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Efficacy of a Daily Mindful Breathing Intervention to Increase Academic Engagement

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University of Connecticut, 2016

Low academic engagement is a common student-related problem faced by teachers. Internally-managed systems of change, such as self-management strategies, used in conjunction with existing behavioral frameworks may provide an efficient and effective way of addressing student engagement. Mindfulness has received increasing attention in the research literature over the past decade and has been shown to improve a variety of cognitive, behavioral, and physiological outcomes, especially with clinical populations. However, school-based mindfulness curricula are typically expensive, time-consuming, and require specialized training, resulting in barriers to implementation. There is a need for mindfulness-based interventions (MBIs) that are replicable and easily integrated into school settings, as well as more experimental studies of mindfulness to support its use in schools. This study employed a multiple-baseline across subjects design to examine the impacts of a daily, audio-delivered, mindful breathing intervention on adolescents with emotional and behavioral difficulties in an alternative educational setting. The intervention was designed to promote self-management of student attention. It was unique, as it required little training and time from teacher implementers and was easily incorporated into the school day with minimal disruption to existing routines. The effects of the mindful breathing intervention on academic engagement were investigated, along with acceptability of the intervention from the perspectives of implementers and participants. Results of the study indicated that teachers and students perceived the intervention to be both feasible and acceptable. In addition, participants displayed increases in academic engagement as measured by both Direct Behavior Rating (DBR)

and systematic direct observation (SDO) that were maintained at 6-week follow-up. Decreases in disruptive behavior were also observed. However, because the effects could not be replicated three times due to issues with attrition, changes cannot be directly attributed to the mindful breathing intervention. Implications of the findings, as well as future directions for research, are discussed.

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Chapter I: Introduction

In this era of increasingly rigorous academic standards and an accountability-based, data-driven educational system, teachers are under a great deal of pressure to produce evidence of student learning through a variety of evaluation methods. Yet teachers are often met with obstacles in producing such evidence – two of the most common student-related obstacles being lack of academic engagement and difficulty with sustaining attention (Bundick, Quaglia, Corso, & Haywood, 2014; DuPaul, 2007). Wolraich, Hannah, Baumgaertel, and Feurer (1998) found that approximately 16% of elementary school students exhibit some level of inattention or difficulty with concentration in the classroom. In a review of the literature on student engagement, Klem and Connell (2004) found that between 40% and 60% of high school students are "chronically disengaged" (p. 262). Lack of student engagement and attentional difficulties are particularly problematic, as research has demonstrated that student engagement is positively correlated with measures of academic achievement (Fredricks, Blumenfeld, & Paris, 2004; Strambler & McKown, 2013). In an analysis of longitudinal data, Duncan et al. (2007) found that the strongest predictors for later achievement include school-entry math, reading, and attention skills. Therefore, it can be ascertained that student engagement is an important contributor to academic outcomes.

Behavior modification interventions are widely-recommended to promote attention and engagement in students (DuPaul, 2007). These interventions are based on the premise that behavior can be changed by systematically manipulating antecedents (e.g., environmental factors, such as the physical structure of a classroom) and consequences (e.g., teacher and peer reactions) that are related to the target behavior. Although the efficacy of traditional behavior modification techniques is well-supported in the research literature (Gresham, 2004), there are

limitations that impact the effectiveness of such interventions in school settings. In order for an intervention to be effective, it must be implemented as intended. Behavior modification is primarily an externally-managed system of change that involves the manipulation of a variety of variables, often by a number of individuals (e.g., teachers, paraprofessionals, related service providers). The complexity of behavior modification interventions can make implementation both time and resource intensive (Thomas, 1980). In addition, treatment integrity may be difficult to monitor and ensure (Gresham, 2004). Another challenge with an externally-managed system is that generalization of behavior change to alternate settings is typically dependent upon some level of intervention implementation in other settings (e.g., home). As a result, the success of generalization can be vulnerable to the varying levels of commitment of individuals in other settings (e.g., parents) to implement the same strategies with fidelity. For these reasons, it may be prudent for educators to consider additional options for promoting academic engagement, such as more internally-managed systems of change to use in conjunction with existing behavioral frameworks in schools.

Mindfulness-based intervention (MBI) may provide an efficient tool for increasing academic engagement in students by promoting self-management skills. Research has demonstrated that a consistent mindfulness practice can enhance parts of the brain associated with attention (Chiesa & Serretti, 2010). Within a school-based setting, research suggests that mindfulness can be an effective method of treating a variety of difficulties, from depression to behavioral issues (Black et al., 2009; Burke, 2010; Zoogman et al., 2014). Additionally, participants who display higher levels of problematic behavior at baseline have demonstrated more change as a result of MBIs compared to participants with more typical behavior at baseline (Flook et al., 2010; Joyce et al., 2010; Razza et al., 2013; Semple et al., 2010).

The purpose of this study was to examine the effectiveness of a brief, daily, audio-delivered mindful breathing intervention in increasing academic engagement in at-risk adolescent students within an alternative educational setting. The study also evaluated the feasibility and student perceptions of the intervention.

Chapter II: Review of the Literature

Mindfulness Defined

Mindfulness-based interventions (MBIs) have received an increasing amount of attention in the research literature over the past decade. Mindfulness has been defined as "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p. 145). Creswell and Lindsay (2014) clarified the concept further by stating that mindfulness involves "taking notice of what is happening right now, regardless of whether one's experience is positive, negative, or neutral," as well as "inviting in experience with curiosity and interest" (p. 401). Bishop et al. (2004) proposed an operational definition for mindfulness as a meta-cognitive skill with two components: the self-regulation of attention, and an orientation of curiosity, openness, and acceptance towards one's experiences. This orientation promotes viewing thoughts and feelings as passing events of the mind rather than inherent aspects of the self or accurate reflections of reality (p. 234). Two core features are evident in definitions of mindfulness: the act of attending to the present moment coupled with a non-judgmental attitude of acceptance.

The roots of mindfulness can be traced to ancient Buddhism; however, the concept is not specifically Buddhist in nature, but rather a universal human capacity (Kabat-Zinn, 2003). Felver, Doerner, Jones, Kaye, and Merrell (2013) illustrated this point with a comparison to fasting. They pointed out that although abstaining from food and drink is a common practice in many religions, fasting in and of itself is not inherently religious in nature (p. 532). Likewise, although mindfulness is incorporated into some religions, it can also be practiced without the tie to religious beliefs. Mindfulness is sometimes compared to relaxation; however, the goals of the two concepts differ. While both mindfulness and relaxation may result in a more relaxed

physical and mental state, the goal of mindfulness is not to become more relaxed, but to be more aware and accepting of the current state of the body and mind (Fodor & Hooker, 2008). Yoga, tai chi, and quigong are often viewed as forms of mindfulness, as they involve focusing attention on one's breathing while performing specific movements with the body, as well as adopting an open, nonjudgmental attitude (Gould, Dariotis, Mendelson, & Greenberg, 2012; Wisner, Jones, & Gwin, 2010).

Mindfulness is sometimes compared to meditation. Meditation typically refers to an act of initially directing attention towards a specific focus, such as the breath, a sensation, a feeling (e.g., loving-kindness), or a word or phrase (e.g., mantra). The focus of the attention is referred to as an attentional "anchor." As one practices meditation, it becomes apparent that the mind will frequently drift away from the anchor into naturally arising thoughts and feelings. After noticing this drift, the meditator repeatedly refocuses his/her attention on the anchor (Meiklejohn et al., 2012). Although the root of many mindfulness practices involves a focus on the breath akin to meditation, some mindfulness practices, such as mindful eating and mindful driving, cannot be equated to meditation. In addition, meditation is frequently associated with religious activities, such as prayer (Felver et al., 2013). Therefore, for the purposes of this research study, the term *meditation* is avoided in favor of more secular terminology, *mindfulness*.

Mindfulness has been formalized into a variety of manualized programs, therapies, and school-based curricula. Possibly the most well-known mindfulness program was developed by Jon Kabat-Zinn in 1979. Mindfulness-based Stress Relief (MBSR) was originally developed at the University of Massachusetts Medical Center to train patients in mindfulness techniques with the intention of reducing stress, pain, and illness. MBSR is conducted as an 8- to 10-week course that teaches mindfulness through such activities as sitting meditation, body scan, and yoga. It has

been well-researched, shown to be effective in reducing a variety of physiological and psychological problems in adults and children, and serves as a model for many other mindfulness programs (Baer, 2003; Kabat-Zinn, 2003). Other mindfulness-based therapies include Mindfulness-based Cognitive Therapy (Segal, Williams, & Teasdale, 2002), Acceptance and Commitment Therapy (Hayes, Strosahl, & Wilson, 1999), Dialectical Behavior Therapy (Linehan, 1993), and Meditation on the Soles of the Feet (Singh, Wahler, Adkins, Myers, & The Mindfulness Research Group, 2003).

Numerous curricula have been developed to teach mindfulness in schools. Most of the programs involve a combination of direct instruction of mindfulness concepts through classroom lessons and experiential activities intended to provide opportunities to practice mindfulness (Meiklejohn et al., 2012). Specific school-based curricula include Inner Kids (Flook et al., 2010), Mindful Schools (Liehr & Diaz, 2010), MindUP (Schonert-Reichl & Lawlor, 2010), and Learning to BREATHE (Broderick & Metz, 2009), among others.

In addition to manualized therapies and school-based curricula, mindfulness has been conceptualized as a number of activities that involve focusing one's attention on something specific. Examples of proposed mindfulness activities include awareness of an object, awareness of oneself in the environment, attending to the senses, and awareness of movement (Fodor & Hooker, 2008). Many of these activities are incorporated in some capacity into the manualized mindfulness programs and therapies. However, at the core of most mindfulness practices is the act of focusing on the breath that is described above (Fodor & Hooker, 2008; Meiklejohn et al., 2012). The initial focus on the breath is believed to build concentrated attention that can then be broadened toward what arises from sensory, mental, or emotional states (Smalley et al., 2009, p. 1089).

Mindfulness as a Self-management Strategy

Self-management strategies have been defined as those that include at least one, or a combination of the following components: (a) personal goal setting, (b) self-monitoring, (c) self-evaluation and recording, (d) self-reinforcement, and (e) self-charting (Briesch & Chafouleas, 2009c). Baer (2003) noted that mindfulness training may promote early recognition of a problem, which can then provide an opportunity to apply previously learned skills at a time when they are most likely to be effective in preventing the problem (p. 129). Thus, engaging in mindfulness can promote self-management of attention, which has been hypothesized to be a primary mechanism of mindfulness (Semple, Reid, & Miller, 2005).

When conceptualizing mindfulness as a behavioral self-management strategy, refocusing one's attention on a neutral stimulus (e.g., the breath) when the mind wanders serves as the target behavior to be increased. By engaging in a mindful breathing practice, one learns to recognize when the mind wanders. Mind wandering is an antecedent, and the process of recognition demonstrates self-monitoring. A mindful breathing practice involves taking note of the mind wandering in an accepting and nonjudgmental manner. This can take the form of a self-delivered prompt, such as saying to oneself, "I notice that I'm worrying about what will happen later," or more simply, "I'm not focusing on my breath anymore." The prompt initially serves as a cue or reminder to engage in the target behavior. It later becomes a discriminative stimulus (S^D) that signals that reinforcement following a behavior is likely to occur. After providing the self-delivered prompt, one engages in the target behavior, refocusing attention on the breath. Repetition of this process results in what has been described as a "stable intrapsychic environment" (Semple et al., 2005, p. 380). This stable intrapsychic environment enables one to think more clearly and to be less reactive to emotional stimuli, essentially to feel better. The

enhanced thinking then serves as positive reinforcement that continues to increase the likelihood of occurrence of the target behavior (refocusing one's attention). Through engaging in this practice, it becomes more and more likely that when the mind wanders, attention is refocused on the breath, thus demonstrating stimulus control. Stimulus generalization occurs when one engages in this self-management strategy in coping with a variety of stressful situations (e.g., academic instruction, taking a test, conflict situation). Behavioral principles and associated examples of mindfulness are further described in Table 1 and Figure 1.

Mechanisms of Change

Although the manner in which mindfulness specifically improves outcome measures is not yet fully understood, some researchers have proposed hypotheses regarding relevant mechanisms of change. Referring to current research, Baer (2009) proposed that mindfulness fosters the ability to respond mindfully, or with awareness but not emotional reactivity, to daily experiences. Increased mindfulness then mediates improvements in well-being and reductions in psychological symptoms. Baer noted that the mechanism through which this occurs is not well-established. However, some evidence suggests that mindfulness may promote the development of an adaptive form of self-focused attention that is associated with the nonreactive observation of thoughts and the reduction of rumination, fear, and avoidance. This type of self-focused attention cultivated through mindfulness may consequently improve the ability to engage in constructive behavior even while experiencing unpleasant thoughts and feelings.

Creswell and Lindsay (2014) cited numerous well-controlled studies in support of a stress buffering hypothesis to provide an explanation of how mindfulness affects health outcomes. The premise of their hypothesis is that mindfulness changes the way that stress is processed in the brain. Specifically, mindfulness activates regions of the brain associated with stress-regulation

(e.g., ventral and dorsal regions of the lateral prefrontal cortex) and reduces the reactivity of stress processing regions (e.g., amygdala, interior cingulate cortex, ventromedial prefrontal cortex, hypothalamus, and parabrachial pons). This process enables mindful individuals to become more resilient to stress and stress-related disease, such as depression, Posttraumatic Stress Disorder (PTSD), HIV infection, diabetes, and psoriasis.

Numerous brain-based research studies of mindfulness provide additional information that sheds light on possible mechanisms of change. Davidson et al. (2003) found evidence of significant differences in immune function and brain activation associated with positive affect in subjects who participated in an 8-week MBSR program. In a recent review, Chiesa and Serretti (2010) reported that several high-quality neuroimaging studies have demonstrated differences between the brains of long-term meditators and matched controls. Specifically, studies have indicated that cerebral areas and subcortical structures involved in attention are thicker in long-term meditators, and that meditators do not show decreased grey matter volume and attentional performance with age (p. 1245). Other studies using Functional Magnetic Resonance Imaging (fMRI) and electroencephalogram (EEG) technology have found evidence that meditation may increase brain efficiency through improved focusing of attentional resources, reduced recruitment of cognitive resources, and improved impulse control (Kozasa et al., 2012; Moore, Gruber, Derose, & Malinowski, 2012).

Researchers have also found that effects from meditation can be observed after a very short period of time. Van Leeuwen, Singer, and Melloni (2012) examined differences between meditators and non-meditators on a spatial attention task and changes in spatial attention using EEG and behavioral performance data. Differences in attention were noted after only 4 days of training in a new meditation technique.

Proposed theory of change. Although most research concerning mindfulness mechanisms of change has been conducted from a neurological orientation, a behavioral perspective may arguably be most relevant to a school-based setting due to the theoretical emphasis on observable change and data-based decision making. Therefore, a theory of change that reflects a behavioral perspective is proposed for this study. When students engage in a daily mindful breathing intervention, they strengthen behavioral self-management skills, leading to increased engagement during learning time, ultimately resulting in improved academic outcomes. This specific study was designed to address the first three components of the theory of change illustrated in Figure 2.

Mindfulness Intervention Research

In clinical and non-clinical adult populations, MBIs have been shown to be effective treatments for a variety of conditions, such as chronic pain, psoriasis, anxiety, depression, stress, binge eating, fibromyalgia, aggressive behavior, and quality of life in patients with multiple sclerosis (Baer, 2003; Simpson et al., 2014; Singh et al., 2003). Using meta-analytic procedures, Baer calculated medium to large post-treatment and follow-up effect sizes. Overall mean effect sizes (Cohen's *d*) have been calculated to be 0.50 (Grossman, Niemann, Schmidt, & Walach, 2004) to 0.59 (Baer, 2003). MBIs have also been found to positively impact parenting outcomes and family relationships (Bogels, Hoogstad, van Dun, de Schutter, & Restifo, 2008; Coatsworth, Duncan, Greenberg, & Nix, 2010; Duncan, Coatsworth, & Greenberg, 2009; Harrison, Manocha, & Rubia, 2004; Singh et al., 2010a).

Studies examining behavioral measures of attention and cognitive functioning in adults have had positive results. Jha, Krompinger, and Baime (2007) studied the effects of mindfulness training on three distinct attentional subsystems in adults, specifically conflict monitoring,

orientation, and alerting. Differences in all three subsystems were noted in mindfulness participants, as measured by performance on the Attention Network Test (ANT). Prakash et al. (2010) compared the performance of 15 adult, male, long-term meditation practitioners with a matched control group on neuropsychological tests intended to measure various domains of attention. Long-term Vihangam Yoga meditators performed significantly better on all tests, suggesting that meditation can improve attention span, processing speed, attention alternation ability, and performance on interference tests. Mrazek, Franklin, Phillips, Baird, and Schooler (2013) investigated the impact of a 2-week mindfulness training program on working memory, GRE performance, and mind wandering in college students. Results of the randomized controlled study indicated that participants in the mindfulness training group demonstrated significant improvements in working memory and GRE performance, as well as reductions in distracting thoughts. In an active control group study, Zeidan, Johnson, Diamond, David, and Goolkasian (2010) found that just four meditation training sessions produced significant improvements in performance on cognitive tasks involving sustained attention in college undergraduate students.

Although there is less research on MBIs in child and adolescent populations in comparison to adult populations, numerous studies have demonstrated positive results. MBIs have been shown to improve outcomes such as internalizing and externalizing behaviors, resilience, mental health, happiness, well-being, quality of life, sleep, and substance abuse (Biegel, Brown, Shapiro, & Schubert, 2009; Britton et al., 2010; Coholic, Eys, & Lougheed, 2012; Lee, Semple, Rosa, & Miller, 2008; Sibinga et al., 2011; Singh et al., 2010a; Singh et al., 2011a; Singh et al., 2011b; Sinha & Kumar, 2010).

Burke (2010) reviewed 15 studies in a recent meta-analysis of mindfulness studies with children and adolescents. Analyses of post-treatment results produced reported effect sizes

(Cohen's *d*) ranging from small to large (*d* = -0.2 - 1.4). Burke noted that numerous studies presented with methodological issues, such as small sample size, missing controls, lack of randomization, few objective measures, potential biases from recruitment volunteers, and reliance on subjective self or parent/teacher reports (p. 4). Despite methodological weaknesses, Burke concluded that the current research provides a reasonable base of support for the feasibility and acceptability of MBIs with children and adolescents, and that more rigorous, empirical investigation of the interventions is warranted. Results of a systematic literature review of sitting meditation interventions with participants aged 18 and under conducted by Black, Milam, and Sussman (2009) indicated that median effect sizes for physiological outcomes (e.g., blood pressure, heart rate, cardiac output, etc.) ranged from 0.16 to 0.29. Median effect sizes for psychosocial/behavioral outcomes (e.g., anxiety, social behavior, ADHD, etc.) ranged from 0.27 to 0.70. Zoogman, Goldberg, Hoyt, and Miller (2014) conducted a meta-analysis of MBIs with youth from 2004-2011. An overall small effect size was calculated over a broad range of samples and outcome measures (*del*=0.227). Of particular interest, a sub-omnibus analysis for attention was significant and about the same size as the overall global effect (*del*=0.280).

Zoogman and colleagues (2014) also found that clinical samples demonstrated higher effects than non-clinical samples (*del*=0.500 vs. *del*=0.197). Several other research studies have noted that participants who were less well-regulated and/or displayed higher levels of problematic behavior at baseline demonstrated more change as a result of MBIs compared to participants with more typical self-regulation and/or behavior at baseline (Flook et al., 2010; Joyce et al., 2010; Razza et al., 2013; Semple et al., 2010). In other words, participants who are more in need of mindfulness may benefit more from MBIs, providing support for further investigation of the effects of MBIs with at-risk youth.

Studies specifically examining the effect of MBIs on attention in children and adolescents have demonstrated positive results. Harrison et al. (2004) found that a 6-week training in the Sahaja Yoga Meditation technique for children diagnosed with ADHD and their parents resulted in parent-reported improvements in children's ADHD symptoms. Semple, Lee, Rosa, and Miller (2010) conducted a randomized controlled trial to examine the effects of a 12-week Mindfulness-based Cognitive Therapy (MBCT) program on children aged 9 to 13. Results of the study demonstrated a reduction in attention problems in participants who completed the program, which was maintained at 3-month follow-up. Bogels et al. (2008) employed a quasi-experimental, within-subject, wait-list group design to analyze the impact of an 8-week mindfulness-based cognitive therapy (MBCT) program on adolescent and parent behavior. Results of the study indicated significant self-reported improvements in the adolescents' attention problems. Van de Weijer-Bergsma, Formsma, de Bruin, and Bögels (2012) employed a quasi-experimental design to study the effects of 8-week, concurrent mindfulness training programs for adolescents diagnosed with ADHD and their parents. Results of the study indicated significant self-reported improvements in the adolescents' attention, which were supported by significant improvements in adolescents' performance on computerized attention tasks following training. Zylowska et al. (2008) conducted a feasibility pilot study of an 8-week mindfulness program for adults and adolescents diagnosed with ADHD. Post-test assessment indicated significant self-reported reduction of ADHD symptoms, as well as improvement on performance of some neurocognitive tests of attention.

School-based mindfulness intervention research. Numerous school-based studies have shown that MBIs are generally perceived to be feasible and acceptable by teachers and students (Huppert & Johnson, 2010; Jennings, Frank, Snowberg, Coccia, & Greenberg, 2013; Lagor,

Williams, Lerner, & McClure, 2013; Mendelson et al., 2010; Metz et al., 2013; Schonert-Reichl & Lawlor, 2010). Studies of MBIs with teachers have revealed positive outcomes with variables such as stress (Gold et al., 2010; Roeser et al., 2013; Winzelberg & Luskin, 1999); anxiety and depression (Gold et al., 2010); relationship quality (Napoli, 2004); well-being and self-efficacy (Jennings et al., 2013; Winzelberg & Luskin, 1999); attention, working memory, and occupational self-compassion (Roeser et al., 2013); and student behavior (Singh, Lancioni, Winton, Karazsia, & Singh, 2013). Studies of MBIs with students have demonstrated a variety of benefits, including improvements in blood pressure and heart rate (Barnes, Davis, Murzynowski, & Treiber, 2004; Barnes, Pendergrast, Harshfield, & Treiber, 2008; Gregoski, Barnes, Tingen, Harshfield, & Treiber, 2011; Wright, Gregoski, Tingen, Barnes, & Treiber, 2011); stress (Mendelson et al., 2010; Metz et al., 2013); anxiety and depression (Beauchemin, Hutchins, & Patterson, 2008; Joyce, Etty-Leal, Zazryn, Hamilton, & Hassed, 2010; Lagor et al., 2013; Liehr & Diaz, 2010; Linden, 1973; Steiner, Sidhu, Pop, Frenette, & Perrin, 2013); behavior (Black & Fernando, 2014; Mehta et al., 2011; Mehta et al., 2012; Singh et al., 2007; Steiner, Sidhu, Pop, Frenette, & Perrin, 2013); social/emotional competence (Schonert-Reichl & Lawlor, 2010); executive function/self-regulation (Broderick & Metz, 2009; Flook et al., 2010; Metz et al., 2013; Razza, Bergen-Cico, & Raymond, 2013); psychological protective factors (Viafora, Mathiesen, Unsworth, 2014); social skills (Beauchemin, Hutchins, & Patterson, 2008); analytic thinking (Linden, 1973); and academic performance (Beauchemin, Hutchins, & Patterson, 2008; Mehta et al., 2011; Mehta et al., 2012).

Mindfulness and student engagement. A handful of studies have investigated the impact of MBIs on student attention and engagement. Napoli, Krech, and Holley (2005) implemented a mindfulness-training program with 194 first, second, and third grade students in a general

education setting and studied the impact on student attention. The program consisted of 12, 45-minute, bimonthly mindfulness lessons involving breathwork, bodyscan, movement, and sensorimotor awareness activities. Participants were randomly assigned to intervention and control groups, and both teacher-report and cognitive measures were used to assess attention. Significant differences were evident between intervention and control groups on three out of four measures of student attention.

Carboni, Roach, and Fredrick (2013) employed a multiple baseline research design to assess the effects of a mindfulness training program on academic engagement in four, 8-year-old boys diagnosed with ADHD. Mindfulness training was based partially on an MBSR-adapted program for children. A school psychologist delivered the training two times per week for 30-45 minutes. Intervention sessions were delivered during times of the day in which off-task behaviors occurred most frequently. Results of the study indicated that the intervention was effective in increasing intervals of time spent on-task.

Klatt, Harpster, Browne, White, and Case-Smith (2013) utilized a single group pre-post design to investigate the impact of an 8-week MBI on student behavior in a low-income, urban elementary school. The Move-Into-Learning (MIL) program included mindfulness meditation, yoga, and expression in the written and visual arts. Analysis of teacher rating scales indicated significant improvements in hyperactivity and subscales related to ADHD symptoms and inattentiveness.

In a quasi-experimental study, Schonert-Reichl & Lawlor (2010) examined the impact of the Mindfulness Education (ME) program (later renamed MindUP) on pre- and early-adolescents' optimism, self-concept, positive affect, and social-emotional functioning in school. The ME program is a 10-week, teacher-delivered, universal, preventative program designed to

enhance the social-emotional competence of children. It consists of daily lessons and mindful attention training three times per day. Results of the study indicated that students who participated in the ME program demonstrated significant improvements in teacher-rated social-emotional competence, specifically in the areas of attention and concentration. Additionally, program participants evidenced significant improvements in self-reported optimism.

In summary, current research suggests that a variety of school-based mindfulness curricula and programs have shown promise in increasing student attention and engagement.

Current status of school-based mindfulness intervention and research. Some researchers have provided recommendations regarding the nature and delivery of school-based MBIs. Many of the school-based studies examined curricula that incorporate a combination of classroom-based lessons and experiential activities. However, Broderick and Metz (2009) and Sibinga and colleagues (2011) noted that adolescent participants expressed a preference for in-class meditation (mindful breathing) exercises over lessons and discussions. Researchers have generally agreed that mindful breathing exercises for children and adolescents should be much shorter in duration in comparison to adults, in some cases lasting for only a few minutes for young children (Shapiro et al., 2014; Wisner et al., 2010).

The costs of many existing school-based mindfulness programs can be significant, and specialized training for facilitators is typically required. For example, the Mindful Schools curriculum requires program implementers to complete a 6-week Mindfulness Fundamentals course costing $125, prior to enrolling in the Curriculum Training course. The training course is then completed either online over six weeks or in person and costs $550, which includes the program materials (www.mindfulschools.org). Most school-based programs also require a significant time commitment on the part of classroom teachers. For instance, the Inner Kids

curriculum generally requires young children to meet twice per week for ½ hour sessions, and older children to meet once per week for approximately 45 minutes (www.susankaisergreenland.com). Monetary costs, specialized training requirements, and associated time commitments may provide barriers to implementation of school-based mindfulness programs.

Wisner et al. (2010) proposed a need for MBIs that are "replicable, transportable, and easily incorporated into school settings" (p. 156). For these reasons, it may be advisable to explore the implementation of MBIs that are inexpensive, require little time, and do not require specialized training or experience to facilitate. One possible way to address these barriers is to create an audio-delivered MBI that does not require specialized training or a substantial time commitment from teachers. Bakosh, Snow, Tobias, Houlihan, and Barbosa-Leiker (2015) recently found empirical support for such an audio-delivered, 10-minute-per-day MBI based on the MBSR program. Results of their quasi-experimental study indicated that their teacher-independent program significantly enhanced students' quarterly grades in reading and science, compared to a control group (N = 191).

Although numerous research studies have demonstrated positive results with a wide range of outcome variables, many child and adolescent MBI studies are limited by a variety of methodological factors. Limitations include inadequate controls, small sample sizes, wide variety of interventions (independent variables), lack of thorough description of interventions, overreliance on self-report outcomes, missing measures of treatment fidelity and interrater reliability, and lack of behavioral outcome measures (Biegel et al., 2009; Burke, 2010; Harnett & Dawe, 2012). Although the existing research base provides optimistic evidence of the potential value of school-based MBIs with children and adolescents, there is a need for more

methodologically-sound studies (Black et al., 2009; Felver et al., 2013). Additionally, some researchers have communicated a need for future studies of MBIs to assess socially valid outcome measures, such as student attentiveness and academic achievement. Meiklejohn et al. (2012) believe that such studies would increase the appeal of MBIs, helping to provide educators and policymakers with a rationale for investing time and money on new educational programs.

Furthermore, research has indicated that participants who display higher levels of problematic behavior at baseline may demonstrate more change as a result of MBIs compared to participants with more typical behavior at baseline (Flook et al., 2010; Joyce et al., 2010; Razza et al., 2013; Semple et al., 2010). This provides support for further investigation of the effects of MBIs with at-risk youth.

The current study was designed to investigate the effects of a school-based MBI while attending to cost, ease of implementation, and use of an experimental research design. Because research has indicated that MBIs may be particularly beneficial for at-risk youth, this study utilized a population of students with emotional and behavioral difficulties. A single case, multiple baseline research design was employed to examine the efficacy of an audio-delivered, mindful breathing intervention with adolescents in an alternative educational setting. The intervention was designed to require very little training on the part of teacher implementers and was short in duration (approximately five minutes long). Effects on a socially valid outcome measure, academic engagement, were measured.

Research Questions

This study addressed the following research questions:

Research question 1. Will participation in a daily, audio-delivered, mindful breathing

intervention increase academic engagement in adolescent students within an alternative educational setting:

a. As measured by teacher Direct Behavior Rating (DBR)?

b. As measured by systematic direct observation (SDO)?

Hypothesis 1. Research has demonstrated that mindfulness-based intervention can effectively improve student attention and levels of engagement (Carboni et al., 2013; Klatt et al., 2013; Napoli et al., 2005). Therefore it was hypothesized that participation in a daily, audio-delivered, mindful breathing intervention would increase academic engagement as measured by both DBR and SDO.

Research question 2. Will effects on academic engagement of a daily, audio-delivered, mindful breathing intervention be maintained at 6-week follow-up?

Hypothesis 2. Research has shown that the effects of mindfulness-based intervention on adolescent attention can be maintained at 8-week follow-up (Van de Weijer-Bergsma et al., 2012). Therefore, it was hypothesized that effects on academic engagement would be maintained at 6-week follow up.

Research question 3. Do teachers perceive a daily, audio-delivered, mindful breathing intervention to be feasible and acceptable?

Hypothesis 3. Numerous school-based studies have shown that MBIs are perceived to be feasible and acceptable by teachers (Huppert & Johnson, 2010; Jennings, Frank, Snowberg, Coccia, & Greenberg, 2013; Lagor, Williams, Lerner, & McClure, 2013; Mendelson et al., 2010; Metz et al., 2013; Schonert-Reichl & Lawlor, 2010). Therefore, it was hypothesized that teachers would perceive the daily, audio-delivered, mindful breathing intervention to be feasible and acceptable.

Research question 4. What are student perceptions of a daily, audio-delivered, mindful breathing intervention?

Hypothesis 4. Numerous school-based studies have shown that MBIs are perceived to be feasible and acceptable by students as well (Huppert & Johnson, 2010; Jennings, Frank, Snowberg, Coccia, & Greenberg, 2013; Lagor, Williams, Lerner, & McClure, 2013; Mendelson et al., 2010; Metz et al., 2013; Schonert-Reichl & Lawlor, 2010). Therefore, it was hypothesized that students would also perceive the daily, audio-delivered, mindful breathing intervention to be feasible and acceptable.

Chapter III: Methods

Participants

The study was conducted at a non-residential alternative educational program in northeastern Connecticut that services students with predominantly emotional and behavioral difficulties. The school was recruited through the student investigator's contacts, and a letter of permission was obtained. The school served 38 students divided amongst six classrooms spanning grades 4-12. All students received special education services, 29% were ethnically diverse, and 68% qualified for free/reduced lunch. See Table 2 for a summary of demographic information on the school setting.

Recommendations of student participants were initially solicited at a faculty meeting and through speaking with school-based clinicians. Characteristics of ideal student participants were shared and included such qualities as "willing to follow directions" and "engages in activities appropriately." The description of these characteristics was designed keeping in mind that all students in the school had experienced significant behavioral difficulty either in the past or presently. The intent was to seek student participants who would be willing to engage in the study throughout its duration. After obtaining recommendations from teachers and clinicians, students were screened according to specified inclusion criteria. Initial criteria for inclusion in the study were that the student (a) must be a returning student who had attended the school during the previous school year and (b) had received no more than two major office referrals specifically for defiance within the first two weeks of school. These criteria were designed in order to ensure that study participants were not adjusting to new school staff and routines, and that they would be willing to comply with study procedures. After student participants met initial criteria for inclusion in the study and all the necessary consents were obtained, participants were

screened according to a second inclusion criterion. Specifically, participants needed to demonstrate problematic levels of academic engagement as identified by teacher-completed Direct Behavior Rating (DBR) prior to entering the Baseline phase (i.e., qualifying students were rated less than an 8 on the Academic Engagement scale of DBR for at least 3 out of 4 days).

Five students were initially recruited for the study. Shortly after the study began, one student left the school. Two of the initial students did not display problematic levels of academic engagement pre-baseline; therefore, they did not move forward into the Baseline phase of the study and were replaced with two new participants. After entering the Baseline phase, Student 1 communicated that he no longer wished to participate in the study. Despite displaying problematic levels of academic engagement pre-baseline, Student 4 displayed engagement levels that were not in need of intervention during Baseline. Therefore, only Students 2 and 3 entered the Intervention phase.

Student 2 was a 15-year-old, African-American, male student in ninth grade. Student 3 was a 16-year-old, Caucasian, male in tenth grade. Both students received special education services under the disability category of Emotional Disturbance. Teacher A and Teacher B were both certified teachers with over 15 years of teaching experience.

Materials and Measures

Demographic information. Teacher participants completed an Educator Background Form upon consenting to participate in the study. This form was used to gather information on teacher participants' demographics (e.g., age, sex, number of years teaching, highest degree attained, etc.) (see Appendix A). Student demographic information (e.g., age, grade, ethnicity, special education status) was gathered from the school's School-wide Information System (SWIS) database after receiving permission to do so.

Independent variable. A recording of a guided mindful breathing activity was created and pre-tested with two adolescent students to ensure understanding. The script for the intervention (see Appendix B) was developed through consultation with a registered yoga teacher who has developed mindful breathing recordings specifically for military veterans recovering from PTSD that are being used by over 10,000 veterans in more than 47 Veterans Affairs (VA) hospitals across the country (http://mindfulyogatherapy.org/wp/). Fodor and Hooker (2008) recommended that MBIs for children and adolescents are clear, concrete, and short in duration. The mindfulness script was developed based on those recommendations. Language was designed to be simple and concrete, and the recording was approximately five minutes in length. A panel of five individuals with mindfulness expertise reviewed the script and completed an Expert Panel Review Form (see Appendix C) to ensure the presence of necessary core features. All five members of the expert panel indicated that mindfulness core features were evident in the intervention script, and that the script accurately represented a mindfulness-based practice. Student participants listened to and engaged in the mindful breathing activity daily on their computer using headphones.

Direct Behavior Rating (DBR). Research has shown that direct behavior rating (DBR) (see Appendix D) is a psychometrically-sound assessment tool that can be used to demonstrate sensitivity to behavioral change in formative assessment (Chafouleas, Sanetti, Kilgus, & Maggin, 2012). Moderate to high correlations between DBR and teacher rating scales (Chafouleas et al., 2009), as well as systematic direct observation (SDO) have been demonstrated (on-task behavior: $r = 0.811$, $p < .01$) (Riley-Tillman et al., 2008). Comparison of DBR and SDO data has also shown good relative consistency (Riley-Tillman et al., 2008).

DBR involves rating three target behaviors in close proximity to the end of a specified observation period. The target behaviors, considered core school-based behavioral competencies, include Academic Engagement, Respectful Behavior, and Disruptive Behavior. Information on all three target behaviors was collected in this study. While Academic Engagement was the primary focus of the study, data regarding Disruptive Behavior and Respectful Behavior were beneficial in helping to explain Academic Engagement outcomes. Additionally, the inclusion of the other two target behaviors helped to obscure the primary outcome variable from teacher raters, thus reducing the potential for rater bias.

Primary dependent variable. Academic Engagement was operationally defined as "active or passive participation in the classroom activity (e.g., writing, hand raising, answering a question, talking about a lesson, listening to the teacher, reading silently, or looking at instructional materials)" (Chafouleas et al., 2012, p. 495). Participants' teachers completed DBR daily during Baseline and Intervention phases after a specified observation period. The observation period included a natural block of instructional time (e.g., language arts period) immediately following implementation of the intervention. These DBR data were used to measure change in student engagement due to the mindfulness intervention.

Secondary dependent variables. Respectful Behavior was operationally defined as "compliant and polite behavior in response to adult direction and/or interactions with peers and adults (e.g., follows teacher direction, pro-social interaction with peers, positive response to adult request, verbal or physical disruption without negative tone/connotation)" (Chafouleas, 2011, p. 583). Disruptive Behavior was defined as "student action that interrupts regular school or classroom activity (e.g., out of seat, fidgeting, playing with objects, acting aggressively,

talking/yelling about things that are unrelated to classroom instruction)" (Chafouleas, 2011, p. 583).

Systematic Direct Observation (SDO) form. Systematic Direct Observation (SDO) probes using an SDO form (see Appendix E) were utilized as a second measure of academic engagement. Because academic engagement is a relatively continuous behavior, the SDOs employed a momentary time-sampling method (Cooper, Heron, & Heward, 2007). Fifteen-minute observation periods were divided into 10-second intervals. With the passage of each interval, the observer documented when the student was engaged at the end of each 10-second interval (Cooper et al., 2007). SDO probes were conducted during 40% of the DBR data collection points, across participants and phases, to ensure that the study met current single-case design standards (Kratochwill et al., 2010) (see Table 3). SDO data were collected during the same time blocks as DBR data (i.e., at a pre-specified time during Baseline phases and immediately following the intervention during Intervention phases). Attempts were made to protect against reactivity of the participants, or the possibility that the participants' behavior was influenced by their awareness that they were being observed, thus creating a threat to the validity of SDO data (Kazdin, 2011). As such, the student investigator and/or trained observers waited for at least three minutes after entering the classroom to begin SDO data collection to provide time for the participant to acclimate to the observer's presence. In order to meet current single-case design standards, reliability estimates of the SDOs were established by having a second rater present for 56% of the observations, across participants and phases (Kratochwill et al., 2010) (see Table 3).

Descriptive school-based data. Teachers at this school document instructional minutes accessed for each student on a daily basis. Reasons for not accessing instructional time (e.g.,

absence, office referrals, etc.) are also documented. These data were summarized descriptively in table and graphic forms for each participant during Baseline, Intervention, and Follow-up phases to provide an overview of changes in engagement that may take place over the course of the entire school day.

Procedural Integrity (PI) checklist. In order to ensure that the intervention was implemented as planned, a procedural integrity (PI) checklist (see Appendix F) was completed by teachers daily and by observers on the same dates that SDOs were conducted. The checklist included essential steps of the mindful breathing intervention, as well as data collection using DBR. Reliability estimates of PI were established by comparing agreement between teacher-completed checklists and observer-completed checklists. This occurred during 56% of data collection points, across participants and phases (see Table 3). Although it was not necessary during the study, if procedural integrity had fallen below 80% on two or more consecutive days, incomplete steps would have been addressed and reviewed with the teacher implementer.

Usage Rating Profile-Intervention Revised (URP-IR). To assess the acceptability and feasibility of the mindful breathing intervention from the perspective of implementers, teachers were asked to complete the URP-IR (Chafouleas, Briesch, Neugebauer, & Riley-Tillman, 2011) during the post-intervention phase, prior to follow-up. The URP-IR (see Appendix G) is a self-report measure designed to assess factors believed to influence the probability that someone would consider an intervention and subsequently use it over time (Briesch, Chafouleas, Neugebauer, & Riley-Tillman, 2013). The 29-item questionnaire produces subscale scores related to the areas of acceptability, understanding, family-school collaboration, feasibility, system climate, and system support (Briesch et al., 2013). High levels of reliability have been demonstrated for both the acceptability and feasibility subscales ($\alpha = .95$ and $\alpha = .88$,

respectively; Briesch et al., 2013). Data from those specific subscales were analyzed to assess feasibility and acceptability of the intervention according to implementers.

Children's Usage Rating Profile (CURP). To assess the acceptability and feasibility of the mindful breathing intervention from the perspective of participants, students were asked to complete the CURP (Briesch & Chafouleas, 2009a) during the post-intervention phase, prior to follow-up. The CURP (see Appendix H) was developed to assess internal and external factors that may impact students' usage of an intervention. The 23-item, self-report questionnaire has demonstrated high reliability (α ranging from .75 to .92) on three subscales: Personal Desirability, Feasibility, and Understanding. Data obtained from the CURP was analyzed to assess participant perspectives of the intervention.

Design and Procedures

This study employed a multiple-baseline across subjects design. This design shows the effect of an intervention by demonstrating that behavior changes when and only when an intervention is applied, while controlling for threats to internal validity (Kazdin, 2011). Results of neurological research have indicated that consistently-practiced mindful breathing promotes significant changes in the brain, some of which are apparent in a relatively short period of time (Chiesa & Serretti, 2010; van Leeuwen et al., 2012). This suggests that the effects of mindful breathing may not be immediately reversible; therefore, a research design that involves withdrawal of a treatment would not be suitable. A multiple baseline design was chosen to evaluate the effects of mindfulness that cannot be withdrawn (Cooper et al., 2007).

In a multiple-baseline design, documentation of experimental control is achieved through "the staggered introduction of the independent variable at different points in time" (Horner et al., 2005, p. 168). In this study, introduction of the mindful breathing intervention was implemented

for the first participant when relatively stable baseline responding had been established. Introduction of the intervention for the subsequent participant was implemented when decreasing trend in baseline responding was evident, and when the first participant had demonstrated stable responding to the intervention condition. Confirmation of a functional relationship between the independent variable and dependent variables typically occurs when an experimental effect is replicated at least three times (Horner et al., 2005). This study attempted to employ five participants to protect against potential threats to validity, such as attrition. However, because only two participants entered the Intervention phase, confirmation of a functional relationship was unable to occur.

Kratochwill and Levin (2010) have suggested that elements of randomization can be added to single-case designs to increase the credibility of conclusions and to decrease threats to validity. Therefore, the order in which participants entered the Intervention phase was randomly assigned using a random-number generator (e.g., random.org).

In order to assess the sustainability of the mindful breathing intervention, this study utilized a Follow-up phase at six weeks post-intervention. Teachers and participants were not given specific instructions regarding the continuation of the intervention between Intervention and Follow-up phases. They were given the option to continue to utilize the intervention as frequently or infrequently as desired. The purpose of the Follow-up phase was to determine if effects on academic engagement were maintained in addition to providing valuable information regarding the acceptability of the intervention.

Pre-baseline. After obtaining participant recommendations from teachers and school-based clinicians, the recommended students were screened using specified initial inclusion criteria (e.g., returning student and no more than two major office referrals for defiance within

the first two weeks of school). The student investigator then met with teachers of students who met initial criteria for inclusion in the study to provide information on the study. The study was presented as an opportunity to provide students with a brief intervention intended to improve student behavior. Potential benefits and risks of the study were highlighted, as well as the associated time commitment. Following procedures approved by the university's HSIRB, informed consent was obtained.

Parents of students who met initial criteria for inclusion in the study were contacted via phone and offered an in-person meeting with the student investigator if desired. The study was presented as an opportunity to provide their child with an intervention intended to improve his/her behavior at school. Potential benefits and risks of the study were highlighted, as well as the associated time commitment. Parental informed consent was obtained.

After obtaining written consent from parents, the student investigator met with each student participant. The study was presented as an opportunity to build skills that may improve one's ability to focus, learn, and cope with stress. Mindfulness was operationalized using developmentally appropriate language, and the participants were encouraged to ask questions. Participant assent was obtained.

The second inclusion criterion for the study involved a pre-baseline assessment of academic engagement levels of student participants. This was conducted using DBR measures. Students who scored less than 8 on the Academic Engagement scale of teacher-completed DBR on at least 3 out of 4 days moved forward in to the Baseline phase. Students who did not meet this criterion did not continue in the study.

Teacher training. After teacher, parent, and participant informed consent/assent were obtained for five participants, an initial meeting was held with each participant's teacher. This

meeting took approximately 30 minutes to complete. An overview of the specific components of the study was provided using a detailed fact sheet (see Appendix I) as guidance. The teachers were provided with the necessary audio equipment (e.g., headphones, mindful breathing recording) and assisted with acclimating to the equipment. A brief overview of DBR was provided. The teachers were directed to the DBR training website (http://www.directbehaviorratings.org/training/) and asked to complete the training by a mutually agreed upon date prior to the commencement of the study. The online training module took approximately 25-40 minutes for each teacher to complete. The teachers were also given the PI checklist and instructed on its use.

Finally, the student investigator and teachers determined an appropriate time to implement the intervention on a daily basis. The intervention was implemented just prior to a period of the day in which each participant was expected to engage in some type of academic activity (e.g., classroom lesson, morning meeting, independent seatwork). Kabat-Zinn (2003) noted that the benefits of mindfulness are enhanced through a regular, daily practice. Therefore, participants engaged in the mindful breathing intervention at the same time each day. At this particular school, the schedule on Fridays is different than the rest of the week in that there is a focus on vocational, rather than academic, activities. Therefore, each teacher was instructed to have their student engage in the intervention on a daily basis (Monday through Friday); however, DBR and SDO data were only collected Monday through Thursday. Fodor and Hooker (2008) recommended that ideal times to engage in mindfulness activities include the beginning of the day, at transition points during the day (e.g., before or after a break in instruction, after lunch), at the end of the day, or before important events (e.g., tests, sporting events, competitions). For this study, teachers implemented the intervention at the beginning of the day, prior to beginning

academic instruction. For Student 2, the intervention was implemented prior to the first period of the day. Student 3 had gym class first period; therefore, the intervention was implemented prior to the second period of the day.

Observer training. The student investigator trained two observers to assist with SDO probes and IOA data collection. The observers were graduate students studying either educational or clinical psychology. Both observers had prior training and/or experience with SDO procedures.

Observer training included three phases, based on an approach outlined by Cooper et al. (2007). In the first phase, the student investigator provided an overview of the study, as well as reviewed the operational definition of the behavior (academic engagement), SDO form and recording procedures, and PI checklist. In the second phase, the student investigator modeled use of the SDO form while viewing a video of a classroom as observers followed along with copies of the form. The student investigator engaged in verbal self-talk to further illustrate the procedure. The student investigator also modeled use of the PI checklist during this phase of training. Finally, the observers practiced using the SDO form independently while viewing videos of classrooms. The student investigator addressed questions or misunderstandings after each practice video. Training was concluded when the observers attained 90% agreement with the student investigator on three consecutive videos (Cooper et al., 2007). Observers practiced using the PI checklist and had an opportunity to ask any questions.

Phase I: Baseline. During the Baseline phase, teachers completed daily ratings of participant behavior using DBR. These data were used to establish baseline levels of student engagement. The teachers completed DBR after observation of the students during a natural instructional block (e.g., language arts period) that coincided with the observation period during

the Intervention phase. The teachers were instructed to conduct instructional activities as usual so that the baseline data reflected typical student behavior. At least three to five baseline ratings were completed in order to meet current single-case research design standards (Kratochwill et al., 2010).

Training. Training was initiated after a relatively stable rate and/or a decreasing trend in baseline responding was established. Timing of the Training phase for the second participant also took into account stability of responding to intervention for the first participant. It occurred after the Baseline phase, prior to the Intervention phase, and consisted of two sessions. During the first session, the student investigator introduced the mindful breathing activity and modeled the intervention procedures while the teacher observed, following along with the PI checklist. In this school, each student has their own workspace with a computer, and cubicle walls that create privacy and minimize distraction delineate each workspace. The students engaged in the intervention at their workspaces by listening to the recording on their computers using headphones. For training purposes, a proper seated posture was modeled, and the participant was acclimated to the audio equipment. The participant engaged in the activity and had an opportunity to debrief with the student investigator and ask questions afterwards. During the second session, the teacher engaged in the intervention procedures while the student investigator observed and completed the PI checklist. The student investigator reviewed the PI checklist with the teacher and clarified any misunderstandings at that time. Procedures surrounding completion of DBR were also reviewed with the teacher during the second training session.

Phase II: Intervention. During the Intervention phase, teachers prompted participants to engage in the mindful breathing intervention on a daily basis (Monday through Friday) at the specified time. Teachers rated participant behavior using DBR daily (Monday through Thursday)

according to specified procedures, as well as completed the PI checklist. The student investigator and/or trained observers completed SDO probes and the PI checklist according to specified procedures. A minimum of five DBR ratings was completed for each participant during the Intervention phase in order to meet current single-case research design standards (Kratochwill et al., 2010). When the classroom teacher was absent, the student did not engage in the intervention that day, and data was not collected. If there was a change in schedule for the day (e.g., assembly, delayed opening) and the specified intervention time was not feasible, the teacher was instructed to make his/her best effort to implement the intervention and collect data at an appropriate alternate time. Although this did not occur over the course of this study, if a student had not completed 5 consecutive intervention sessions due to refusal, behavioral difficulties, or absence, he/she would have been removed from the study.

Student 2 engaged in the intervention on 16 out of a possible 27 days. Reasons why the student did not engage in the intervention on all days included student absence (n = 1), teacher absence (n = 2), participation in special activities (n = 1), receiving instruction outside of the classroom (n = 1), and intervention was not prompted by the teacher (n = 6). Student 3 engaged in the intervention on 15 out of a possible 22 days. Reasons why this student did not engage in the intervention on all days included student absence (n = 3), teacher in a meeting (n = 1), student in support room (n = 1), student refused to participate (n = 1), and intervention was not prompted by the teacher (n = 1). In addition there were two days in which school was canceled due to snow, and three scheduled days off from school due to holidays over the course of the Intervention phase of the study.

Post-intervention. At the conclusion of the Intervention phase, the student investigator distributed copies of the URP-IR for teachers to complete within one week. Teachers were told

that they may continue to implement the mindful breathing intervention with their students as frequently or infrequently as desired prior to the Follow-up phase.

The student investigator also met with each participant individually for approximately 15-20 minutes to debrief regarding his experiences with the mindful breathing intervention. Participants were asked to complete the CURP during this meeting. Assistance was provided when necessary. Parents of participants were called by the student investigator and informed that the study had concluded. An overview of the study results pertaining to their child was provided and any questions were answered.

Follow-up. The Follow-up phase took place six weeks following the completion of the Intervention phase. This phase was identical to the Baseline phase with respect to daily DBR data collection by teachers. However, teachers were instructed to implement the intervention as frequently or infrequently as desired. Teachers completed the PI checklist daily during this phase to monitor implementation of the intervention; however, neither student engaged in the intervention during Follow-up. SDO probes and IOA observations were conducted according to specified procedures.

At the conclusion of the Follow-up phase, teachers were provided with a gift card as a token of thanks for their participation in this study.

Post-follow up. At the conclusion of the Follow-up phase, the student investigator met with each teacher for approximately 15-20 minutes to review the data on their student's academic engagement. Teachers were able to view graphs of their student's engagement across Baseline and Intervention phases.

Data Analysis

Academic engagement. Conclusions about the efficacy of the mindful breathing intervention were drawn based on several methods of analysis of the outcome data. First, DBR and SDO data were analyzed using visual inspection techniques. Line graphs were examined to draw conclusions about the magnitude and rate of change evident. Specifically, the mean (average rate of academic engagement) and level (shift in academic engagement from the end of one phase to the beginning of the next) were analyzed across phases to draw conclusions about the magnitude of change. Additionally, the slope (trend line that characterizes data within each phase) and latency (amount of time between the beginning of a phase and a change in academic engagement) were analyzed across phases to draw conclusions about the rate of change (Kazdin, 2011). Variability of the data was analyzed across phases to draw conclusions about the degree of control over factors influencing academic engagement in each phase (Cooper et al., 2007).

Effect sizes for dependent measures of academic engagement were calculated for each participant using two different methods. Because three repetitions of an effect were not achieved in this study, a functional relationship could not be confirmed. Therefore, an overall effect size for the study was not calculated.

Standard Mean Difference (SMD) was utilized as a measure of the magnitude of change between Baseline and Intervention phases for each participant. SMD gives equal consideration to all data points within a phase and takes into account the distribution of data around the mean of each phase (Olive & Smith, 2005). SMD has been recommended as a complement to visual analysis techniques, particularly with respect to evaluating change in level across phases (Olive & Smith, 2005). It has been suggested that SMD calculations between .20 and .49 indicate small

effects, between .50 and .79 indicate medium effects, and greater than .80 indicate large effects (Busk & Serlin, 1992; Olive & Smith, 2005).

Tau-U was utilized as a measure of nonoverlap of data between phases that takes into account trend in its analysis (Parker, Vannest, Davis, & Sauber, 2011). Tau-U has been said to have more statistical power than other nonoverlap methods and to be more discriminating than other statistical methods used to evaluate single-case design research (Parker et al., 2011). Tau-U was chosen as a measure of effect size because it equally emphasizes all data points through pairwise comparisons across phases (Parker, Vannest, & Davis, 2011). Therefore, it is not easily skewed by outliers in the data. Tau-U values provide an overall percent improvement from one phase to the next and are interpretable on a 0-100 scale (Vannest & Davis, 2013).

School-based data regarding instructional minutes accessed were summarized in table and graphic form and analyzed descriptively for each participant across phases.

Changes in secondary dependent variables (respectful and disruptive behavior as measured by teacher-completed DBR) were analyzed using visual inspection techniques.

Procedural Integrity. Procedural integrity was calculated by dividing the total number of steps answered "yes" on the PI Checklist by the total number of possible steps (5) and multiplying by 100%.

Inter-observer Agreement. Because academic engagement was recorded in a discrete manner (i.e., occurrence or non-occurrence in each interval) for the SDO probes, IOA was calculated using an interval-by-interval procedure (Cooper et al., 2007). The number of intervals with agreement was divided by the total number of intervals to arrive at an IOA estimate. Because observers were not blind to the treatment conditions, IOA was also calculated using a more conservative correlational statistic, *kappa* (k). Kappa provides an estimate of agreement

between observers that is corrected for agreement on the basis of chance (Kazdin, 2011). Kappa was calculated using the following formula from Kazdin (2011):

$$k = \frac{\mathrm{Po} - \mathrm{Pc}}{1 - \mathrm{Pc}}$$

IOA was also calculated for the PI Checklist using an interval-by-interval procedure. The number of steps with agreement was divided by the total number of steps to arrive at an IOA estimate.

Social Validity. Social validity of the mindful breathing intervention was assessed by examining data obtained from the URP-IR and CURP. Means and standard deviations of subscales were calculated and analyzed accordingly.

Chapter IV: Results

Results of the study are presented below, organized by research question. Information on descriptive school-based data, secondary dependent variables, procedural integrity, and IOA are also summarized. Results presented pertain only to the students who entered the Intervention phase of the study.

Research Questions

This study involved four research questions regarding implementation of a daily mindful breathing intervention and associated student outcomes. These questions are listed below along with hypotheses, data analyses, and results.

Research Question 1: Will participation in a daily, audio-delivered, mindful breathing intervention increase academic engagement in adolescent students within an alternative educational setting:

a. As measured by teacher Direct Behavior Rating (DBR)?

b. As measured by systematic direct observation (SDO)?

It was hypothesized that participation in a daily, audio-delivered, mindful breathing intervention would increase academic engagement as measured by both DBR and SDO. This hypothesis was based on research that has demonstrated that MBI can effectively improve student attention and levels of engagement (Carboni et al., 2013; Klatt et al., 2013; Napoli et al., 2005). Academic engagement data across participants and phases are illustrated in Figure 3. Phase averages of DBR and SDO data are summarized in Tables 4 and 5, effect sizes for academic engagement can be found in Table 6, and changes in dependent variables using visual analysis and effect size techniques are summarized in Table 7.

Prior to Intervention, Student 2 displayed moderate levels of academic engagement as measured by both DBR (*M* = 7.00) and SDO (*M* = 60.25). While DBR data indicated slight increasing trend in Baseline, SDO data reflected slight decreasing trend. Both DBR and SDO data reflected moderate variability (DBR: *SD* = 1.77, SDO: *SD* = 12.23). As indicated earlier, Student 2 engaged in the intervention on 16 out of a possible 27 days. Additionally, he was interrupted by other students in the classroom while engaging in the intervention on two occasions, and he appeared to be distracted by playing with the sound controls on the computer during three other occasions. These factors may have impacted the effectiveness of the mindful breathing intervention in increasing academic engagement. Nevertheless, upon implementation of the intervention, engagement levels of Student 2 immediately increased as measured by both DBR (*M* = 7.93) and SDO (*M* = 84.17). Decreased variability in DBR data was evident (*SD* = 1.44), and some overlap between Baseline and Intervention was present. SDO data also indicated more consistency in Intervention (*SD* = 3.87), and no overlap was present between Baseline and Intervention phases. A stable trend was observed in both DBR and SDO data in Intervention. SMD and Tau-U effect size calculations suggest that the mindful breathing intervention had a small to medium positive effect on engagement levels of Student 2 according to DBR measures (SMD = 0.53, Tau-U = 0.35) and a large positive effect according to SDO measures (SMD = 1.96, Tau-U = 1.00).

Prior to Intervention, Student 3 displayed moderate levels of academic engagement as measured by both DBR (*M* = 6.85) and SDO (*M* = 70.83). Significant variability was evident in both DBR and SDO data (DBR: *SD* = 2.44, SDO: *SD* = 23.67). As indicated earlier, Student 3 engaged in the intervention on 15 out of a possible 22 days. Upon implementation of the intervention, engagement levels of Student 3 immediately increased as measured by both DBR

(*M* = 8.17) and SDO (*M* = 95.70). Variability in DBR data reduced significantly (*SD* = 1.08), and some overlap between Baseline and Intervention was present. SDO data also indicated much less variability in Intervention (*SD* = 3.51), and very little overlap was present between Baseline and Intervention phases. A stable trend was evident in both DBR and SDO data in Intervention. SMD and Tau-U effect size calculations suggest that the mindful breathing intervention had a small to medium positive effect on engagement levels of Student 3 according to DBR measures (SMD = 0.54, Tau-U = 0.50) and a medium to large positive effect according to SDO measures (SMD = 1.05, Tau-U = 0.61).

Analysis of descriptive school-based data. At this particular school, staff track instructional minutes accessed on a daily basis and document reasons for missing instruction. Because accessing instructional time is a necessary component of academic engagement, this information was summarized as an additional measure to draw conclusions about possible changes in levels of engagement that may occur over the course of the school day. School-based data pertaining to instructional minutes accessed and reasons for missing instructional time are summarized in Table 8 and Figures 6 and 7.

As part of a School-wide Positive Behavioral Interventions and Supports (SWPBIS) framework that is implemented in this school, teachers and staff follow a systematic protocol when responding to problem behavior. If problem behavior continues to occur after implementing a variety of proactive and responsive strategies that involve keeping the student in the classroom, staff then cues the student to take a break outside of the classroom. If problem behavior still continues to occur, staff would next direct the student to a "Time Aside" room for five minutes, which is a quiet office space with a desk where the student can continue his/her classwork if desired, complete a processing worksheet, or sit or stand quietly. Finally, if problem

behavior still continues to occur or escalate, or if the student displays unsafe or severely disruptive behavior, the student is directed to a "Time Out" room where he/she must spend 10 minutes completing three short compliance tasks to demonstrate readiness to return to class. Although breaks outside of the classroom, Time Asides, and Time Outs are intended to be short in nature, they can sometimes take longer than the specified time to complete depending upon the student's readiness to return to class. At times a student may engage in problem behavior at the end of the school day, thus accruing a Time Aside and/or Time Out that he/she is not able to fulfill that day. In this school, the student is required to fulfill that time the following morning when they enter school. This is referred to as completing "Time Owed." Students may also be required to complete Time Owed the following school day for engaging in unsafe behavior.

Reasons for missing instruction that were documented include minutes spent in breaks outside of the classroom, minutes spent in Time Aside, minutes spent in Time Out, and minutes spent in Time Owed. In addition, student absences were documented as well. However, absences were not factored in to calculations pertaining to percentage of instructional minutes accessed in Table 8 and Figures 6 and 7; therefore, these data provide a summary of each student's time spent in school.

Student 2's percentage of instructional minutes accessed increased from 82% in Baseline to 92% in Intervention. A reduction in time spent in Time Aside, Time Out, and Time Owed was observed in Intervention. However, time spent in breaks out of class increased slightly, and his absence rate increased from 0.00 in Baseline to 0.04 in Intervention. Student 3's percentage of instructional minutes accessed in Baseline was quite high, at 97%. A decrease to 94% was observed in Intervention. A decrease was observed in time spent in Time Aside in Intervention;

however, there was a slight increase in time spent in breaks out of class and Time Out. Student 3's absence rate decreased from 0.11 in Baseline to 0.05 in Intervention.

Research Question 2: Will effects on academic engagement of a daily, audio-delivered, mindful breathing intervention be maintained at 6-week follow-up?

It was hypothesized that effects on academic engagement would be maintained at 6-week follow up. This hypothesis was based on research that has shown that the effects of MBI on adolescent attention can be maintained at 8-week follow-up (Van de Weijer-Bergsma et al., 2012).

In Follow-up, Student 2's academic engagement levels as measured by DBR remained above Baseline levels and increased from Intervention levels (M = 8.33; see Table 4). Variability also remained below Baseline levels, although an increase from Intervention was observed (SD = 1.53). SMD and Tau-U effect size calculations suggest that small to medium, positive effects were maintained in Follow-up according to DBR measures (SMD = 0.75, Tau-U = 0.42). While academic engagement levels as measured by SDO were consistent with DBR measures, only one SDO probe was collected during Follow-up. Therefore, maintenance of effects cannot be fairly assessed by SDO measures.

In Follow-up, Student 3's academic engagement levels as measured by DBR remained above Baseline levels but decreased slightly from Intervention (M = 8.00; see Table 4). Variability also remained below Baseline levels, and a small decrease from Intervention was observed (SD = 1.00). SMD and Tau-U effect size calculations suggest that small, positive effects were maintained in Follow-up according to DBR measures (SMD = 0.47, Tau-U = 0.31). Again, while academic engagement levels as measured by SDO were consistent with DBR

measures, only one SDO probe was collected during Follow-up. Therefore, maintenance of effects cannot be fairly assessed by SDO measures.

Analysis of descriptive school-based data. In Follow-up, Student 2's overall percentage of instructional minutes accessed remained at a level similar to Intervention and higher than Baseline at 93% (see Table 8 and Figure 6). Percentage of time spent in breaks out of class, Time Aside, Time Out, and Time Owed during Follow-up were all similar to Intervention. A decrease in absence rate from 0.04 in Intervention to 0.00 in Follow-up was observed.

A small increase in overall percentage of instructional minutes accessed was observed for Student 3 from 94% in Intervention to 98% in Follow-up (see Table 8 and Figure 7). While percentages of time spent in breaks out of class and Time Aside were similar to Intervention, a decrease in time spent in Time Out was observed in Follow-up. An increase in absence rate from 0.05 in Intervention to 0.20 in Follow-up was observed; however, there were only five days of school in Follow-up in comparison to 21 days in Intervention. Student 3 was absent for one day during both Intervention and Follow-up phases.

Research Question 3: Do teachers perceive a daily, audio-delivered, mindful breathing intervention to be feasible and acceptable?

Numerous school-based studies have shown that MBIs are perceived to be feasible and acceptable by teachers (Huppert & Johnson, 2010; Jennings, Frank, Snowberg, Coccia, & Greenberg, 2013; Lagor, Williams, Lerner, & McClure, 2013; Mendelson et al., 2010; Metz et al., 2013; Schonert-Reichl & Lawlor, 2010). Therefore, it was hypothesized that teachers would perceive the daily, audio-delivered, mindful breathing intervention to be feasible and acceptable.

Feasibility and acceptability of the mindful breathing intervention were assessed by having teacher implementers complete the Usage Rating Profile – Intervention Revised (URP-IR) upon completion of the Intervention phase (Chafouleas et al., 2011; see Appendix G). Teachers were asked to rate 29 items on a 1-6 scale (1=Strongly Disagree, 6=Strongly Agree). Means and standard deviations of the ratings across the six factors assessed by the URP-IR are displayed in Table 9. Results of the URP-IR indicated that teacher implementers (n = 2) generally found the mindful breathing intervention to be both *feasible* (*M* = 5.08, *SD* = 0.54) and *acceptable* (*M* = 4.89, *SD* = 0.47), with acceptability ratings being slightly lower than feasibility ratings. Teachers reported that they moderately to strongly agreed that the intervention was feasible and slightly to moderately agreed that the intervention was acceptable. During the study, one teacher was experiencing staffing issues in her classroom and did not have the level of support that she was accustomed to having. She noted that her ratings on some questions would have been higher if the appropriate number of staff had been present in her classroom.

Results of the URP-IR also indicated that teacher implementers reported a high level of *understanding* of the intervention (*M* = 5.50, *SD* = 0.55) and that the *system climate* in their school aligned with the intervention (*M* = 5.20, *SD* = 0.63). Results were neutral with respect to *home-school collaboration* (*M* = 3.50, *SD* = 1.22). Responses fell between slightly disagree and slightly agree on this factor. Finally, ratings pertaining to *system support* were lower (*M* = 2.80, *SD* = 1.83), indicating that teacher implementers reported confidence in their ability to implement the intervention independently.

Research Question 4: What are student perceptions of a daily, audio-delivered, mindful breathing intervention?

Numerous school-based studies have shown that MBIs are perceived to be

feasible and acceptable by students as well (Huppert & Johnson, 2010; Jennings, Frank, Snowberg, Coccia, & Greenberg, 2013; Lagor, Williams, Lerner, & McClure, 2013; Mendelson et al., 2010; Metz et al., 2013; Schonert-Reichl & Lawlor, 2010). Therefore, it was hypothesized that students would also perceive the daily, audio-delivered, mindful breathing intervention to be feasible and acceptable.

Student perceptions of the mindful breathing intervention were assessed by having student participants complete the Children's Usage Rating Profile (CURP) upon completion of the Intervention phase (Briesch & Chafouleas, 2009; see Appendix H). Students were asked to rate 21 items on a 1-4 scale (1=Totally Disagree, 4=Totally Agree). Means and standard deviations of the ratings across the three factors assessed by the CURP are displayed in Table 10. Results of the CURP indicated that student participants (n = 2) generally found the mindful breathing intervention to be both *feasible* (M = 1.81, SD = 0.75) and *personally desirable* (acceptable) (M = 3.07, SD = 1.00). Lower scores for *feasible* indicate a higher degree of feasibility with respect to effort required and overall intrusiveness to classroom dynamic. Additionally, the students reported a high degree of *understanding* of the intervention (M = 3.42, SD = 0.79).

Anecdotally, both students shared that they felt that the mindful breathing intervention helped them to calm down and focus their attention. One student really liked the intervention, while the other thought that it was "alright." Of interest, the student who thought it was "alright" appeared to be highly engaged in the intervention early on in the study; however, his enthusiasm seemed to decrease somewhat over time. Both students shared that they used the breathing techniques at other times throughout the day in addition to practicing them with the recording. One student stated that he used the breathing techniques when he was "mad" or "too hyper" and

"needed to calm down." That student also suggested that it would be helpful to have a variety of recordings to listen to so that he was not practicing the same breathing exercise every day.

Analysis of Secondary Dependent Variables

Respectful behavior. Prior to Intervention, Student 2 displayed moderate levels of respectful behavior as measured by DBR (*M* = 7.62; see Table 4 and Figure 4). A slight increasing trend and moderate variability (*SD* = 2.13) were evident. Upon implementation of the intervention, respectful behavior of Student 2 immediately increased as indicated by examining the final Baseline data point and the first Intervention data point. However, when immediacy of effect was measured by examining the mean of the final three Baseline data points and the mean of the first three Intervention data points, no change was evident. An overall increase in level (*M* = 8.36) and decrease in variability (*SD* = 1.60) was observed in Intervention. Overlap between Baseline and Intervention data was present, and a slight increasing trend in respectful behavior was present in Intervention. In Follow-up, Student 2's respectful behavior as measured by DBR remained above Baseline levels and similar to Intervention levels (*M* = 8.33). Variability also remained below Baseline levels and similar to Intervention (*SD* = 1.53).

Prior to Intervention, Student 3 displayed generally high levels of respectful behavior as measured by DBR (*M* = 8.15). A slight decreasing trend and moderate variability (*SD* = 2.61) were evident. Upon implementation of the intervention, respectful behavior of Student 3 immediately increased in level (*M* = 9.83) as indicated by examining the mean of the final three Baseline data points and the mean of the first three Intervention data points. A decrease in variability (*SD* = 0.40) was evident. Overlap between Baseline and Intervention data was present, and stable trend in respectful behavior was observed in Intervention. In Follow-up, Student 3's respectful behavior as measured by DBR remained above Baseline levels; however a decrease

from Intervention was observed (*M* = 8.67). Variability also remained below Baseline but increased from Intervention (*SD* = 0.57).

Disruptive behavior. Prior to Intervention, Student 2 displayed low to moderate levels of disruptive behavior as measured by DBR (*M* = 3.38). A slight decreasing trend and moderate variability (*SD* = 2.97) were evident. Upon implementation of the intervention, disruptive behavior of Student 2 immediately decreased in level (*M* = 1.00) and variability (*SD* = 1.61). Overlap between Baseline and Intervention data was present, and a moderate decreasing trend in disruptive behavior was observed in Intervention. In Follow-up, Student 2's disruptive behavior as measured by DBR remained below Baseline levels; however, an increase from Intervention was observed (*M* = 1.67). Variability also remained below Baseline and decreased from Intervention (*SD* = 1.53).

Prior to Intervention, Student 3 displayed low levels of disruptive behavior as measured by DBR (*M* = 1.46). A slight increasing trend and some variability (*SD* = 1.13) were evident. Upon implementation of the intervention, disruptive behavior of Student 3 immediately decreased in level (*M* = 0.17) when comparing the mean of the last three Baseline data points to the mean of the first three Intervention data points. A decrease in variability (*SD* = 0.40) was evident. Overlap between Baseline and Intervention data was present, and stable trend in disruptive behavior was observed in Intervention. In Follow-up, Student 3's disruptive behavior as measured by DBR increased above Baseline and Intervention levels (*M* = 1.67). Variability remained below Baseline but increased from Intervention (*SD* = 0.58).

Procedural Integrity

The extent to which the intervention was implemented as planned was assessed using the Procedural Integrity (PI) Checklist (see Appendix F), which included essential steps of the

mindful breathing intervention as well as data collection using DBR. Overall, Student 2's teacher reported that the intervention was implemented with integrity 92.9% of the time (see Table 11). Procedural integrity ranged from 80% to 100% for this student. The most commonly missed step (n = 4) pertained to the question, "Did the student appear to engage in the intervention for the entire duration (e.g., seated, body relatively still, headphones on, eyes closed or gaze down, seeming to be focusing on breathing)?" Reasons for this step not being completed included other students in the classroom interrupting the student while engaging in the intervention (n = 2) and the student playing with sound controls on the computer while engaging in the intervention (n = 2). A second step that was missed (n = 1) pertained to, "Was DBR completed within 15 minutes of the specified completion time?" Student 3's teacher reported that the intervention was implemented with integrity 100% of the time.

Inter-observer Agreement

Inter-observer agreement (IOA) for academic engagement as measured by SDO was calculated using an interval-by-interval procedure, as well as by calculating kappa. A summary of results can be found in Table 12. Both measures of IOA exceeded specified threshold requirements outlined by current single-case design standards (Kratochwill et al., 2010), with interval-by-interval IOA averaging 96.5% over the course of the study and kappa averaging 0.76. In addition, no single measure of interval-by-interval IOA fell below 80% over the course of the study. Although the overall kappa average was above 0.60, two individual measures of kappa fell below that threshold for Student 3. These measures occurred during observations in which the student was highly engaged according to SDO (96% and 99% respectively). It has been noted that kappa does not adjust appropriately when the base rate of the target behavior is very high or very low (Feinstein & Cicchetti, 1990), as was the case in these observations.

IOA for Intervention PI was calculated using an interval-by-interval procedure. A summary of results can be found in Table 13. IOA for PI also exceeded specified threshold requirements outlined by current single-case design standards (Kratochwill et al., 2010), averaging 98.5% over the course of the study and no single measure falling below 80%. All measures of IOA for PI were 100%, with the exception of one observation, which was 80%. The disagreement for that observation pertained to the following question: "Did the student appear to engage in the intervention for the entire duration (e.g., seated, body relatively still, headphones on, eyes closed or gaze down, seeming to be focusing on breathing)?" The teacher implementer answered "yes" to this question; whereas, the student investigator answered "no," noting that the student was observed playing with the sound controls on the computer while engaging in the intervention.

Chapter V: Discussion

Teachers frequently struggle with low student engagement providing a barrier to producing positive academic outcomes (Bundick, Quaglia, Corso, & Haywood, 2014; DuPaul, 2007; Fredricks, Blumenfeld, & Paris, 2004). Behavior modification interventions have been widely-recommended in the research literature to promote attention and engagement in students (DuPaul, 2007). However, traditional behavior modification is primarily an externally-managed system of change that involves the manipulation of a number of variables by a variety of individuals. The complexity of behavior modification interventions can make implementation both time and resource intensive (Thomas, 1980). Additionally, treatment integrity can be challenging to monitor and ensure (Gresham, 2004). Internally-managed systems of change, such as self-management strategies, utilized along with existing behavioral frameworks may provide an efficient and effective way of addressing student engagement.

Mindfulness has been shown to improve a variety of cognitive, behavioral, and physiological outcomes (Baer, 2003). Additionally, research has suggested that mindfulness can be more effective with individuals who display higher levels of problem behavior in baseline (Flook et al., 2010; Joyce et al., 2010; Razza et al., 2013; Semple et al., 2010). School-based mindfulness curricula have been developed; however, they are typically expensive, time-consuming, and require specialized training, resulting in barriers to implementation. There is a need for mindfulness-based interventions (MBIs) that are replicable and easily incorporated into school settings (Wisner et al., 2010), as well as more experimental studies of mindfulness to support its use in schools (Felver et al., 2013). The purpose of this study was to investigate the impacts of a daily, audio-delivered mindful breathing intervention on academic engagement of adolescents with emotional and behavioral difficulties in an alternative educational setting. The

intervention required little training and time from teacher implementers and was incorporated into the school day with minimal disruption to existing routines. Effects of the intervention on respectful and disruptive behaviors were also analyzed.

This study employed a multiple-baseline across subjects design to examine the effects of the intervention. It attempted to employ five participants to ensure that an experimental effect could be replicated at least three times in order to meet current single-case design standards necessary to confirm a functional relationship (Kratochwill et al., 2010). However, due to a number of circumstances, only two participants entered the Intervention phase. This study meets all other single-case design standards for the two participants who entered Intervention with respect to number of data points per phase, rates of SDOs, procedural integrity, and IOA. Overall, data indicated evidence of similar intrasubject changes with respect to academic engagement and disruptive behavior. However, because only two participants completed the study, any changes observed in primary or secondary dependent variables cannot be directly attributed to the mindful breathing intervention (Horner et al., 2005).

Interpretation of Results

Academic engagement. Although visual inspection of academic engagement data as measured by DBR was somewhat limited by a high degree of variability and overlap in Baseline and Intervention phases as well as some high levels of engagement in Baseline, it does appear that both student participants displayed an increase in academic engagement during Intervention. These results were consistent with previous research that indicated that MBI could effectively increase student attention and engagement (Carboni et al., 2013; Klatt et al., 2013; Napoli et al., 2005). An immediate and overall increase in level was observed for both students, as well as a

decrease in variability. Analysis of trend for Student 2 was less clear, as a slight increase (in the desirable direction) was observed in Baseline, followed by stable trend in Intervention. Trend for Student 3 more clearly supported evidence of change in Intervention, as a moderate decreasing trend in Baseline was followed by stable trend in Intervention. It is interesting to note that Student 2 was either interrupted by other students or distracted by playing with the sound controls on the computer five times while engaging in the intervention. During four out of those five instances, his teacher rated him less than an 8 on the Academic Engagement portion of DBR, indicating less than optimal levels of engagement. Conversely, Student 2 was rated an 8 or higher for Academic Engagement on all occasions in which he completed the intervention with no interruption or distraction (see Figure 3). Effect size calculations with SMD and Tau-U supported visual analysis conclusions, indicating that small to medium positive effects were observed in Intervention for both students.

Visual analysis of academic engagement as measured by SDO produced stronger support for evidence of change in Intervention. An immediate and overall increase in level was observed for both students, as well as a decrease in variability. A slight decreasing trend was observed for Student 2 in Baseline, followed by stable trend in Intervention. Stable trend was observed in both Baseline and Intervention phases for Student 3. No overlap in Baseline and Intervention phases was observed for Student 2, and a small amount of overlap was observed for Student 3. Again, effect size calculations with SMD and Tau-U supported visual analysis conclusions, indicating that medium to large positive effects were observed in Intervention for both students. Overall, effect size calculations for both DBR and SDO ranged from small to large and were generally consistent with effect sizes reported for clinical samples in a recent meta-analysis (Zoogman et al., 2014).

Descriptive school-based data pertaining to instructional minutes accessed was summarized and analyzed to draw conclusions about possible changes in engagement that may have occurred over the course of the school day. Analysis of these data was inconclusive. While an increase in percentage of instructional minutes accessed for Student 2 was observed in Intervention, a small decrease was observed for Student 3. However, interpretation of these data for Student 3 was limited by a high percentage of instructional minutes accessed (97%) observed in Baseline that may have contributed to ceiling effects in Intervention.

Teacher implementers were given the option to continue to implement the intervention as frequently or infrequently as desired in between Intervention and Follow-up phases, as well as during Follow-up. Subsequently, neither student engaged in the intervention during the Follow-up phase of this study. An increase in mean academic engagement for Student 2 in Follow-up was observed; whereas, a small decrease in level was observed for Student 3. Although variability increased slightly for Student 2, it decreased slightly for Student 3. Overall, academic engagement levels as measured by DBR at 6-week follow-up appeared to be similar to engagement levels in Intervention. These results are consistent with previous research that indicated that effects of MBI on adolescent attention could be maintained at 8-week follow-up (Van de Weijer-Bergsma et al., 2012). Because only one SDO was conducted for each participant in the Follow-up phase, maintenance of effects could not be fairly assessed by SDO measures. However, SDO data was consistent with DBR data in Follow-up.

Analysis of descriptive school-based data indicated that both students accessed a similar percentage of instructional minutes in Intervention and Follow-up phases, possibly providing further support that changes in engagement levels over the course of the school day may have been maintained at 6-week follow-up. However, interpretation of these data is limited by the

observed decrease in percentage of instructional minutes accessed between Baseline and Intervention phases for Student 3.

Respectful behavior. Conclusions drawn from visual inspection techniques indicated that an overall increase in level and decrease in variability of respectful behavior as measured by DBR were observed for both students in Intervention. Immediacy of the effect was less clear. When immediacy was assessed by examining the last Baseline data point and the first Intervention data point, an immediate effect was observed for Student 2 but not for Student 3. However, when immediacy was assessed by examining the mean of the last three Baseline data points and the mean of the first three Intervention data points, the conclusions were reversed. Analysis of trend was also somewhat inconclusive. A slight increasing trend (in the desirable direction) was observed in Baseline for Student 2, followed by a slight increasing trend in Intervention. Analysis of trend for Student 3 produced stronger support for evidence of change in Intervention, as a slight decreasing trend was observed in Baseline followed by stable trend in Intervention. A significant amount of overlap in Baseline and Intervention phases was observed due to considerable variability in Baseline data for both students. Overall, results of visual analysis of respectful behavior for Student 2 were somewhat unclear; whereas, conclusions for Student 3 suggested that an increase in respectful behavior occurred in Intervention.

Student 2 appeared to maintain similar levels and consistency of respectful behavior in Follow-up. A decrease in mean respectful behavior was observed for Student 3; however, the level remained above Baseline. An increase in variability for Student 3 was similarly observed; however, it also remained below Baseline. Overall, maintenance of effects on respectful behavior at 6-week follow-up was unclear.

Disruptive behavior. Visual inspection of disruptive behavior data as measured by DBR indicated that overall decreases in level and variability were observed for both students in Intervention. An immediate effect was observed for both students when immediacy was assessed by comparing the mean of the last three Baseline data points to the mean of the first three Intervention data points. Overall, analysis of trend contributed to support for evidence of change in Intervention. A slight decreasing trend was observed in Baseline for Student 2, followed by a moderate decreasing trend in Intervention. For Student 3, a slight increasing trend in Baseline was followed by stable trend in Intervention. A significant amount of overlap in Baseline and Intervention phases was observed due to considerable variability in Baseline data for both students. In general, results of visual analysis appeared to indicate that both students displayed a decrease in disruptive behavior in Intervention. These results were consistent with previous research demonstrating that a reduction in problem behavior was observed upon implementation of MBI (Semple et al, 2005; Singh et al., 2007; Singh et al., 2011a; Singh et al., 2011b).

Social validity. Analysis of post-intervention teacher Usage Rating Profile – Intervention Revised (URP-IR) ratings suggested that teacher implementers found the mindful breathing intervention to be feasible, acceptable, and easily understandable. These results were consistent with previous studies that indicated that teachers have received MBI favorably (Huppert & Johnson, 2010; Jennings, Frank, Snowberg, Coccia, & Greenberg, 2013; Lagor, Williams, Lerner, & McClure, 2013; Mendelson et al., 2010; Metz et al., 2013; Schonert-Reichl & Lawlor, 2010). Anecdotally, Teacher A shared that she was experiencing higher student to staff ratios than usual at the time of implementation. She reported that if she had more ideal student-staff ratios in her classroom, she would have found the intervention to be even more feasible. This was reflected in Teacher A's *system support* subscale score (M = 4.0), which was somewhat

higher than the overall mean score for this subscale (M = 2.8). This suggested that she was somewhat less confident in her ability to implement the intervention independently. These findings indicated that staffing resources would be important to consider in future implementation of this intervention, especially in an alternative educational setting where classroom dynamics can be particularly impacted by staffing changes.

Home-school collaboration was not perceived to be an integral component of the intervention. This is not surprising, as the intervention was designed to be implemented within the school setting using very little resources and time. Teachers reported that they felt that their school administration was in support of such an intervention and that, overall, they were able to implement it with relative independence.

Analysis of post-intervention student Children's Usage Rating Profile (CURP) ratings indicated that student participants found the mindful breathing intervention to be feasible, acceptable, and easily understandable. These results were also consistent with previous research indicating that students received MBI favorably (Huppert & Johnson, 2010; Jennings, Frank, Snowberg, Coccia, & Greenberg, 2013; Lagor, Williams, Lerner, & McClure, 2013; Mendelson et al., 2010; Metz et al., 2013; Schonert-Reichl & Lawlor, 2010). Individual differences in preference were apparent, as one student shared that he liked the intervention a lot, while the other student said that it was "alright." Of interest, the student who liked the intervention a lot continued to demonstrate improved levels of academic engagement in Follow-up, possibly because he continued to utilize the intervention in between Intervention and Follow-up phases. The student who reported that the intervention was "alright" appeared to be very engaged at the beginning of the Intervention phase; however, over time he seemed to be less enthusiastic. Overall, both students reported that they liked engaging in the intervention, it helped them to feel

calm and focused, and they both reported self-managing independently and using it at other times in the day. This information is particularly meaningful considering that it is not uncommon for students with emotional and behavioral difficulties to be somewhat resistant to accepting new and novel tools and strategies.

Limitations and Directions for Future Research

Attempts were made to control threats to internal and external validity of this study. For example, the order in which participants entered the Intervention phase was randomly assigned. However, there were a number of limitations to consider when interpreting the results of this study. First and foremost, despite initially recruiting five students to participate in the study, only two students entered the Intervention phase. Because an experimental effect could not be replicated at least three times, this study did not meet current single-case design standards necessary to confirm a functional relationship (Kratochwill et al., 2010). Therefore, it cannot be confirmed that observed changes in primary or dependent variables were directly related to the mindful breathing intervention.

Secondly, participants for this study were not chosen randomly. Teacher participants volunteered to participate. Student participants were recommended by school staff based on their willingness and likelihood to complete the study and screened according to specified inclusion criteria. Teachers who volunteered may have been more accepting of new strategies and interventions to use in the classroom, and students who were recommended may have been more receptive to demonstrating behavior change. Use of the inclusion criteria may have inadvertently limited students who would have benefited from the intervention from participation in the study. Additionally, two participants who were initially recruited displayed high pre-baseline levels of engagement that were not in need of intervention; therefore, they did not move forward to the

Baseline phase. Furthermore, the students who did move forward to Baseline still displayed some high levels of engagement in that phase. Future researchers may wish to consider which components of inclusion criteria should be utilized to best identify student participants. Furthermore, with only two student participants, generalizability of the results is limited. Both students who completed the study were male and received special education services in an alternative educational setting under the designation, Emotional Disturbance. Additional research in this area could aid in the generalization of the results to other student populations and educational settings.

There were limitations associated with methodology and subsequent interpretation of data in this study. Considerable variability was evident in Baseline measures of dependent variables for both students. Though inconsistent behavior patterns are not uncommon in alternative educational settings, it was not always possible to establish stable baseline responding before implementing the intervention. Significant variability in Baseline data also created challenges to drawing conclusions from visual analysis techniques specifically pertaining to overlap of data. Additionally, because some data indicated desirable levels of behavior in Baseline for both students, ceiling effects may have impeded the ability to draw conclusions about any changes evident in Intervention. Continued research on the effects of MBI on academic engagement will strengthen conclusions regarding possible causality of observed changes.

Another limitation that affected the ability to draw conclusions regarding changes observed in dependent variables as a result of MBI was the relative inconsistency with which study participants engaged in the intervention. Results of previous research have suggested that a regular, daily, mindfulness practice is necessary to produce change (Kabat-Zinn, 2003). Although teacher implementers were asked to prompt their students to engage in the mindful

breathing intervention daily, a number of barriers (e.g., student and teacher absence, student behavioral difficulties, etc.) prevented the intervention from being implemented as frequently as planned. The Intervention phases were also interrupted by snow days and school holidays. Additionally, one of the students was distracted by other students in his classroom while engaging in the intervention on a couple of occasions. Although some barriers, such as student or teacher absence, may be unavoidable, others (e.g., student behavioral difficulties) may be more prevalent in the alternative educational setting in which this study was conducted. Continued research in various educational settings (e.g., general education) may be beneficial in reducing barriers to implementation. However, it is also important to note that despite the relatively short length of time (e.g., number of days) and inconsistency of implementation, similar patterns of intrasubject change in academic engagement and disruptive behavior were evident. This provides promising support for implementation of a mindful breathing intervention. Future research may involve analyzing whether effects on dependent variables are more or less apparent when the dosage (e.g., frequency, duration) of the intervention is systematically altered. It may be particularly meaningful to examine whether or not a *consistent, daily* practice is truly necessary to produce significant change in a school setting where less frequent implementation may be more feasible.

There were limitations associated with interpretation of descriptive school-based and Follow-up data. Descriptive school-based data was not collected by the student investigator. Accuracy and integrity of these data could not be ensured, thus limiting interpretation. With respect to Follow-up data, teachers were not asked to document the frequency of intervention implementation between the end of Intervention and the beginning of Follow-up phases. Maintenance of effects on dependent variables may have been affected by the frequency with

which the intervention was implemented in between phases. In future research, documentation of intervention implementation in between Intervention and Follow-up phases may provide additional information regarding possible maintenance of effects. Follow-up phases met minimum thresholds with respect to the number of data points considered to be acceptable in single-subject research (Kazdin, 2011); however, there were comparatively fewer data points in Follow-up than in Baseline and Intervention phases. This limitation further restricts the ability to draw conclusions regarding maintenance of effects.

Results of teacher-completed social validity surveys provided information that could be particularly meaningful in conceptualizing future research. One teacher reported that she had fewer staff than usual in her classroom during implementation, and this impacted her perception of how easily the intervention could be implemented independently. She indicated that if she had a typical number of staff in her classroom, she would have found the intervention to be easier to implement. Additionally, the student participant who was in her classroom was interrupted by other students while engaging in the intervention on multiple occasions, thus impacting procedural integrity and subsequent conclusions that could be drawn from the data. A potential way to address these implementation barriers would be to utilize the mindful breathing activity as a classwide, rather than individual, intervention. Classwide implementation would require only one staff member to initiate the intervention; and ideally all students in the class would participate, thus maximizing staffing resources. Classwide implementation may reduce the likelihood that students would be interrupted, as all students would be engaging in the intervention at the same time. Additionally, classwide implementation would enable the classroom staff to engage in the intervention with the students. This could further strengthen

outcomes of the intervention, as Singh and colleagues (2013) have found support for teacher participation in MBI resulting in improved student behavioral outcomes.

Results of student-completed social validity surveys also provided information that could be meaningful in planning future research. Individual differences in student preferences with respect to the intervention were apparent. One student reported that he liked it a lot, and the other student shared that it was "alright." The student who thought that the intervention was "alright" appeared to be highly engaged in the intervention at the beginning of the study. However, over time, his enthusiasm seemed to decrease somewhat. While this reaction may be somewhat typical of adolescent students, there may also be ways to address and prevent declining interest over time. The student who liked the intervention a lot suggested that it would be helpful to incorporate a variety of recordings so that each student is not engaging in the same activity every day. Future research may be developed to investigate the impacts of using different recordings and subsequent effects on student perceptions over time.

Finally, it is important to note that the teacher implementers (i.e., primary observers) were not blind to study phases; and the student investigator and research assistants (i.e., secondary observers) were not blind to study phases, research questions, or hypotheses. This may have inadvertently presented a threat to experimental control.

Conclusion

The goal of this study was to determine if engaging in an audio-delivered, daily, mindful breathing intervention would increase academic engagement in adolescent students with emotional and behavioral difficulties in an alternative educational setting. Despite significant limitations that impact the conclusions that can be drawn from the study, the initial findings

provide preliminary support for such an intervention being an effective way of increasing academic engagement. Research findings were similar to other studies that have evaluated the impacts of MBI on attention and academic engagement (Carboni et al., 2013; Klatt et al., 2013; Napoli et al., 2005). An increase in academic engagement as indicated by two different measures (i.e., teacher-rated DBR and SDO) was observed for study participants in Intervention, and the increase appeared to be maintained at 6-week follow-up. Similar to other research findings (Semple et al, 2005; Singh et al., 2007; Singh et al., 2011a; Singh et al., 2011b), participants displayed lower levels of disruptive behavior in Intervention as well. According to the results of this study, teachers and students found the mindful breathing intervention to be both feasible and acceptable.

This study contributes to the growing body of research in support of the use of MBI in school settings. The study attempted to use an experimental research design to investigate effects on a socially valid outcome measure (i.e., academic engagement) in an alternative educational setting while also assessing procedural integrity, IOA, and social validity. Low student engagement and attention concerns continue to be common student-related problems faced by teachers. The results of this study preliminarily provide support for using a low-resource, mindful breathing intervention to promote self-management of student attention, leading to increased academic engagement and ultimately positive student outcomes.

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Table 1

Behavioral Principles and Mindfulness Examples

Behavioral Principle	**Definition**	**Mindfulness Example**
Target behavior	A measurable action desired to be increased or decreased	Refocusing attention
Neutral stimulus (stimulus delta)	A stimulus in the presence of which a given behavior has not occasioned reinforcement in the past	The breath
Antecedent	An environmental condition existing or occurring prior to a behavior of interest	Mind wandering
Self-monitoring	When a person systematically observes his/her behavior and records the occurrence or nonoccurrence of a specific behavior	Recognition that the mind has wandered
Prompt	A stimuli created to be a cue or reminder for a desired behavior	Taking note that the mind has wandered in an accepting manner Examples: Saying to oneself, "I notice that I'm worrying about what will happen later," or "I'm not focusing on my breath anymore." Non-examples: "I'm not doing this very well," "I'm so mad I keep getting distracted!"
Positive reinforcement	Presentation of a stimulus following a behavior of interest that increases the future frequency of that type of behavior in similar conditions	Mindful breathing results in the ability to think more clearly and be less reactive to emotional stimuli, improving academic engagement and management of emotions, resulting in praise from others and better relationships, increasing the probability of engaging in mindful breathing in the future
Stimulus control	A situation in which the frequency, latency, duration, or amplitude of a behavior is altered by the presence or absence of an antecedent stimulus	When the mind wanders, it becomes more likely that self-monitoring will be occasioned, a prompt will be delivered, and attention will be refocused on the breath
Stimulus generalization	Transfer of stimulus control to untrained stimulus conditions	When presented with a variety of stressful situations (i.e., academic instruction, taking a test, conflict situations), one can cope more effectively by refocusing attention on the breath

Behavioral definitions adapted from Cooper et al. (2007)

Table 2

Demographic Profile of Participating School

Total Number of Classroom Teachers	6
Grade Levels of Students Served	4 – 12
Total Students	38
Ethnically Diverse Students	11 (29%)
Students Receiving Special Education Services	38 (100%)
Students Eligible for Free or Reduced Lunch	26 (68%)

Table 3

Rates of *Systematic Direct Observation (SDO)* Probes and *Inter-observer Agreement (IOA)* Observations across Study

	Baseline	Intervention	Follow-up	Total
Student 2				
% SDO Probes	50%	43%	33%	44%
% IOA Observations	50%	33%	100%	45%
Student 3				
% SDO Probes	46%	25%	33%	36%
% IOA Observations	83%	33%	100%	70%
	Baseline Totals	Intervention Totals	Follow-up Totals	Study Totals
% SDO Probes	48%	35%	33%	40%
% IOA Observations	70%	33%	100%	56%

Note: % SDO Probes refers to the % of DBR data points in which SDO probes were conducted. % IOA Observations refers to the % of SDO probes and procedural integrity (PI) checklists in which IOA data was collected.

Table 4

Direct Behavior Rating (DBR) Data across Phases and Participants

	Baseline			Intervention			Follow-Up		
	M	*(SD)*	*Range*	*M*	*(SD)*	*Range*	*M*	*(SD)*	*Range*
Student 2									
Acad. Engaged	7.00	(1.77)	3-9	7.93	(1.44)	5-10	8.33	(1.53)	7-10
Respectful	7.62	(2.13)	5-10	8.36	(1.60)	5-10	8.33	(1.53)	7-10
Disruptive*	3.38	(2.97)	0-9	1.00	(1.61)	0-5	1.67	(1.53)	0-3
Student 3									
Acad. Engaged	6.85	(2.44)	0-9	8.17	(1.08)	6-10	8.00	(1.00)	7-9
Respectful	8.15	(2.61)	1-10	9.83	(0.40)	9-10	8.67	(0.57)	8-9
Disruptive*	1.46	(1.13)	0-4	0.17	(0.40)	0-1	1.67	(0.58)	1-2

*For the Disruptive scale, lower scores are desirable.

Table 5

Systematic Direct Observation (SDO) Data across Phases and Participants

	Baseline			Intervention			Follow-Up
	M	*(SD)*	*Range*	*M*	*(SD)*	*Range*	*M*
Student 2							
Acad. Engaged	60.25	(12.23)	48-77	84.17	(3.87)	80-91	97.80
Student 3							
Acad. Engaged	70.83	(23.67)	34-97	95.70	(3.51)	92-99	74.72

Note: One SDO was completed for each student in Follow-up; therefore, standard deviations and ranges are not reported for that phase.

Table 6

Effect Sizes for Academic Engagement as Measured by *Direct Behavior Rating (DBR)* and *Systematic Direct Observation (SDO)*

		Intervention to Baseline			Follow-up to Baseline		
		Value	Qualitative Descriptor	Direction of Effect	Value	Qualitative Descriptor	Direction of Effect
Student 2							
DBR	SMD	0.53	Medium Effect	Positive	0.75	Medium Effect	Positive
	Tau-U	0.35	Small Effect	Positive	0.42	Small Effect	Positive
SDO	SMD	1.96	Large Effect	Positive	N/A	N/A	N/A
	Tau-U	1.00	Large Effect	Positive	N/A	N/A	N/A
Student 3							
DBR	SMD	0.54	Medium Effect	Positive	0.47	Small Effect	Positive
	Tau-U	0.40	Small Effect	Positive	0.31	Small Effect	Positive
SDO	SMD	1.05	Large Effect	Positive	N/A	N/A	N/A
	Tau-U	0.61	Medium Effect	Positive	N/A	N/A	N/A

Note: SMD refers to Standard Mean Difference.
N/A: Effect sizes were not calculated for SDOs for Follow-up, as there was only one SDO data point for each participant for this phase.

Table 7

Summary of Change in Dependent Variables from Baseline to Intervention

	Level[a]	Standard Mean Difference[b]	Immediacy[c]	Consistency[d]	Overlap[e]	Trend[f]
Student 2						
DBR						
Acad. Engaged	Increase	Medium, positive	Increase	Improved	Small, positive	Slight incr. trend to stable trend
Respectful	Increase	N/A	No Change	Improved	N/A	Slight incr. trend to slight incr. trend
Disruptive*	Decrease	N/A	Decrease	Improved	N/A	Slight decr. trend to mod. decr. trend
SDO						
Acad. Engaged	Increase	Large, positive	Increase	Improved	Large, positive	Slight decr. trend to stable trend
Student 3						
DBR						
Acad. Engaged	Increase	Medium, positive	Increase	Improved	Small, positive	Moderate decr. trend to stable trend
Respectful	Increase	N/A	Increase	Improved	N/A	Slight decr. trend to stable trend
Disruptive*	Decrease	N/A	Decrease	Improved	N/A	Slight incr. trend to stable trend
SDO						
Acad. Engaged	Increase	Large, positive	Increase	Improved	Medium, positive	Stable trend to stable trend

Note: DBR refers to Direct Behavior Rating. SDO refers to Systematic Direct Observation.
[a]*Level*: Increase, Decrease, or No Change in Mean
[b]*Standard Mean Difference*: Using criteria: Small = .20-.49, Medium = .50-.79, Large = .80+
[c]*Immediacy*: Increase, Decrease, or No Change between mean of final 3 baseline DBR data points & mean of first 3 intervention DBR data points or between final baseline SDO data point and first intervention SDO data point
[d]*Consistency*: Improved, Declined, or No Change (using standard deviation as measure)
[e]*Overlap*: Using Tau-U effect size criteria: Small = .20-.49, Medium = .50-.79, Large = .80+
[f]*Trend*: Comparison of baseline trend to intervention trend utilizing the split-middle technique
N/A: Effect sizes were not calculated for secondary dependent variables
*A decrease in level and immediacy on the Disruptive scale of DBR is desirable

Table 8

Descriptive School-based Data Pertaining to Instructional Minutes Accessed

	# Days of School	# Inst. Min. Offered	Minutes Spent in Breaks Out	Minutes Spent in TA	Minutes Spent in TO	Minutes Spent in Time Owed	Total Inst. Min. Lost	Percentage of Inst. Min. Accessed	# of Absences	Absence Rate
Student 2										
Baseline	14	4080	51	135	293	256	735	82%	0	0.00
Intervention	26	7200	134	80	334	20	568	92%	1	0.04
Follow-up	5	1350	18	15	63	0	96	93%	0	0.00
Student 3										
Baseline	19	4920	5	75	45	15	140	97%	2	0.11
Intervention	21	5760	72	35	253	0	360	94%	1	0.05
Follow-up	5	1050	10	10	0	0	200	98%	1	0.20

Note: Inst. Min. Offered does not include days in which the student was absent. Breaks Out refers to teacher-prompted breaks taken outside of the classroom. TA refers to a teacher-directed, 5-minute Time Aside. TO refers to a teacher-directed, 10-minute Time Out. Time Owed refers to TA, TO, or time due to unsafe behavior that must be fulfilled the following school day.

Table 9

Means and Standard Deviations for Post-intervention Teacher (n = 2) *Usage Rating Profile – Intervention Revised (URP-IR)* Ratings

Factor	*M*	*(SD)*
Acceptability	4.89	(0.47)
Understanding	5.50	(0.55)
Home-School Collaboration	3.50	(1.22)
Feasibility	5.08	(0.54)
System Climate	5.20	(0.63)
System Support*	2.80	(1.83)

Note: Items on the UPR-IR were rated on a 1-6 scale (1=Strongly Disagree, 6=Strongly Agree).
*Lower scores for System Support indicate greater confidence in being able to implement the intervention independently.

Table 10

Means and Standard Deviations for Post-intervention Student (n = 2) *Children's Usage Rating Profile (CURP)* Ratings

Factor	*M*	*(SD)*
Personal Desirability	3.07	(1.00)
Feasibility*	1.81	(0.75)
Understanding	3.42	(0.79)

Note: Items on the CURP were rated on a 1-4 scale (1=Totally Disagree, 4=Totally Agree).
*Lower scores for Feasibility indicate higher degree of feasibility in terms of effort required and overall intrusiveness to classroom dynamic.

Table 11

Intervention *Procedural Integrity (PI)* Data across Participants

	M	*(SD)*	*Range*
Student 2	92.90%	(1.10)	80-100
Student 3	100.00%	N/A	N/A

Note: Standard deviation and range are not reported for Student 3, as all PI values were 100%.

Table 12

Inter-observer Agreement (IOA) for *Systematic Direct Observation (SDO)* across Study

	Interval-by-Interval			Kappa		
	M	*(SD)*	*Range*	*M*	*(SD)*	*Range*
Student 2	95%	(2.97)	92-99%	0.79	(0.12)	0.67-0.94
Student 3	98%	(1.25)	97-100%	0.72	(0.38)	0.00-1.00

Table 13

Inter-observer Agreement (IOA) for Intervention *Procedural Integrity (PI)*

	Interval-by-Interval		
	M	*(SD)*	*Range*
Student 2	97%	(8.16)	80-100%
Student 3	100%	N/A	N/A

Note: Standard deviation and range are not reported for Student 3, as all IOA values were 100%.

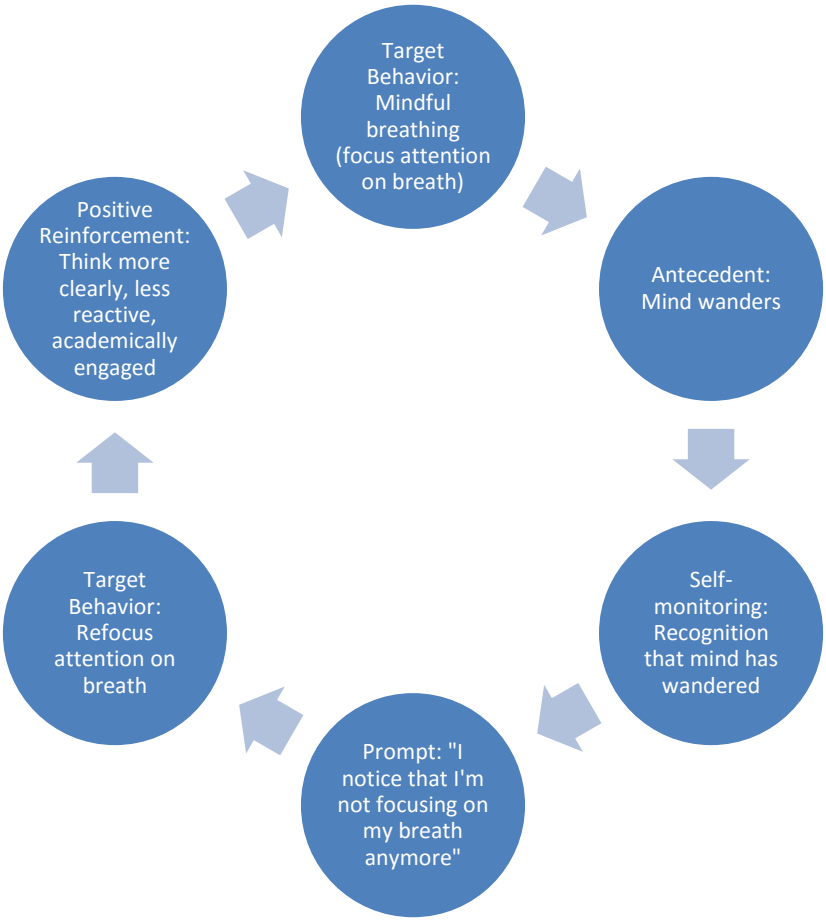

Figure 1. Illustration of Mindful Breathing Sequence in Behavioral Terms

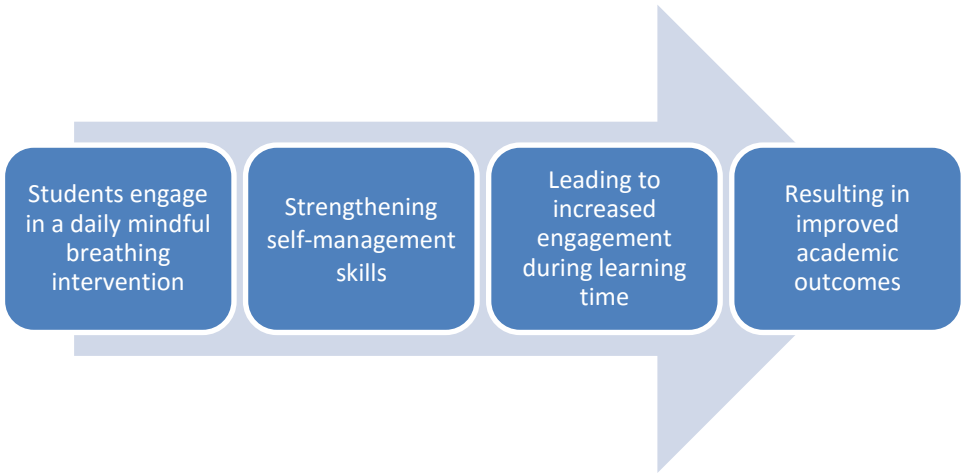

Figure 2. Proposed Theory of Change

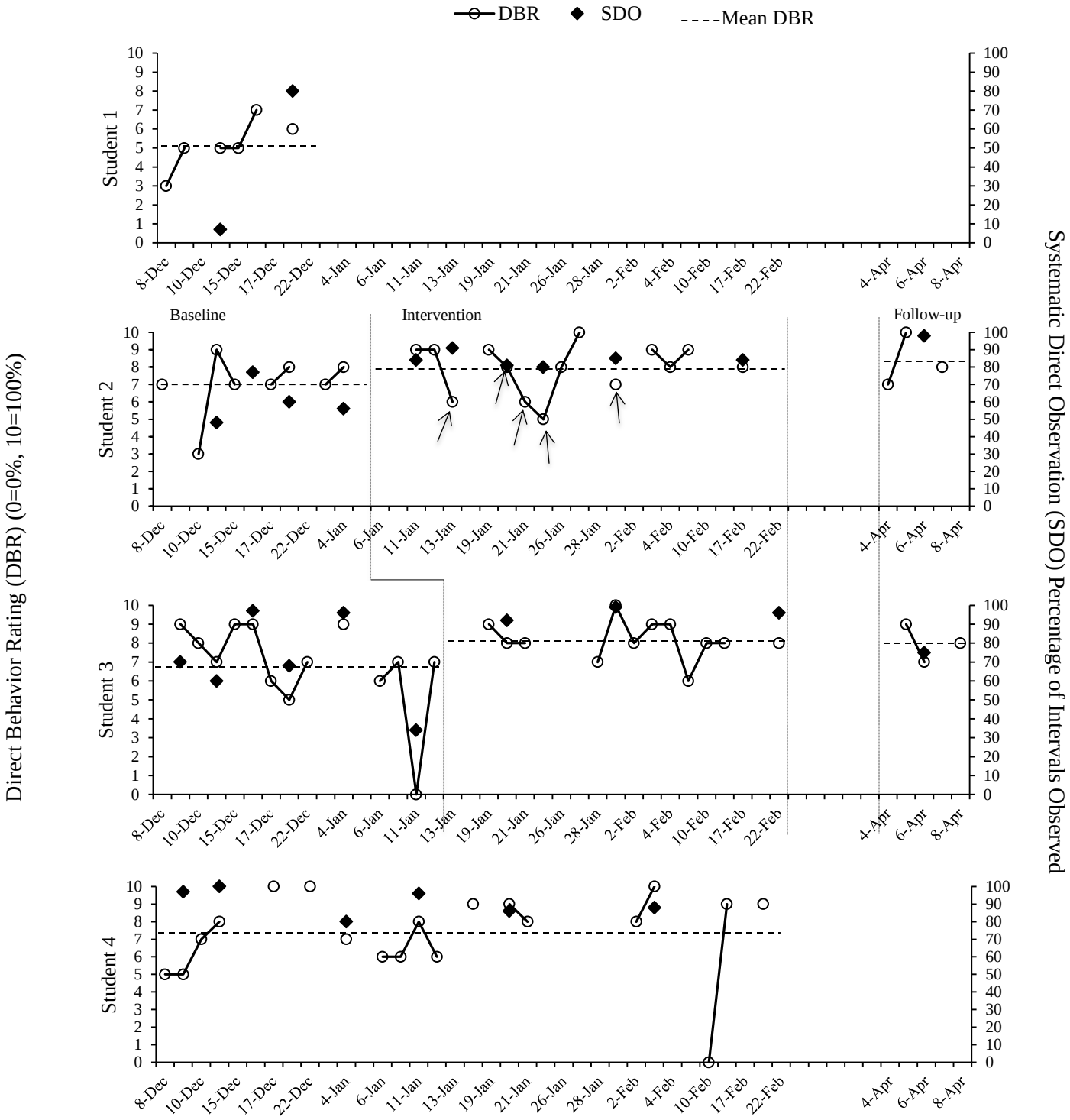

Figure 3. Rates of Academic Engagement across Participants and Phases

Note: ↑ denotes instances in which the intervention was not implemented as intended

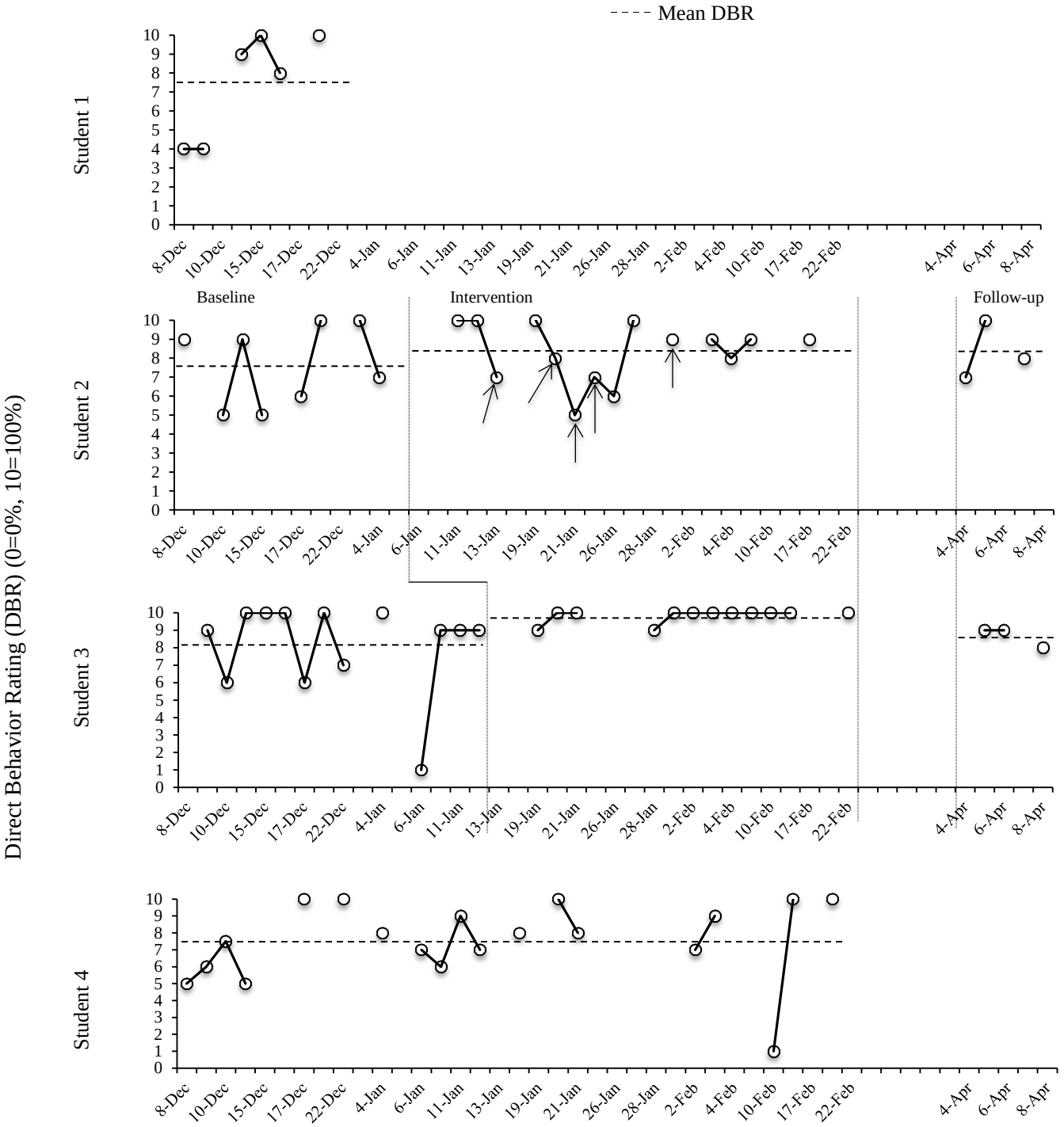

Figure 4. Rates of Respectful Behavior across Participants and Phases

Note: ↑ denotes instances in which the intervention was not implemented as intended

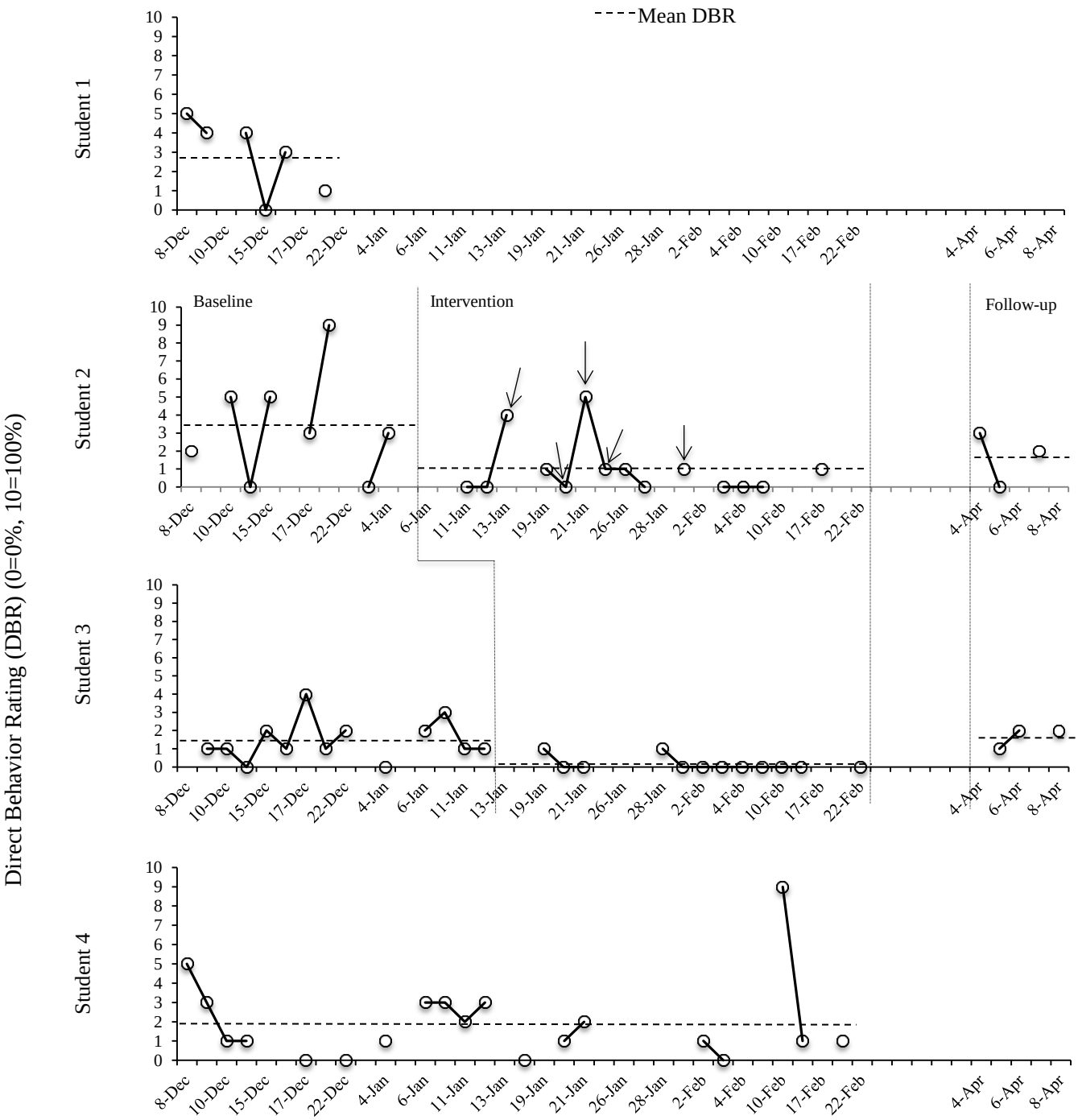

Figure 5. Rates of Disruptive Behavior across Participants and Phases

Note: ↑ denotes instances in which the intervention was not implemented as intended

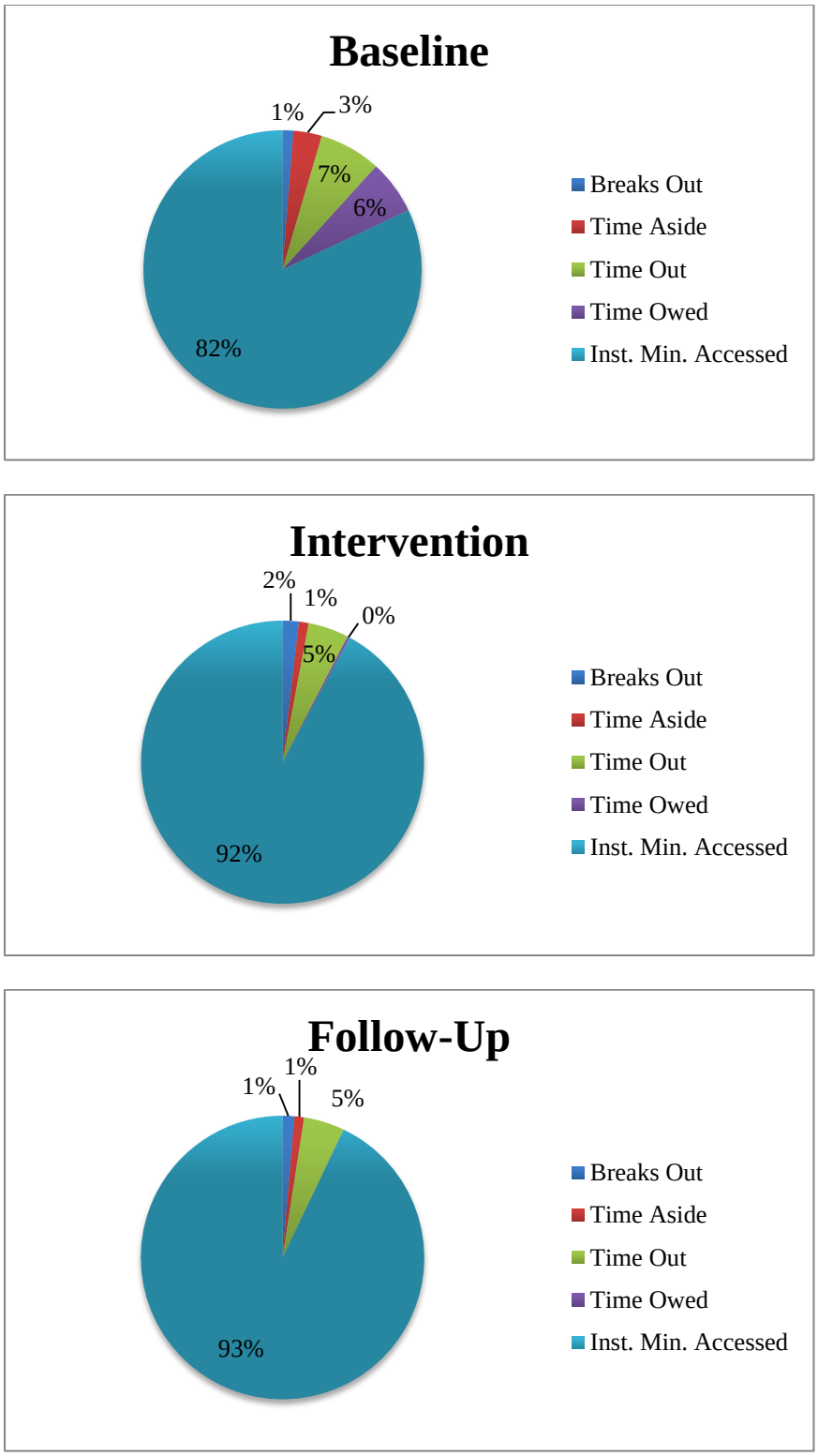

Figure 6. Summary of Instructional Minutes Accessed across Phases for Student 2

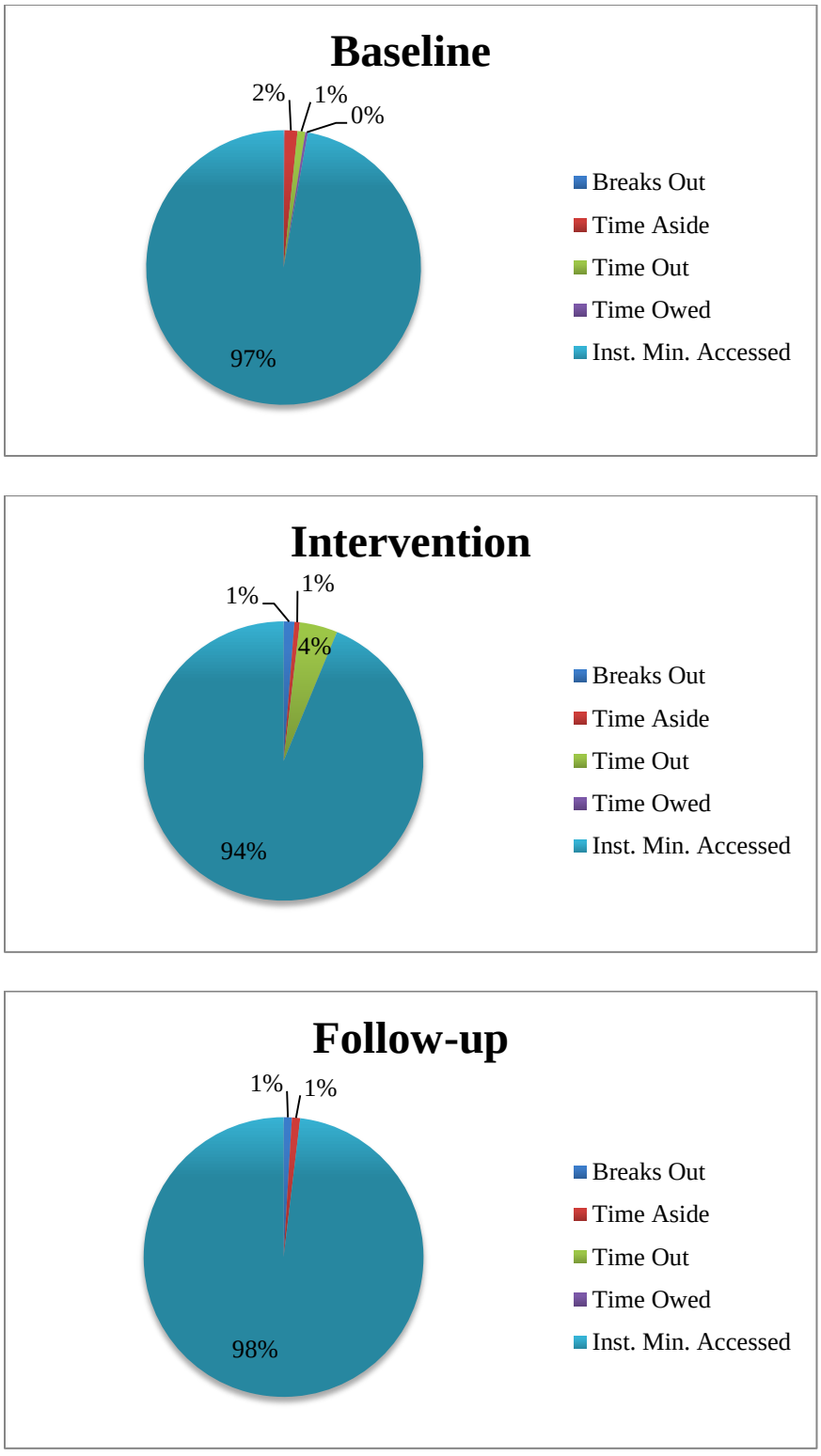

Figure 7. Summary of Instructional Minutes Accessed across Phases for Student 3

Appendix A

Educator Background Form

Thank you for participating in my research project. Completion of this form is optional and all information will remain confidential. All names will be removed and will not be shared with anyone outside this project.

Name: _____ **Date**:_____

School/Center/Office: _____ **Telephone Number:**_____

E-Mail Address:_____

Age:____ **Birthdate**: _____ **Sex**: ☐ Male ☐ Female

Profession:_____ **Number of Years in Profession:**____

Current Grades/Ages that you teach: _____

Highest Degree Attained:

☐ High School or GED
☐ Some college, 2-year
☐ College or vocational
☐ Bachelor's degree
☐ Other:_____
☐ Some graduate work
☐ Master's degree
☐ Master's plus sixth year certificate
☐ Doctoral degree

Race/Ethnicity:

☐ American Indian/Alaska Native
☐ Hispanic
☐ White, non-Hispanic
☐ Other:_____
☐ Asian/ Pacific Islander
☐ Black, non-Hispanic
☐ Bi-racial:_____

Appendix B

Mindful Breathing Intervention Script

Breathing is so simple, yet so important. Breathing allows us to take in the oxygen that our body needs. When we really focus on our breathing, we can help our body and brain to feel more relaxed and more clear, which helps us to learn better and even to be happier. When we pay attention to something very closely, this is called being mindful. Practicing mindfulness helps us to find a place inside of us where we are calm and present. We're going to practice a short mindful breathing exercise that will help get your body and brain ready for the day, ready to learn. This exercise can be done seated or lying down on the floor. If you are sitting in a chair, make sure your feet are on the ground, your back is straight, and you are comfortable. Close your eyes and place both hands on your belly. If you don't feel comfortable closing your eyes, look down towards your belly. Try not to look around, because this will distract you. With your hands on your belly, start breathing deeply. Try to breathe in and out through your nose. Take in a few deep breaths, noticing that your hands may rise as you breathe in fresh oxygen, and fall as you breathe out what you don't need. Notice that your breath is causing your hands to rise and fall. Take a few more deep breaths as you feel your hands rise and fall. You might notice that as you try to pay attention to your breath, your brain may get distracted, you may start to think about other things. This is okay and completely normal. The brain's job is to think, this is what it does. But when you notice that your brain is getting distracted, just bring your attention back to your breath. Let's try counting our breaths, feeling your hands rise as you breathe in and fall as you breathe out. Remember to breathe through your nose. Let's start by breathing out first. Now count 1 as you breathe in, 2 as you breathe out. 3 in… 4 out… 5 in… 6 out… 7 in… 8 out… 9 in… 10 out. Good. With each breath, notice how your body feels. Does it feel more calm and

relaxed? Is your brain more clear, ready to learn? Now bring your hands to rest in your lap, or on the floor next to you if you are lying down. Feel your breath moving in and out of you. You might feel your belly rising, your chest expanding, or air coming in through your nose. Pick one spot to focus on. Try to keep your attention on this spot while we count more breaths. Remember, it's normal for your brain to get distracted. If this happens just bring your attention back to counting your breaths. Count 1 as you breathe in, and 2 as you breathe out, all the way up to 10 like we did before….(allow time for breaths). Good. You've just given your body and your brain what it needs to make it through the day. Take a moment to notice how you feel. Is your body calm and relaxed? Is your brain clear, ready to learn? You can use mindful breathing throughout the day. When you get distracted or stressed, try taking a few deep mindful breaths and see how you feel. The more you practice, the easier it will become.

Appendix C

Expert Panel Review Form

Reviewer's Name_____

Brief description of mindfulness background/expertise _____

_____

_____

The research literature states that the following attributes are core features of mindfulness-based practices. After reading the Mindful Breathing Intervention Script, please check below to indicate whether or not the core features of mindfulness are evident in the script.

Core Feature	Is this feature evident in the script?
Directing one's attention to the present moment	Yes ☐ No ☐
Adopting a non-judgmental attitude of acceptance	Yes ☐ No ☐

Based on your knowledge of mindfulness, do you believe that the Mindful Breathing Script accurately represents a mindfulness-based practice? Yes ☐ No ☐

References

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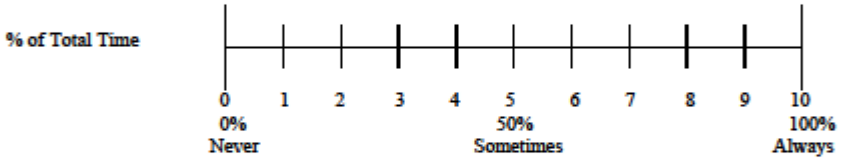
Appendix D

Direct Behavior Rating (DBR) Form: 3 Standard Behaviors

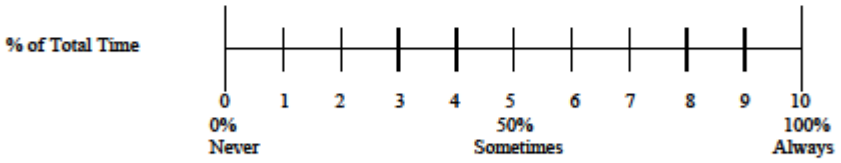
Date: M T W Th F	Student: Rater:	Activity Description:
Observation Time: Start:_____ End: _____ ☐ Check if no observation today	Behavior Descriptions: **Academically engaged** is actively or passively participating in the classroom activity. For example: writing, raising hand, answering a question, talking about a lesson, listening to the teacher, reading silently, or looking at instructional materials. **Respectful** is defined as compliant and polite behavior in response to adult direction and/or interactions with peers and adults. For example: follows teacher direction, pro-social interaction with peers, positive response to adult request, verbal or physical disruption without a negative tone/connotation. **Disruptive** is student action that interrupts regular school or classroom activity. For example: out of seat, fidgeting, playing with objects, acting aggressively, talking/yelling about things that are unrelated to classroom instruction.	

Directions: Place a mark along the line that best reflects the percentage of total time the student exhibited each target behavior. Note that the percentages do not need to total 100% across behaviors since some behaviors may co-occur.

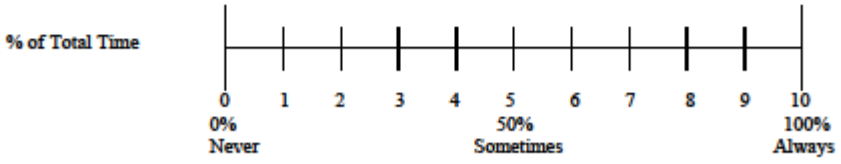
Academically Engaged



Respectful



Disruptive *



* Remember that a lower score for "Disruptive" is more desirable.

Appendix E

Systematic Direct Observation Form

Observer name:_____

Date:	Time start:	Time stop:	Setting/Activity:
ID 1:			
Name:			

Check if Study Observation or IOA Observation: ☐Study Observation ☐IOA Observation

Academically Engaged is participation in the classroom activity. Examples: writing, raising hand, answering a question, talking about a lesson, listening to the teacher, reading silently, or looking at instructional materials.

Disruptive behavior is action that interrupts regular school or classroom activity. Examples: out of seat, fidgeting, playing with objects, acting aggressively, talking/yelling about things that are unrelated to classroom instruction.

Respectful is following teacher direction and using polite behavior during interactions with peers and adults. Examples: follows teacher directions, being positive with peers and to adults, NOT using a negative tone such as talking back or inappropriate gesture and language.

Time (Start)	:00	:10	:20	:30	:40	:50	1:00	1:10	1:20	1:30	1:40	1:50	2:00	2:10	2:20
AE															
Disruptive															
Respectful															

Time (Start)	2:30	2:40	2:50	3:00	3:10	3:20	3:30	3:40	3:50	4:00	4:10	4:20	4:30	4:40	4:50
AE															
Disruptive															
Respectful															

Time (Start)	5:00	5:10	5:20	5:30	5:40	5:50	6:00	6:10	6:20	6:30	6:40	6:50	7:00	7:10	7:20
AE															
Disruptive															
Respectful															

Time (Start)	7:30	7:40	7:50	8:00	8:10	8:20	8:30	8:40	8:50	9:00	9:10	9:20	9:30	9:40	9:50
AE															
Disruptive															
Respectful															

Time (Start)	10:00	10:10	10:20	10:30	10:40	10:50	11:00	11:10	11:20	11:30	11:40	11:50	12:00	12:10	12:20
AE															
Disruptive															
Respectful															

Time (Start)	12:30	12:40	12:50	13:00	13:10	13:20	13:30	13:40	13:50	14:00	14:10	14:20	14:30	14:40	14:50
AE															
Disruptive															
Respectful															

Systematic Direct Observation Form

Observer name:_____

Date:	Time start:	Time stop:	Setting/Activity:
ID 1:			
Name:			

Check if Study Observation or IOA Observation: ☐ Study Observation ☐ IOA Observation

Time (Start)	15:00	15:10	15:20	15:30	15:40	15:50	16:00	16:10	16:20	16:30	16:40	16:50	17:00	17:10	17:20
AE															
Disruptive															
Respectful															

Time (Start)	17:30	17:40	17:50	18:00	18:10	18:20	18:30	18:40	18:50	19:00	19:10	19:20	19:30	19:40	19:50
AE															
Disruptive															
Respectful															

Time (Start)	20:00	20:10	20:20	20:30	20:40	20:50	21:00	21:10	21:20	21:30	21:40	21:50	22:00	22:10	22:20
AE															
Disruptive															
Respectful															

Time (Start)	22:30	22:40	22:50	23:00	23:10	23:20	23:30	23:40	23:50	24:00	24:10	24:20	24:30	24:40	24:50
AE															
Disruptive															
Respectful															

Systematic Direct Observation Form – Observation Summary Sheet

Observer name:_____

Date:	Time start:	Time stop:	Setting/Activity:
ID 1:			
Name:			

Check if Study Observation or IOA Observation: ☐ Study Observation ☐ IOA Observation

Student 1 Target Behavior	Total # of intervals behavior was present	Total # of intervals in observation session	Percentage
AE			
Disruptive			
Respectful			

Student 2 Target Behavior	Total # of intervals behavior was present	Total # of intervals in observation session	Percentage
AE			
Disruptive			
Respectful			

Student 3 Target Behavior	Total # of intervals behavior was present	Total # of intervals in observation session	Percentage
AE			
Disruptive			
Respectful			

Student 4 Target Behavior	Total # of intervals behavior was present	Total # of intervals in observation session	Percentage
AE			
Disruptive			
Respectful			

Student 5 Target Behavior	Total # of intervals behavior was present	Total # of intervals in observation session	Percentage
AE			
Disruptive			
Respectful			

Systematic Direct Observation Form - IOA

Child: _____ Subject: _____
Date: _____ Setting: _____
Observer: _____ Time of Observation: _____

Agreement Calculations

Interval-by-Interval

1. For each behavior, determine the number of intervals for which the observers have agreement.
2. For each behavior, divide the number of intervals with agreement by the total number of intervals. Insert the resulting percentage into the % Agreement column.
3. After completing percentages for each behavior, determine the number of intervals for which the observers have agreement across all behaviors, and then divide the number of intervals with agreement by total number of intervals. Insert the resulting percentage into the Total % Agreement column.

	Number of Intervals with Agreement	Total Intervals	% Agreement	Total % Agreement
AE				
Disruptive				
Respectful				

Appendix F

Participant Number _____

Date _____

Teacher/Observer Initials _____

Specified Intervention Time _____

Specified DBR Completion Time _____

Procedural Integrity Checklist

Please provide answers to the following questions. Anecdotal notes can be written in margins if elaboration is needed for questions answered "No."

1. Was the intervention initiated (e.g., student provided with audio equipment) within 15 minutes of the specified intervention time?	Yes No
2. If answer to #1 is No, what time was the intervention initiated?	
3. Was the student provided with all of the necessary audio equipment (headphones, CD/MP3 player, mindful breathing recording)?	Yes No
4. Did the student sit in a comfortable area (i.e., as little distraction as possible)?	Yes No
5. Did the student appear to engage in the intervention for the entire duration (e.g., seated, body relatively still, headphones on, eyes closed or gaze down, seeming to be focusing on breathing)?	Yes No
6. Was DBR completed within 15 minutes of the specified completion time?	Yes No

Total # of Questions Answered "Yes" _____

% Procedural Integrity (# "Yes"/5 x 100%) _____

URP-Intervention

Directions: Consider the described intervention when answering the following statements. Circle the number that best reflects your agreement with the statement, using the scale provided below.

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1.	This intervention is an effective choice for addressing a variety of problems.	1	2	3	4	5	6
2.	I would need additional resources to carry out this intervention.	1	2	3	4	5	6
3.	I would be able to allocate my time to implement this intervention.	1	2	3	4	5	6
4.	I understand how to use this intervention.	1	2	3	4	5	6
5.	A positive home-school relationship is needed to implement this intervention.	1	2	3	4	5	6
6.	I am knowledgeable about the intervention procedures.	1	2	3	4	5	6
7.	The intervention is a fair way to handle the child's behavior problem.	1	2	3	4	5	6
8.	The total time required to implement the intervention procedures would be manageable.	1	2	3	4	5	6
9.	I would not be interested in implementing this intervention.	1	2	3	4	5	6
10.	My administrator would be supportive of my use of this intervention.	1	2	3	4	5	6
11.	I would have positive attitudes about implementing this intervention.	1	2	3	4	5	6
12.	This intervention is a good way to handle the child's behavior problem.	1	2	3	4	5	6
13.	Preparation of materials needed for this intervention would be minimal.	1	2	3	4	5	6

USAGE RATING PROFILE

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
14.	Use of this intervention would be consistent with the mission of my school.	1	2	3	4	5	6
15.	Parental collaboration is required in order to use this intervention.	1	2	3	4	5	6
16.	Implementation of this intervention is well matched to what is expected in my job.	1	2	3	4	5	6
17.	Material resources needed for this intervention are reasonable.	1	2	3	4	5	6
18.	I would implement this intervention with a good deal of enthusiasm.	1	2	3	4	5	6
19.	This intervention is too complex to carry out accurately.	1	2	3	4	5	6
20.	These intervention procedures are consistent with the way things are done in my system.	1	2	3	4	5	6
21.	This intervention would not be disruptive to other students.	1	2	3	4	5	6
22.	I would be committed to carrying out this intervention.	1	2	3	4	5	6
23.	The intervention procedures easily fit in with my current practices.	1	2	3	4	5	6
24.	I would need consultative support to implement this intervention.	1	2	3	4	5	6
25.	I understand the procedures of this intervention.	1	2	3	4	5	6
26.	My work environment is conducive to implementation of an intervention like this one.	1	2	3	4	5	6
27.	The amount of time required for record keeping would be reasonable.	1	2	3	4	5	6
28.	Regular home-school communication is needed to implement intervention procedures.	1	2	3	4	5	6
29.	I would require additional professional development in order to implement this intervention.	1	2	3	4	5	6

USAGE RATING PROFILE

Appendix H

CURP - Actual

Directions: Think about the method that your teacher or other adult has used with you. After reading each sentence, circle the number that matches your belief about it. For example, if the sentence was "I like chocolate ice cream," you might circle "4" for "I totally agree."

		I totally disagree	I kind of disagree	I kind of agree	I totally agree
1.	This was too much work for me.	1	2	3	4
2.	I understand why my teacher picked this method to help me.	1	2	3	4
3.	I could see myself using this method again.	1	2	3	4
4.	This is a good way to help students.	1	2	3	4
5.	It is clear what I had to do.	1	2	3	4
6.	I would not want to try this method again.	1	2	3	4
7.	This took too long to do.	1	2	3	4
8.	If my friend was having trouble, I would tell him/her to try this.	1	2	3	4
9.	I was able to do every step of this method.	1	2	3	4
10.	I felt like I had to use this method too often.	1	2	3	4

USAGE RATING PROFILE

		I totally disagree	I kind of disagree	I kind of agree	I totally agree
11.	Using this method gave me less free time.	1	2	3	4
12.	There are too many steps to remember.	1	2	3	4
13.	Using this method got in the way of doing other things.	1	2	3	4
14.	I understand why the problem needed to be fixed.	1	2	3	4
15.	This method focused too much attention on me.	1	2	3	4
16.	I was excited to try this method.	1	2	3	4
17.	This method made it hard for the other students to work.	1	2	3	4
18.	I would volunteer to use this method again.	1	2	3	4
19.	It is clear what the adult needed to do.	1	2	3	4
20.	I was able to use this method correctly.	1	2	3	4
21.	I liked this method.	1	2	3	4

Appendix I

Mindful Breathing Intervention Fact Sheet

Pre-intervention Steps

- Meet with student researcher to discuss study procedures (30 minutes)
- Complete online training module for Direct Behavior Rating (DBR) at http://www.directbehaviorratings.org/training/ by a mutually agreed upon date (25-40 minutes)

Baseline Phase Steps (1-7 weeks)

- Observe student daily during a specified block of instructional time (time varies according to classroom)
- Complete DBR daily (<1 minute)
- Complete Procedural Integrity (PI) checklist daily (< 1 minute)

Training Phase Steps (2 days)

- Day 1: Observe student researcher introduce intervention to student (5-7 minutes), review implementation and data collection steps (5-7 minutes)
- Day 2: Introduce intervention to student while student researcher observes (5-7 minutes), review implementation and data collection steps (5-7 minutes)

Intervention Phase Steps (1-7 weeks)

- Provide student with audio equipment and prompt them to initiate intervention (1-2 minutes)
- Observe student during a specified block of instructional time (time varies according to classroom)
- Complete DBR daily (<1 minute)
- Complete Procedural Integrity (PI) checklist daily (< 1 minute)

Post-intervention Steps (approximately 6 weeks)

- Complete Usage Rating Profile – Intervention Revised (URP-IR) within 1 week of the completion of the Intervention Phase (5 minutes)
- Implement the mindful breathing intervention as frequently or infrequently as desired

Follow-up Phase Steps (1 week)

- Implement the mindful breathing intervention as frequently or infrequently as desired
- Observe student during a specified block of instructional time (time varies according to classroom)
- Complete DBR daily (<1 minute)
- Complete Procedural Integrity (PI) checklist daily (< 1 minute)