meet criteria for substance dependence, bipolar disorder, or have evidence of psychosis. Forty people were randomly allocated to the acceptance based behavior therapy (ABBT) treatment condition designed by Roemer and Orsillo (2009), described in more detail below.

Of the 40 people in the total sample, 33 completed at least one of the assessment measures for each variable and were thus included in the analyses. Participants were allowed to endorse more than one race to allow for multi-racial identification, thus endorsements of race sum to more than 33. Of the 33 who were included in all analyses,

the majority (25 or 75.8%) self-identified as only Non-Latino White, 2 (6.1%) as only Latino White, 2 (6.1%) as only Black, 1 (3%) as only Asian, 1 (3%) as White and Asian, and 1 (3%) as Middle Eastern, Non-Latino White, and Latino White, and 1 (3%) as Latino White and Latino Non-White. Participants were 34.1 years old on average (*SD* = 12.7). Twenty-two (66.7%) reported their gender identity as female, 11 (33.3%) reported their gender identity as male. Twenty-one (63.6%) reported a biological sex of female, and 12 (36.4%) participants reported their biological sex as male. Two participants (6.1%) identified as lesbian or gay, and 31 (93.9%) as heterosexual. Fourteen (42.4%) participants reported being single, 13 (39.4%) married, 4 (12.1%) cohabiting, and 2 (6.1%) divorced. Twenty-nine (87.9%) identified English as their first language, while 4 (12.1%) indicated a language other than English. Two participants (6.1%) reported their highest educational level completed as a professional degree, 10 (30.3%) a masters degree, 14 (42.4%) a college degree, 5 (15.2%) 1-3 years of college, and 2 (6.1%) 12 grade/high school diploma. In terms of current annual household income at the pre-treatment assessment 8 (24.2%) reported earning $0-15,000, 1 (3%) between $15,001 and $25,000, 3 (9.1%) between $25,001 and $35,000, 5 (15.2%) between $35,001 and $50,000, 5 (15.2%) between $50,001 and $75,000, 1 (3%) between $75,001 and $100,000, 8 (24.2%) between $100,001 and $200,000, and 1 person (3%) reported earning more than $200,000 per year. One person left this blank. Thirteen (39.4%) reported having no previous experience with meditation, while 20 (60.6%) reported having at least some previous meditation experience. Twenty-one (63.6%) endorsed no current meditation practice, while 12 (36.4%) indicated that they practiced meditation at

least "occasionally" at the time of the pre-treatment assessment. Participants had an average GAD clinician severity rating of 4.85 (*SD* = 2.19) on the ADIS-IV-L interview at pre-treatment. Clinical severity is defined for this measure as a score of 4 or higher. The average number of additional diagnoses was 1.07 (*SD* = 0.87), with social anxiety disorder (n=13), depressive disorders (n=4), and obsessive-compulsive disorder (n=3) being the most common.

Chi-Square tests showed that the sample of 33 who were included in the analysis did not differ significantly from the 7 who were not for all of the demographic variables listed above except for level of education. The group of 7 who were not included had a significantly lower proportion of people in categories reflecting having completed a college degree or higher.

Treatment

Acceptance-based behavior therapy (ABBT; Roemer & Orsillo, 2007; Roemer, Orsillo, & Salters-Pednault, 2008) is a recently developed treatment specifically for people with a principal diagnosis of generalized anxiety disorder (GAD). It is delivered individually with sessions once a week for 14 weeks and then two tapered sessions every other week. The treatment focuses on learning new ways of relating to unwanted internal experiences, cultivating mindful awareness to help reduce experiential avoidance, and exploring valued action as a way to engage in behaviors consistent with client-defined ways of living a meaningful life. Methods are explicitly drawn from cognitive-behavioral treatments for GAD (e.g., Borkovec, Newman, Lytle, & Pincus, 2002) as well

as from other mindfulness and acceptance based treatments, including Acceptance and Commitment Therapy (ACT; Hayes, Strohsal, & Wilson, 1999), Dialectical Behavioral Therapy (DBT; Linehan, 1993), and mindfulness-based cognitive therapy (MBCT; Segal, Williams, & Teasedale, 2002). Mindfulness activities begin in the first session, consist of formal and informal practices, and remain an explicit part of treatment and between-session homework assignments for the duration of treatment. Importantly, ABBT was designed to offer mindfulness activities flexibly, giving participants exposure to a wide variety of mindfulness practices and exercises, with the explicit acknowledgement that different exercises may suit different people and life circumstances more appropriately. The hope is that by allowing clients to choose and integrate mindfulness practices that suit them well, they will be more likely to continue practicing them during treatment and beyond, helping them develop mindfulness as a long-term life skill. Very few studies looking at mindfulness practice in relation to mindfulness skills development and treatment outcomes have involved such a flexible approach to teaching mindfulness. Other types of between session assignments include thought, emotion, and behavioral monitoring and writing assignments used to explore experiential mindfulness and values development.

Measures

Measure of Mindfulness Practice

Quantifying mindfulness practice has been done inconsistently in previous research and as yet has not been standardized in the field. The present study used a measure of

mindfulness practice completed by the therapist following each session. The measure is based on the client-reported written frequency (in the form of tally marks on a calendar) of practice on each day since the previous session and takes into account any verbal information provided in session but not reported on the form. For instance, on some days clients reported not practicing at all, and on other days clients practiced formal mindfulness multiple times. In this way a more comprehensive picture of practice may be possible. The final number for each person at each session indicates the therapist's best estimate of the total number of times the participant engaged in formal practice since the previous session. We felt that this estimate of practice frequency contained the most information, as therapists have noted that sometimes the clients' written reports of practice frequency under-report practice amounts due to the client forgetting to fill it out or misunderstandings about how to label and tally specific practices. Therapists specifically inquire about practice frequency in each session, allowing them to adjust the client's written report of frequency according to information gathered in session. One limitation of this measure is that an estimate of duration (i.e., minutes or hours) of formal mindfulness practice cannot be derived. For example, a single episode of formal practice may have lasted an hour or five minutes. Additionally, informal mindfulness practices are not included in this analysis.

To test the question of whether formal practice in the beginning of therapy is particularly important in predicting the development of mindfulness skills, and because using the frequency of practice early in treatment allowed us to examine temporal precedence in the hypothesized relationships, frequency of formal practice across the first

four sessions was used. More specifically, the mindfulness practice variable used in the analyses was the summed values for frequency of practice recorded at sessions 2, 3, and 4. Because mindfulness practice is first introduced and assigned during session 1, no frequency of practice is expected at session 1.

Five Facet Mindfulness Questionnaire

The construct of mindfulness skills was quantified in this study using the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). Refer to the above section on "Mindfulness as a Skill" for more details about the FFMQ. Using confirmatory factor analysis, Baer et al. (2006) combined all items from five different mindfulness questionnaires to create a comprehensively defined measure of mindfulness. Tests of the alternative factor structures of this new measure indicate that each factor measures a unique component of mindfulness, and also that primarily for individuals with meditation experience, an overall mindfulness score combining all items may be meaningful. Interestingly, as mentioned above, the *observe* factor has been found to function differently in relation to psychological symptoms and well-being for meditators vs. non-meditators, in that those with no meditation experience showed a non-significant or negative relationship between the *observe* factor and psychological symptoms and well-being, whereas a positive relationships were seen for people with meditation experience (Baer et al., 2008). For the present study, because many participants have no mindfulness practice experience at the outset of treatment, the *observe* facet of the FFMQ was not used in primary analyses involving mindfulness

skills. The other four facets were combined and used to estimate each individual's mindfulness skills over the course of treatment. Items are rated on a Likert Scale ranging from 1 = *never or very rarely true* to 5 = *very often or always true*. The FFMQ subscales have been shown to correlate in the predicted directions with many variables of interest including meditation experience, self-compassion, psychological symptoms, and emotion regulation difficulties, among others (Baer et al. 2006, 2008). Additionally, three of the five facets demonstrated incremental validity by significantly predicting psychological symptoms independently of the other factors (Baer et al. 2006). Baer et al. (2008) also demonstrated construct validity of the FFMQ in a combination of samples including experienced meditators and non-meditators. The FFMQ showed good internal consistency in the current sample, with α's ranging from 0.91 to 0.96. The FFMQ was given to subjects at 5 time points throughout therapy, at pre-treatment, sessions 4, 8, and 12, and at post treatment.

Penn State Worry Questionnaire—Past Week

As noted in the previous section, chronic and pervasive worry is considered a central component of GAD. It is therefore important to investigate whether or not mindfulness practice and skills are related to changes in worry in the context of ABBT. The Penn-State Worry Questionnaire (PSWQ) is a 16-item measure of trait worry, found to be particularly applicable to people with severe anxiety in general and GAD specifically (Meyer, Miller, Metzger, & Borkovec, 1990). The measure has demonstrated good to very good internal consistency (α's from .86 to .93) and adequate to good test-retest

reliability (*r*'s ranging from .74 to .93 across periods ranging from 2 to 10 months; Molina & Borkovec, 1994). The PSWQ scores have been found to significantly decrease from pre- to post- and follow-up treatment for people with GAD in two previous clinical trials of ABBT (Roemer & Orsillo, 2007; Roemer, Orsillo, & Salters-Pednault, 2008). Participants in this study received a state-version of the PSWQ, referred to as the PSWQ-Past Week, at pre-treatment, sessions 4, 8, and 12, and at post treatment. The measure has shown good internal consistency (average Cronbach's alpha of .91) as well as external validity (Stober & Bittencourt, 1998). Questions are on a 7-point Likert scale with responses ranging from "never" (0) to "almost always" (6), and items were modified to ask the participant to report the degree to which each statement describes themselves over the past week. For example while a PSWQ item reads "once I start worrying, I can't stop", the corresponding PSWQ-PW item reads "once I started worrying, I couldn't stop". One item from the original PSWQ ("I've been a worrier all my life") was omitted from the state-version because it was impossible to convert it into a short-term item. Thus the PSWQ-PW contains 15 items. The PSWQ-PW showed good internal consistency in the current sample, with α's ranging from 0.87 to 0.91.

Quality of Life Inventory

To obtain an estimate of the effects of mindfulness practice and skills development on clients' overall sense of satisfaction across different life domains, the Quality of Life Inventory (QOLI; Frisch, Cornwell, Villanueva, & Retzlaff, 1992) was administered at pre-, mid-, and post-treatment time points. The QOLI is a 32-item scale

designed to produce an overall score based on the product of a person's level of satisfaction with and importance of 16 specific life domains. For each of the 16 domains (e.g., career, friends, community, creativity, family, income, health, romantic relationships, etc.) a person rates both how important a domain is to them (0 = *not important*, 1 = *slightly important*, and 2 = *extremely important*) and how satisfied they currently are with that domain (from -3 = *very dissatisfied* to 3 = *very satisfied*). These numbers are multiplied together for each domain, and the sum of the 16 products yields the overall quality of life score. The QOLI shows good internal consistency (α's ranging from .83 to .89 in clinical samples) and excellent test-retest reliability (r = .91 in a sample of veterans who completed an inpatient alcohol treatment program; Frisch et al. 1992). Supporting its validity, the QOLI has been found to correlate significantly with other measures of life satisfaction and well-being, and be significantly negatively correlated with measures of psychopathology (Frisch et. al., 1992). In two previous clinical studies of ABBT, sustained significant improvements in QOLI scores were found to occur from pre to post and follow up time points (Roemer & Orsillo, 2009; Roemer, Orsillo, & Salters-Pednault, 2008). The QOLI showed good internal consistency in the current sample, with α's ranging from 0.79 to 0.85. The QOLI was given to subjects at 5 time points throughout therapy, at pre-treatment, sessions 4, 8, and 12, and at post treatment

Analysis

The data for mindfulness skills, worry, and quality of life variables were collected from each client at five time points across the course of treatment. Formal mindfulness practice was collected during each session. Because of the longitudinal within-subject nature of the data, latent variable growth curve modeling was used in the analyses of the proposed hypotheses, with the exception of Hypothesis 3, for which the growth curve model was unable to be run, most likely due to lack of power. Latent growth curve models (LGM) are based on the calculation of at least two latent variables, the slope of change in a variable over time and the intercept or value of the variable of interest at a point of time of particular interest. Latent variables are estimated based on observed measurements. This type of analysis differs from other longitudinal analyses, such as repeated measures ANOVA and multilevel linear modeling, by estimating a slope and intercept value for each individual in the sample, which allows for the correlation of slope and intercept and estimation of the variances of slope and intercept. In contrast, alternative repeated measures analyses that analyze group differences may only compute group mean changes over time and treat individual variation as error variance. Latent growth curve modeling also accommodates missing data through maximum likelihood replacement. See Hayes, Orsillo, and Roemer (2010) and Hardy and Thiels (2009) for examples of LGM in clinical samples.

Because the aim of these analyses was to test whether formal mindfulness practice during the first four sessions predicted changes in mindfulness skills and outcome variables later in treatment, the growth models were based on the session 4, session 8,

session 12, and post-treatment assessments as the repeated variable, with the starting value or intercept being set at session 4. Within-subject t-tests were performed to examine whether or not the values of mindfulness skills, worry, and quality of life differed significantly from pre-treatment to session 4. For mindfulness skills and quality of life, pre-treatment scores were not significantly different from session 4 scores justifying the exclusion of pre-treatment scores in building the growth curves (FFMQ: t = 0.42, p = 0.68; QOLI: t = 0.28, p = 0.78) However pre-treatment worry scores were significantly lower than at session four (PSWQ-PW: t = 2.43, p = 0.02), requiring the pre-treatment time point to be kept in the model of worry change over time. For this model, the intercept was set at session four and the pre-treatment time point was kept in the model to allow it to be reflected in the estimated slope values. Importantly, the PSWQ-PW was added later in the study, so clients that entered the study earlier were not administered this measure at pre-treatment. This is reflected in the smaller sample sizes in analyses involving the PSWQ-PW in Hypothesis 3. The bias of this excluded group of participants on the analyses may be limited because order of study entry determined this exclusion, which is unlikely to be mediated by other important variables.

The analyses presented here were run using MPlus 5 (Muthen & Muthen, 2007), a structural equation modeling software package. For the growth curve models significance tests were done using Z-scores, with Z-scores greater than 1.96 indicating significance at the level of p=.05, and scores greater than 2.58 indicating significance at the level of p=.01.

CHAPTER 4

RESULTS

Preliminary Outcome Data

Table 1 provides the means, ranges, and standard deviations of the variables used in the analyses (mindfulness skills, worry, and quality of life scores at each of the five time points, and total practice scores across sessions 2 through 4). Skewedness and Kurtosis values were all within the acceptable range (Tabachnick & Fidell, 2007).

Hypothesis 1:

Using MPlus software (Muthen & Muthen, 2007), an unconditional linear growth curve model (Flora, 2008) of mindfulness skills was constructed using FFMQ total scores at each time point from session four to post treatment (omitting the *observe* subscale). Latent variables created by this initial unconditional model of change in mindfulness skills include the slope or average rate of linear change in mindfulness across treatment, and the intercept, which was set at session 4 (see Table 2).

Table 1.
Means, Standard Deviations and Ranges of Variables used in Analyses

Measure	Mean	Standard Deviation	Range
FFMQ (omitting *observe* subscale)			
Pre	87.47	18.39	57-124
Session 4	86.01	14.65	44-108
Session 8	97.74	14.63	72-141
Session 12	103.29	15.72	76-141
Post	107.01	15.99	75-148
QOLI			
Pre	0.24	2.14	-3.73-4.88
Session 4	0.38	1.81	-2.64-4.44
Session 8	0.89	1.88	-2.94-3.81
Session 12	1.25	1.84	-3.06-4.40
Post	1.67	1.78	-1.81-4.75
PSWQ-PW			
Pre	60.93	9.47	47.31-86.25
Session 4	54.51	7.85	41.54-71.79
Session 8	48.85	11.25	22.5-80.0
Session 12	44.26	11.42	19.0-66.96
Post	43.35	10.71	19.0-63.75
Formal Practice (from pre to session 4)	18.48	8.96	4.0-40.0

Note: FFMQ = Five Facet Mindfulness Questionnaire total score (omitting the *observe* subscale); QOLI = Quality of Life Inventory; PSWQ-PW = Penn State Worry Questionnaire-Past Week

The estimated intercept value for mindfulness skills was 88.12 ($z = 38.89$, $p <$ .001), and the estimated unstandardized value of the slope was 6.90 ($z = 9.68$, $p < .001$). The latter value indicates that there was a statistically significant average linear increase

in FFMQ total score (omitting the *observe* subscale) of 6.90 points from each time point to the next. Interestingly, although the correlation between the slope and intercept was of a medium effect size, it was non-significant [$r(31) = 0.46$; $p = 0.57$], indicating that participants' rate of growth in mindfulness skills was not related to their level of skills early in treatment. The variance of the intercept value was significant (*Est.* = 121.92, $z = 2.87$, $p = 0.004$) while the variance of the slope was not (*Est.* = 2.87, $z = 0.60$, $p = 0.55$) indicating that all clients experienced a similar rate of change in mindfulness skills, regardless of where they started out; however, there was significant variation in levels of mindfulness skills at session 4.

Table 2.
Unconditional Growth Model Results for FFMQ, QOLI, and PSWQ-PW

	Intercept			Slope		
	Est	*SE*	*z*	*Est*	*SE*	*z*
FFMQ (*n*=33)	88.12	2.27	38.86***	6.90	0.71	9.68***
QOLI (*n*=33)	0.44	0.31	1.42	0.41	0.08	5.47***
PSWQ-PW (*n*=31)	53.52	1.56	34.38***	-3.96	0.79	-4.66***

Note: ** = $p < 0.01$; *** = $p < .001$; SE = Standard Error; FFMQ = Five Facet Mindfulness Questionnaire total score (omitting the *observe* subscale); QOLI = Quality of Life Inventory; PSWQ-PW = Penn State Worry Questionnaire-Past Week

For the second step (see Table 3), frequency of formal mindfulness practice was totaled for the 2nd, 3rd, and 4th sessions. The summed frequency of formal practice during the first quarter of therapy was added to the model as a time-invariant predictor. This conditional growth model tested whether the frequency of formal practice reported during the first quarter of treatment predicts individuals' level of mindfulness skills at session

four (intercept) and/or their magnitude of linear change from session four to post treatment (slope).

Frequency of formal practice during the first quarter of therapy did not significantly predict the intercept [$\beta(31)=0.13$; $p=0.55$] or slope [$\beta(31)=0.33$; $p=0.48$] of mindfulness skills. This indicates that the frequency of practice reported during this period does not account for the magnitude of change in mindfulness skills from session 4 to post treatment in this sample nor people's level of mindfulness at session 4, thus hypothesis 1 was unconfirmed.

Table 3.
Conditional Growth Model Results—Regression Coefficients of Formal Practice Across Sessions 2-4, Predicting the Slopes and Intercepts of FFMQ, QOLI, and PSWQ-PW

Regression coefficients with formal practice	Intercept			Slope		
	β	*z*	*p*	β	*z*	*p*
FFMQ (*n*=33)	0.13	0.60	0.55	0.33	0.70	0.48
QOLI (*n*=33)	0.07	0.34	0.73	-0.12	-0.28	0.78
PSWQ-PW (*n*=32)	0.44	1.55	0.12	-0.31	-0.92	0.36

Note: FFMQ = Five Facet Mindfulness Questionnaire total score (omitting the *observe* subscale); QOLI = Quality of Life Inventory; PSWQ-PW = Penn State Worry Questionnaire-Past Week

Hypothesis 2:

Frequency of formal practice, as calculated in the previous analysis, was used to predict the rate of change in worry, as measured by the state version of the PSWQ, and quality of life, measured by the QOLI. For both worry and quality of life variables,

unconditional linear growth curve models were run as in hypothesis 1, with the intercept at session 4, with frequency of practice added next to create conditional growth curves.

Quality of Life

The unconditional growth curve model for quality of life scores from pre to post treatment (see Table 2) yielded a non-significant intercept estimate of 0.44 ($z = 1.42$, $p = 0.16$) and a significant positive unstandardized slope of 0.41 ($z = 5.47$, $p < 0.001$). These estimates indicate that participants reported an average QOLI score of 0.44 at session 4 and increased by an average of 0.41 points every 4 sessions, such that they had average QOLI scores of 1.67 at post-treatment. The variance of the intercept was significant (*Est.* = 2.58, $z = 3.39$, $p = 0.001$), while the variance of the slope was non-significant (*Est.* = 0.04, $z = 0.71$, $p = 0.48$), indicating, similar to the unconditional model of mindfulness skills described above, the sample evidenced significant variation in quality of life scores at session 4, but showed similar rates of increase QOLI scores across treatment, regardless of their starting point. The correlation between the slope and intercept was non-significant [$r(31) = -0.26$; $p = 0.50$], indicating that participants' magnitude of change in quality of life scores was not related to their scores at session 4.

As in the previous analysis, the summed frequency of formal practice during the first quarter of therapy was added as a time-invariant predictor to the separate unconditional growth models for quality of life. This tested whether frequency of formal practice predicts the slopes of the change in quality of life scores (with a focus on change from session 4 to post-treatment) or the model intercept (quality of life scores at session

4. Frequency of formal practice during the first quarter of treatment was not significantly related to either the intercept [$\beta(31) = 0.07$; $p = 0.73$] or slope [$\beta(31) = -0.12$; $p = 0.78$] for quality of life (see table 3).

Worry

The unconditional growth curve model for worry scores from session four to post treatment (see Table 2) yielded an intercept value of 53.52 ($z = 34.38$, $p<.001$), indicating that on average, PSWQ-PW scores at session 4 were 53.52, and a significant negative unstandardized slope of -3.69 ($z = -4.66$, $p<.001$), indicating that across treatment, participants' worry scores decreased linearly by 3.69 points every four sessions. The variances of the intercept (*Est.* = 36.46, $z = 1.68$, $p=.09$) and slope (*Est.* = 6.06, $z = 1.23$, $p = 0.22$) were non-significant. The correlation between the slope and intercept was non-significant [$r(29) = .36$; $p = 0.58$], indicating that participants' magnitude of change in worry scores was not significantly related to their scores at session 4.

In the second step, as above, practice was added to the model as a time-invariant predictor. The relationships between formal practice during the first quarter of therapy and the intercept [$\beta(30) = 0.44$; $p = 0.12$] and slope [$\beta(30) = -0.31$; $p = 0.36$] of the model for worry were non-significant (see Table 3), indicating that frequency of formal practice early in treatment did not significantly relate to participants' level of worry at session 4 or their magnitude of change in worry scores from session 4 to post-treatment.

Because frequency of formal practice across sessions 2-4 was not significantly related to the slopes of change for worry and quality of life, hypothesis 2 was not supported.

Hypothesis 3:

Parallel process models (Cheong, MacKinnon, & Khoo, 2003) were created to examine the relationships between change in mindfulness skills and change in quality of life and worry across treatment. A parallel process model combines latent growth curve models for two variables that are measured across time. These test to what degree the growth trajectories or slopes of the two variables are related to each other. However, the models were unable to run normally. This is most likely due to the small sample size and lack of power to run the model. Instead, residual gains scores for each of the three variables were computed to quantify the change in each variable from session 4 to post treatment. Residual gains scores were calculated to remove the variance in post-treatment scores that is related to session 4 levels of the variables. Correlations were calculated among the residual gains scores. The correlations between mindfulness skills and worry [$r(21) = -.54$; $p = .01$] and mindfulness skills and quality of life [$r(30) = 0.57$; $p = .001$] were both significant, of large effect size, and in the expected directions. Also of note is that the correlation between worry and quality of life was also significant and in the expected direction [$r(20) = -.46$; $p = .04$]. These findings support hypothesis 3, that larger increases in mindfulness skills were related to larger improvements in quality of life and worry.

Hypothesis 4:

Because frequency of formal mindfulness practice during the first quarter of therapy was unrelated to mindfulness skills, quality of life, and worry, the prerequisites of mediation analysis were not met. Because these hypotheses are not supported, mediation analyses could not be performed. Thus the fourth hypothesis—that changes in mindfulness skills meditates the relationships between mindfulness practice and worry and quality of life—is unsupported.

CHAPTER 5

DISCUSSION

Formal mindfulness practice is a key component in individual and group mindfulness and acceptance-based treatments and is conceptualized as an indispensible tool for learning and developing mindfulness skills (Kabat-Zinn, 1990). However, the relationships among formal mindfulness practice, gains in mindfulness skills, and improvements in outcome variables are not well understood. A recent meta-analysis of group mindfulness-based programs analyzing mindfulness practice and its relationship with outcome variables found that only 24 of the 96 studies included reported on these relationships, and only 13 of those found significant relationships between practice and outcomes in the expected directions (Vettese et al. 2010). This inconsistency is important considering how widely formal mindfulness practices are used in many emerging stress, health, and psychological interventions. Clearly, our current understanding of the relationships among formal mindfulness practice, learning mindfulness skills, and changes in clinical outcomes is limited. The present study used latent growth curve modeling to test the relationships among formal mindfulness practice, mindfulness skills, worry, and quality of life in an individual acceptance-based behavioral therapy for people with a principal diagnosis of generalized anxiety disorder (GAD). The use of multiple time points across treatment was used to capture these relationships in greater detail than

previous studies have been able to, and allowed the use of individual growth trajectories in the analyses rather than group means used in previous studies. Also by looking at the relationships using formal practice during the first quarter of therapy, the establishment of temporal precedence was theoretically possible, which would have enabled more valid mediation analyses to be performed.

Results did not support Hypotheses 1 or 2, which examined the relationships between the frequency of reported formal mindfulness practice during the first quarter of therapy and the trajectory of change in mindfulness skills, worry, and quality of life from session 4 to post-treatment. Given the strong theoretical rationale and some existing (albeit mixed) evidence supporting formal practice's role in developing mindfulness skills and outcomes, it was hypothesized that reported frequency of formal practice early in treatment would be positively correlated with participants' trajectory of change in mindfulness skills, worry, and quality of life from session 4 to post treatment. Our results found no significant relationship between early formal practice frequency and the slope of mindfulness skills, worry, or quality of life. Because of the small sample sizes used in the analyses however, the possibility of a Type II error cannot be ruled out. Complicating the results, the variances of the slopes of the FFMQ, PSWQ-PW, and QOLI were non-significant, indicating that people had similar rates of change in these variables across treatment. If people have similar rates of change in these variables across time, there is very little variability to predict to. This lack of variation may be related to the lack of significant findings in relation to practice frequency.

There are a number of factors that may be important for interpreting these results. First of all, the method of quantifying formal practice was a frequency variable that did not take the duration of formal practice into consideration. Most studies attempting to quantify practice amounts have focused on minutes or hours practiced, and findings in relation to gains in mindfulness skills have been mixed (Vettese et al. 2010). Currently there are no studies that definitively show that formal practice for longer periods of time leads to higher gains in mindfulness skills than shorter but more frequent practice. As such, the question of whether length of time or frequency of practice (or some combination of both) is the most important component of quantity of practice to measure remains unanswered. In a recent meta-analysis of MBSR studies, Carmody and Baer (2009) found that number of in-class hours did not relate to effect sizes of outcomes, further suggesting that improvements resulting from treatment have more to do with just the amount of exposure to such interventions.

Complicating attempts to quantify and understand the effects of mindfulness practice, both formal and informal practices are often assigned as between-session homework. Informal mindfulness practices are thought to be an important link in bridging the gap between formal mindfulness practice and applying mindfulness in daily life. Informal practices can vary widely and are often tailored to a specific client's preferences and lifestyle (Roemer & Orsillo, 2009). Examples of commonly assigned informal practices include applying mindful awareness during routine daily tasks such as eating, walking, or washing the dishes, short breath or sensation awareness exercises, and contemplation of metaphors of mindfulness (Kabat-Zinn, 1990; Roemer & Orsillo, 2009,

Hayes, Strosahl, and Wilson, 1999). Pointing to the importance of informal practice, Bondofi et al. (2010) found that for a group of MBCT participants, frequency of formal practice declined over the 14 month follow up period while the frequency of informal practice remained unchanged. Miller et al. (1995) reported results of a three-year follow up study after completion of an MBSR course and found that of 18 subjects who completed the follow up assessment, 10 continued to practice some formal mindfulness meditation, while 16 reported maintaining some form of informal practice. It is possible that informal practice contributed more directly to the development of mindfulness skills and improved outcomes in the current sample.

It is also possible that there were certain unmeasured moderating variables obscuring the relationship between formal practice and mindfulness skills. It is highly likely that some participants may engage in mindfulness practice as a form of experiential avoidance. Instead of practicing the more difficult task of bringing compassionate, non-judgmental awareness to unwanted thoughts or emotions during formal practice, some participants may be spending their time during formal practice worrying, ruminating, or distracting themselves from their distress and trying to achieve a more peaceful, relaxed state. This use of formal practice as a form of avoidance, while understandable, would be expected not to increase a person's mindfulness skills and possibly even strengthen experientially avoidant habits. If the degree to which people engage in mindfulness practice with acceptance and openness versus avoidance could be called the "quality" of practice, then quality of practice may be an important moderating variable that determines the degree to which higher levels of formal practice leads to increases in

mindfulness skills and outcome variable improvements over time. Unfortunately, such a variable would be exceedingly difficult to measure, since it would most likely have to rely on self-report and the person's own awareness of their open or avoidant practice style.

It may also be possible that there is a conceptual component to learning mindfulness, and that the psychoeducation, metaphors, and discussions about mindfulness that occur in session may be significant contributors to a person seeing how mindfulness fits into their lives. Some people may be able to conceptualize how mindfulness may be of use to them, and begin engaging mindfully in daily life without having to spend a significant amount of time in formal practice. Others may need more experiential understanding that is developed through practice. A person who "gets it" early on and believes that it will be helpful to them is more likely to be open and motivated to integrate it into her or his everyday life, and would be thus more likely to experience an increase in mindfulness skills. Vettese et al. (2009) speculate that prior exposure to mindfulness may moderate some of the variability in how participants learn mindfulness skills. With the proliferation of mindfulness, yoga, and other mind-body practices and concepts in healthcare, the media, and self-help publications, it is likely that participants vary widely at the beginning of treatment studies in their previous exposure and conceptual or experiential understanding of mindfulness practices and skills. This prior exposure could affect the ways mindfulness skills are learned across treatments. Quantifying experience and expectancies about mindfulness at pre-treatment time points will be important for clarifying processes of mindfulness skill learning in future studies.

Additionally, participation in the ABBT in this study also involves engagement in valued action, between-session monitoring of thoughts, emotions, and behaviors, and journaling assignments, and it is possible that these other activities may contribute to the development of mindfulness skills.

Lastly, any potential benefits of formal mindfulness practice on outcomes would likely be mediated by psychological variables including mindfulness skills (Carmody & Baer 2008), and since Hypothesis 1 (that higher frequency of reported between-session formal mindfulness practice across the 1st four sessions would predict larger increases in mindfulness skills) was not supported, a non-significant finding for Hypothesis 2 (that higher frequency of reported between-session formal mindfulness practice would predict larger improvements in worry and quality of life) is not surprising.

Hypothesis 3, which examined the relationships between changes in mindfulness skills and worry and quality of life was supported. Specifically, residual gain scores of mindfulness skills, which controlled for session 4 levels, were significantly positively correlated with quality of life, and significantly negatively correlated with worry. In other words, increases in mindfulness skills from session 4 to post treatment were significantly associated with increases in quality of life scores and decreases in worry.

This finding supports studies that have previously found that higher levels of or increases in mindfulness was associated with more positive or larger improvements in a variety of clinically relevant symptom measures (Frewen et al., 2008; Carmody & Baer, 2008; Carmody, Reed, Kristellar, & Merriam, 2008; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Brown & Ryan, 2003; Coffey & Hartman, 2008; Frewen, Evans, Maraj,

Dozois, & Partridge, 2008; Schroevers & Brandsma 2010). This finding is in line with the theoretical rationale that increases in mindfulness skills—bringing a more accepting present focused awareness to distressing internal experiences—may reduce efforts to experientially avoid, and thus, may reduce worry in people diagnosed with GAD (Roemer, Salters, Raffa, & Orsillo, 2005). Worry has been conceptualized as a form of experiential avoidance, such that chronic worrying tends to be associated with lower physiological arousal—a perspective that has been supported by laboratory findings (Borkovec, 1994; Borkovec, Alcaine, & Behar, 2004). If a function of worry is to avoid unwanted internal bodily sensations associated with anxiety, increasing mindfulness skills should lead to increased willingness to experience and acceptance of internal experience, thus reducing the need for worry as an avoidant strategy. The strong significant inverse relationships between residual gains in mindfulness skills and worry across treatment supports this conceptualization. Additionally, the present-focused nature of mindfulness skills may directly counteract worry processes, which are defined as being-future oriented (Roemer & Orsillo, 2002).

Quality of life has been shown to be impaired in people diagnosed with GAD (Barerra & Norton, 2009; Hoffman, Dukes, & Wittchen, 2008; Porensky, et al. 2009). Because ABBT has a number of different components that aim to improve a person's quality of life, including work on increasing participants' engagement in valued life behaviors, it is noteworthy that mindfulness skill increases were significantly related to quality of life gains. Increasing one's ability to be present-moment focused in a non-judgmental manner may allow one to engage more in valued directions and lead to

greater satisfaction in different life domains. Hayes, Orsillo, & Roemer (2010) found that participants in ABBT with GAD experienced increases in acceptance of internal experiences and engagement in valued actions, and that these improvements were related to responder status at post-treatment above and beyond levels of worry. It is plausible that increases in mindfulness skills may facilitate these mechanisms of change, and lead to improved quality of life.

Mindfulness may also help a person to see their thoughts and worries as events coming and going rather than being reflections of truth. This process has been variously called decentering, defusion, meta-cognition, reperceiving, and nonattachment, among other terms, and has been found to be related to and in some cases mediate the relationship between mindfulness skills and psychological distress (Coffey & Hartman, 2008; Feldman, Greeson, & Senville, 2010; Hargus, Crane, Barnhofer, & Williams, 2010). However, findings have been mixed, possibly due to potential variability across measures (Carmody, Baer, Lykins, & Olendzki, 2009). Future research should further investigate the mechanisms involved in the relationship between mindfulness skills and outcome variables like worry and quality of life.

It is important to note that the analysis testing Hypothesis 3 does not allow interpretations about the directionality of the relationship between mindfulness skills and worry. Specifically, the analysis does not rule out the possibility that reductions in worry occurred through a different mechanism, which then facilitated an increase in subjects' perceived ability to engage mindfully in daily life. Study designs that allow directional conclusions to be drawn are needed to clarify the nature of this relationship.

Finally, because Hypotheses 1 and 2 were not supported, Hypothesis 4, which was designed to test whether the trajectory of change in mindfulness skills mediated the relationships between formal mindfulness practice and changes in outcome variables, was not tested. However, increases in mindfulness skill levels have been found in other studies to mediate the relationship between formal mindfulness practice and levels of fear of emotion, rumination, and behavioral self-regulation (Lykins & Baer, 2009), psychological well-being (Baer et al., 2008), and psychological symptoms and perceived stress (Carmody & Baer, 2008). Yet, none of these studies used longitudinal designs that allowed for the establishment of temporal precedence and thus were unable to make inferences about the directionality of the relationships.

Limitations:

Importantly, a number of limitations of the current study need to be highlighted. First of all, small sample size and the resulting lack of power to detect significant relationships increased the chances of Type II error in this study. The latent growth-curve analyses employed are optimally used with sample sizes many times larger than the one used here. Effect sizes of the relationships between formal practice and mindfulness skills and worry were of medium effect size, indicating that a larger sample size may have identified significant relationships here.

Second, the measurement of formal mindfulness practice was based on the frequency of reported practice, with no way of estimating the total duration of practice. This precluded analysis of duration as a potentially informative dimension of formal

practice amount. Additionally, there are a number of reasons a client may misrepresent how much they practiced mindfulness, and we had no way to objectively verify the accuracy or truthfulness of client reported practice frequency. The current study also did not look at the effects of informal practice or other potentially important contributors to mindfulness skill development.

Thirdly, while the operationalization of mindfulness skills was based on the FFMQ, a validated and frequently used measure of mindfulness skills, there is still no defined standard in the field as to how to best measure this construct (see Grossman, 2008 for an overview of problems involving the measurement of mindfulness skills). A recent study has raised an issue with the FFMQ in particular, showing that meditation naïve participants and those with meditation experience endorsed positive and negative items of the measure in systematically different ways (Van Dam, Earleywine, & Danoff-Burg, 2009). This raises questions about the construct validity of the measure when comparing these two groups or when measuring mindfulness skills across time in samples of initially meditation naïve subjects, as in the current study. However, the current study excluded the *observe* scale from analysis, since it had been found that this scale may be particularly susceptible to differential scoring before and after mindfulness training (Baer et al., 2008). Ideally, operationalizations of mindfulness skills are multimodal, and this study lacked such an assessment of mindfulness skills.

Of critical importance is the lack of generalizability of most studies involving mindfulness-based interventions. The current study is no exception, and a central limitation of this study is that the sample is largely homogenous in terms of self-

identified race/ethnicity, sexual orientation, and socio-economic status. This precludes generalization of these results to groups not represented in this study, which include many underserved groups and identities.

Clinical Implications

While the present study failed to find significant relationships between the frequency of formal mindfulness practice and mindfulness skills, worry, or quality of life, it is important to note that participants in this study did experience significant improvements in mindfulness skills, worry, and quality of life across treatment. This indicates that participants in ABBT are learning and developing their mindfulness skills over the course of treatment, and that this increase is related to improvements in worry, which is a central component of GAD, and quality of life. These findings add to the growing body of literature supporting the clinical benefits of learning and developing mindfulness skills in the treatment of GAD. The lack of significant relationships found relating to formal mindfulness practice highlight the complex nature of how people learn mindfulness skills, and suggest that future studies develop more detailed measures of the various factors that may contribute to the growth of mindfulness skills. These likely include conceptual understandings, belief in the applicability of mindfulness to one's life, and amount of formal and informal practice. Also moderating variables such as the quality of one's practice may help to clarify pieces of the complex process of learning mindfulness skills. These types of investigations are imperative to help increase our

understandings of how to teach mindfulness skills most efficiently, effectively, and appropriately for a given individual or group.

Interventions vary to the degree to which formal mindfulness practice is emphasized. Interventions such as Mindfulness-Based Stress Reduction (MBSR) place the practice of formal mindfulness at the center of their in- and between-session work (Kabat-Zinn, 1990). It might be expected that the development of mindfulness skills in such interventions would be more directly related to formal practice amounts, and indeed some studies have found such relationships (Baer et al. 2008; Carmody & Baer, 2008). The present study examined an acceptance-based behavior therapy (ABBT; Roemer and Orsillo, 2009) that strives to provide clients with a flexible and adaptable training in developing mindfulness skills, including formal and informal practice, conceptual and experiential discussion, engagement in valued action, between-session monitoring, and written assignments. By exposing clients to a wide array of formal and informal mindfulness practices, the likelihood of clients finding and sticking with methods that fit their lives and preferences may be higher, and may lead to long-term integration of such practices into their lives and continual development of mindfulness skills long after treatment termination. Ideally, mindfulness practices and skills learned in short-term therapies will become regular parts of clients' lives, to ensure that gains are maintained. Allowing clients to flexibly tailor their mindfulness practices to their preferences and life constraints may be the most effective strategy for ensuring the long-term integration of mindfulness practice in daily life.

The results of this study support the assertion that mindfulness skills can be learned and cultivated in the absence of a direct relationship with the frequency of formal mindfulness practice early in treatment. However, these results do not negate the potential importance of formal practice, and suggest that moderating variables be investigated to clarify how, and for whom formal mindfulness practice may most effectively foster the cultivation of mindfulness skills. Formal practice should be considered one of a number of potential tools for helping a person learn and develop mindfulness skills.

Future Directions

Of concern is that mindfulness and acceptance-based interventions are restricted mainly to privileged and higher socio-economic sectors of society. Most mindfulness- and acceptance-based interventions require large amounts of time required for course attendance and between-session homework and practice. Additionally, given limitations of access, English language instruction, potentially culturally biased perspectives, and lack of insurance coverage, it remains to be seen whether such interventions can be of use to underserved groups. While it is encouraging that a handful of studies and publications have already emerged that focus on this issue (Roth, 1997; Semple, Lee, Rosa, & Miller, 2009; Woods-Griscombe & Black, 2010), much more work in this area is needed. Studies have shown that mindfulness-based treatments can be culturally adapted with positive outcomes (Hinton et al., 2004; Hinton& Otto, 2006). Future studies need to focus not only on cultural adaptations of mindfulness interventions for diverse

populations and settings, but also on acceptability and feasibility of such interventions in populations of lower socio-economic status and multiple life-stressors.

As mentioned above, future studies need to account for the variety of practices, activities, and influences in treatments that may all foster the development of mindfulness skills. Additionally, standardized valid measures of mindfulness practice need to be developed. Improvements in technology and personal devices may provide opportunities to increase the validity of practice measurements in treatment studies (Wahbe, Zwicky, & Oben, 2011).

It may be of value to the field to begin investigation of moderating variables in learning mindfulness skills, and particularly the development of constructs and measurement tools targeting the quality of mindfulness practice. These may have value in determining if mindfulness practice is being used by participants as a form of avoidance rather than engagement, and thus help clinicians focus instruction on improving the quality of practice to foster its impact on development of mindfulness skills.

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