The Impact of Mindfulness on the Development of Inhibition and Interference Control in Elementary Students

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Abstract

Loss of instructional time due to student inattentiveness is a well-known problem (Godwin et al., 2016). Educators need effective and efficient methods to improve student attention and self-control for optimal learning. Research on the inclusion of mindfulness in schools is an emerging trend (Flook et al., 2010; Lam & Seiden, 2020; Ritter & Alvarez, 2020; Thierry et al., 2016; Van De Weijer-Bergsma et al., 2012). This mixed methods study investigated the impact of mindfulness-based practices on student inhibition and interference control skills; and explored student, teacher, and parent perceptions of including mindfulness-based practices in a school setting. Twenty-five third grade students from two classrooms at a suburban school in northwest Ohio participated in the 6-week mindfulness intervention. Quantitative data collected pre- and post-intervention for student inhibition indicated a moderate effect (d = 0.474) between the treatment and waitlist control group. Data collected for student interference control skills did not yield a significant effect between the treatment and waitlist control group (d = -0.012). Qualitative data gathered from interviews and surveys found positive social validity and acceptability from the perspective of students, teachers, and parents. Transference of mindfulness applications from school-to-home was reported by both students and parents. This study provides a model for introducing mindfulness in the educational environment, with the potential for further student benefit when applied in all settings. Implications for future research include exploring different measures of impact and gaining further qualitative research from all stakeholder's perspectives.

Dedication

This dissertation is dedicated to my family. You are the reason I entered a career in education and this most recent endeavor. I will be forever grateful for your love, support, encouragement, and patience on this journey.

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Thank you to all who have supported me personally and professionally.

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Chapter I. Introduction

Background of the Problem

Why is it increasingly difficult for students to sustain attention while learning at school? Perhaps, attention, working memory, and cognitive flexibility need to be developed through intentional practices and interventions. These are known as the three pillars of executive functioning (EF). Executive functioning allows people to organize, plan and set goals, manage time, control impulses, and understand cause and effect relationships (Barrasso-Catanzaro & Eslinger, 2016; Diamond, 2013). The three core EFs work together to support higher executive functions of reasoning, problem-solving, and planning, which are synonymous with fluid intelligence (Diamond, 2013).

According to Barrasso-Catanzaro & Eslinger (2016), "Research has consistently demonstrated that EF skills may contribute to a youth's ability to sustain attention, inhibit impulsive behaviors, and disregard distractions in order to succeed academically and socially" (p. 114). Executive functioning skills are correlated with math and reading aptitude in school (Duncan et al., 2007). Inhibition and interference control will allow a student to maintain attention during instruction, stay on task to complete academic work, and disregard distractors that would make it difficult to learn and complete assignments. Working memory facilitates academic achievement through the ability to retain previously learned information, so the brain can manipulate and integrate new knowledge (Diamond, 2013). Inhibitory control, working memory, and cognitive flexibility make it possible for a student to develop appropriate social behavior. Inhibition allows people to choose how to react in a given situation, rather than relying on innate impulses to drive behavior (Diamond, 2013). This is important for a student when learning the accepted rules of society in different social settings (Barrasso-Catanzaro & Eslinger,

2016). Working memory assists in understanding cause and effect, in order to learn from mistakes. Cognitive flexibility allows people to gain new perspectives, which for a student could mean seeing a problem through another student's vantage point and developing empathy. Combining working memory and cognitive flexibility improves a student's ability to use symbolic thinking to consider different outcomes and consequences when choosing behavior (Barrasso-Catanzaro & Eslinger, 2016). The purpose of EF is to apply cognitive and emotional skills and decision-making, in an organized, effective manner to accomplish goals and a student needs EF for academic achievement, behavioral success, and appropriate socio-emotional development.

Many conditions can result in lower EF and deficits in inhibition and interference control, working memory, and cognitive flexibility. The disruption in the development of the prefrontal cortex can occur from conditions such as autism spectrum disorder (ASD), attention deficit/hyperactivity disorder (ADHD), traumatic brain injury (TBI), fetal alcohol syndrome (FAS), socioeconomic challenges, and emotional and physical abuse (Barrasso-Catanzaro & Eslinger, 2016; Flook et al., 2010). The implications of ASD stem from the altering of the prefrontal cortex, and impact the areas that control memory, attention, language, and EF (Barrasso-Catanzaro & Eslinger, 2016). Students with ADHD typically struggle in the areas of self-control, maintaining attention, and disregarding distractions, which are skills directly classified under the core EF of inhibition and interference control (Barrasso-Catanzaro & Eslinger, 2016; Diamond, 2013). The lack of financial resources in a home may account for a limited amount of cognitively stimulating materials for a student living in poverty, which may impact the development of EF skills (Finch & Obradovic, 2017). Students with poor EF development are more likely to struggle to maintain attention, manage impulsivity, and ignore

distractions, thus making it more difficult to achieve social and academic success (Barrasso-Catanzaro & Eslinger, 2016). Poor EF development requires treatment and interventions which could be provided by parents, teachers, and health care providers (Barrasso-Catanzaro & Eslinger, 2016). An easy-to-administer, cost-effective, and impactful intervention is needed.

Therefore, with the variety of situations in which students could potentially need development of EF skills, using mindfulness practices as an intervention could include all students, for universal benefit. Research on the addition of mindfulness as part of the instructional day for the development of EF skills is an emerging trend (Flook et al., 2010; Lam & Seiden, 2020; Thierry et al., 2016). Mindfulness has a variety of definitions, but is widely believed to have originated from religious practices of Buddhism (Kabat-Zinn, 2003; Stuart et al., 2017). Mindfulness practices can include meditation, yoga, breathing exercises, bringing awareness to the senses and Tai Chi (Flook et al., 2010; Sapthiang et al., 2019; Schonert-Reichl, et al., 2015). The above-mentioned practices can be easily incorporated into a school day during instructional time, transitions, or even special area classes such as music, art, or physical education, to meet the needs of all students.

Rationale & Significance of the Study

Recently, schools around the world experienced the impacts of interrupted traditional education beginning in the spring of 2020 in response to the COVID-19 pandemic. Over 90% of enrolled students worldwide transitioned to learning at home when schools completely shut down between March and April of 2020 (Jalongo, 2021). For the 2020-2021 school year, some public elementary schools were able to operate on a “business as usual” model with students attending in-person lessons five days a week. Other districts were conducting lessons virtually, and still others were working with a hybrid of the two approaches. Families and teachers have

expressed concerns for both short-term and long-term impacts to their students' academic and social-emotional success and the potential for widening the achievement gap particularly for struggling learners (Timmons et al., 2021). Student engagement was even more imperative, yet challenging as school professionals altered their instruction to meet the demands of virtual and hybrid instruction, and eventual transition back to traditional education. Furthermore, with the significant demands of common core standards and focus on high-stakes testing, teachers and students need meaningful, intentional instruction delivered within the confines of an already busy school day. Research shows that mindfulness is considered to be a simple-to-administer practice students are able to learn quickly for positive gains in academic achievement and prosocial behaviors (Black & Fernando, 2014; Flook et al., 2010; Harpin et al., 2014; Schonert-Reichl et al, 2015).

Student academic success, appropriate behavior, and proper socio-emotional development depend on EF skills; a student with poor EF development would find it challenging to sustain attention, manage impulsive behaviors, and disregard distractions, thus requiring interventions for success in school and ultimately adulthood (Barrasso-Catanzaro & Eslinger, 2016). Mindfulness practices are an effective intervention in addressing not only the needs of students with EF deficits, but all students. Reviews of available research to provide recommendations for implementing a school-wide mindfulness program found positive effects including cognitive improvement, stress resilience, improved executive functioning, fewer attention problems, and reduced anxiety (Sapthiang et al., 2019; Stuart et al., 2017). *MindUp*, an integrated program of mindfulness and social-emotional learning, found positive effects on EF development, stress management, social-emotional skills, and academic achievement (Harpin et al., 2016; Schonert-Reichl et al., 2015; Thierry et al., 2016). *Mindful Schools*, a program

implemented school wide, also yields effective results in paying attention, self-control, participation rates, and respect for others (Black & Fernando, 2014; Harpin et al., 2016). Sheinman et al. (2018) found that implementing the *Mindful Language* program long-term yielded the best results for students' responses of potentially using mindfulness-based coping strategies in stressful situations. Flook et al. (2010) examined the development of EF in children when trained to use mindful awareness practices and found students with poor EF skills benefit the most. Although positive results are found in multiple studies, research overwhelmingly indicates the need to further study these effects to gain empirical data with respect to mindfulness practices (Flook et al., 2010; Sapthiang et al., 2019; Schonert-Reichl et al., 2015; Sheinman et al., 2018; Stuart et al., 2017). For example, Sapthiang et al. stated, "However, notwithstanding these beneficial facets, there remains a need to conduct large-scale empirical investigations that seek to evaluate the effectiveness of school-integrated MBIs at a regional or national level," (Sapthiang et al., 2019, p. 117). Furthermore, Schonert-Reichl contended "Future research is needed to replicate the findings on EF and also to identify the "active ingredients" in the curriculum leading to these specific outcomes," (Schonert-Reichl et al., 2015 p. 62). Flook et al. suggested, "Further investigation of EF in elementary school samples would be useful to tease apart potential sources of variance," (Flook et al., 2010, p.80). Much of the current research spans a variety of demographics utilizing various mindfulness programs; however, most of the sample sizes are small, long-term effects have not been researched, much of the data is quantitative, and most research focuses on student impact within the school environment. Qualitative data from teachers, students, and parents could further enhance present research, and offer perspectives of how mindfulness impacts students outside of the educational setting.

The significance of this study was to contribute to ongoing research of the impact mindfulness interventions have on the development of EF skills in elementary students. This contribution may provide school professionals with efficient methods that can be easily integrated into the classroom for improved attention and self-control, potentially resulting in student academic gains and the development of prosocial behaviors.

Purpose of Study

The purpose of this research was to investigate the executive function skills of elementary students and the impact that short-term mindfulness-based practices had specifically on inhibition and interference control skills. This mixed methods study included gaining further quantitative data on the impact of mindfulness on executive functions through a behavior rating instrument and Stroop task. Secondly, qualitative data was collected through interviews and an open-ended survey to investigate student, teacher, and parent perspectives of mindfulness practices. This study included third grade students from a suburban elementary school in northwest Ohio.

Theoretical Framework

Mindfulness practices are considered to be personal, and individuals will experience subtle differences based on their own perspectives. Shonin et al. (2014) used interpretive phenomenological analysis (IPA) a process rooted in phenomenology and hermeneutics, to examine participant experiences of meditation awareness training (MAT). Phenomenology lends itself to gaining an understanding of student perspectives of mindfulness as they will be experiencing these phenomena firsthand. According to Merriam and Tisdell (2016), phenomenological interviews are the recommended method for gaining an understanding of those who have had direct experience with the phenomenon. Interpretive phenomenological

analysis was used in this research to collect, code, and analyze qualitative data from interviews of students and teachers, in addition to the open-ended surveys completed by parents.

Research Questions

To investigate the impact that a short-term mindfulness-based practice had on development of inhibition and interference control skills in elementary students, two research questions were developed:

1. What is the impact of a short-term mindfulness-based practice on inhibition and interference control in third grade students?
2. What are student, teacher, and parent perceptions of including mindfulness-based practices in a school setting?

Definition of Terms

Several relevant terms were used frequently in this study when discussing executive functioning skills and mindfulness practices. The following definitions listed provide clarity for this vocabulary.

Executive Functioning. Executive functioning is a set of effortful, mental skills needed to maintain one's attention and self-control (Barrasso-Catanzaro & Eslinger, 2016; Diamond, 2013). The three core EFs are inhibition and interference control, working memory, and cognitive flexibility (Diamond, 2013).

Inhibition and interference control. Inhibition and interference control is defined as controlling one's attention to focus on chosen stimuli, maintaining one's focus even with distractions from other stimuli, and regulating impulsivity (Diamond, 2013).

Working memory. Working memory is the ability to hold information in one's mind, manipulate, and apply it to future situations (Diamond, 2013).

Cognitive flexibility. Cognitive flexibility is one's ability to understand different perspectives, switch tasks, and problem solve with multiple approaches (Diamond, 2013).

Mindfulness. "An operational working definition of mindfulness is: 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).

Subjectivity & Researcher Positionality

The mixed methods research design allowed for research bias through the interpretation and analysis of qualitative data. Furthermore, the professional experience and preconceptions of the researcher also impacted the research bias in this study. As an educator who has worked with third-grade students for over 16 years, the researcher had a strong desire to find an intervention to assist students of this age in successful learning. More recently, an emphasis on social emotional learning has led to the focus of this research. The author's experience working with students in this age group and with instruction on social-emotional learning may have been an asset when implementing mindfulness interventions; however, these experiences may have also contributed to bias in assuming the interventions will result in positive impacts.

Within this research, multiple sources of bias within the methods included design bias, sampling bias, measurement bias, analysis bias, and theory bias. As the intervention provider and researcher, design bias towards naturally seeking confirmation of the hypothesis could have impacted the analysis of the results. Regarding sampling bias, a quasi-experimental design with a wait-list control group was implemented. Using convenience sampling with two intact classrooms since randomization was not possible, may have contributed to sampling bias. Although similarity between comparison groups could not be guaranteed, class lists were built to be as equitable as possible in regard to gender, race, ethnicity, academic ability, students with

disabilities, behavior, & socioeconomic status. Participants in the sample were representative of the larger population of the school and local community. As the intervention provider and researcher, the researcher was not blind to the study. To mitigate measurement bias, two standardized assessments were used to collect quantitative data. Classroom teachers provided ratings on student behavior so that an objective evaluation was provided. Potentially, as the intervention provider, the researcher may have had bias in support of the intervention. When analyzing qualitative data gathered through interviews & surveys, the researcher may have naturally looked for data that could be coded as positive responses to the intervention. To mitigate analysis bias, the researcher actively sought out the negative responses in the qualitative data. In terms of theory bias, there is research supporting the idea that mindfulness has positive effects. In contrast, executive function skills are not fully developed until the prefrontal cortex is fully developed (Barrasso-Catanzaro & Eslinger, 2016). This information mitigates the potential outcomes, so objectivity in regard to theory bias was moderated.

Chapter II. Literature Review

It is increasingly difficult for elementary students to sustain attention while learning at school. With the wide variety of factors that could be causing this challenge, development of executive functioning skills may streamline efforts to improve inhibition and interference control. Research on incorporating mindfulness practices within education is emerging (Flook et al., 2010; Lam & Seiden, 2020; Ritter & Alvarez, 2020; Thierry et al., 2016; Van De Weijer-Bergsma et al., 2012). This study will examine the impact of mindfulness on the development of executive functioning skills in elementary students. Insight gained through such a study would be useful to educators seeking a simple-to-administer intervention that can be incorporated into an already busy school day.

A primary computerized literature search was conducted to identify and collect relevant research articles using *Academic Search Complete*, *APA PsycInfo,* and *ERIC* through *EBSCOhost*. General search criteria included peer-reviewed reports published in English from 2000 to 2022 as the primary sources of data. Initial search terms included *mindfulness* or *mindfulness interventions* and *executive functioning* or *executive functioning interventions* and *elementary students* or *primary students.* These initial search terms yielded 15 articles, so the search was broadened to the terms of *mindfulness* or *mindfulness interventions* and *elementary* or *primary students*. The broadened search terms yielded one-hundred twenty-four articles of which inclusion and exclusion criteria were applied. Inclusion criteria included literature on incorporating mindfulness practices within schools and research focused on mindfulness impacts on attention, behavior, and executive functioning skills with general education elementary students 5-12 years of age. Exclusion criteria included research conducted outside of the school setting, participants outside of the inclusionary age range, and research focused solely on the

impact of mindfulness interventions on measurements outside of the scope of this research such as emotion regulation, creativity, eating habits, and motor development. A separate search was conducted to identify relevant data regarding interventions on executive functioning skills. The search terms *executive function interventions* or *inhibition interventions* or *interference control interventions* and *elementary students* or *primary students* yielded 22 peer-reviewed articles in which inclusion and exclusion criteria were applied. Inclusion criteria included research focused on interventions in executive function skills, inhibition skills, or interference control with general education elementary students 5-12 years of age. Exclusion criteria included research conducted outside of the school day, participants outside of the inclusionary age range, and research focused on the impact of interventions on measurements outside of the scope of this research such as the development of motor skills, reading ability, and math skills. Secondary literature searches were conducted by identifying additional relevant sources that were referenced in the primary research articles. One exception was made to include research that included preschool students due to the long-term nature of the study as students transitioned to kindergarten, which was an inclusionary age group for this research. After excluding duplicated research, 23 articles were found relevant to this study; 17 studies which contain empirical research. The literature searches were conducted from June 2020-June 2022, to capture all relevant research available.

The purpose of the research is to review the current literature regarding the use of mindfulness on developing executive function (EF) skills in elementary-aged students. This literature review will examine literature on mindfulness practices, the role of mindfulness in schools, research on mindfulness interventions, interventions on the development of executive functioning, and using mindfulness as an intervention to develop executive functioning in elementary-aged students.

Mindfulness Practices

Mindfulness is most notably 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). Mindfulness practices include activities such as breathing exercises, yoga, meditation, mindful body scan exercise, and bringing awareness to the senses (Flook et al., 2010; Renshaw & Cook, 2017; Sapthiang et al., 2019; Schonert-Reichl, et al., 2015). Mindfulness-based interventions (MBIs; Sapthiang, 2019) is an overarching term which include the following practices: mindfulness-based stress reduction (MBSR; Kabat-Zinn, 2003), mindfulness-based cognitive therapy (MBCT; Felver et al., 2013), and meditation awareness training (MAT; Shonin et al.; 2014). Originally developed in 1979, MBSR was intended to relieve suffering from stress, pain, and illness through intense meditation (Kabat-Zinn, 2003). Mindfulness-based stress reduction is typically an 8-week training designed to teach mindfulness techniques (mindful breathing, body-scan exercises, and mindful stretching) that can be used in everyday life (Felver et al., 2013). Mindfulness-based cognitive therapy is a derivative practice of MBSR that includes principles of cognitive behavior therapy to help individuals become aware of negative response patterns which can be altered by behavioral therapy techniques (Felver et al., 2013). Meditation awareness training is an intensive intervention that includes broader traditional Buddhist practices (Shonin et al., 2014). Typically conducted with older students and adults, mindfulness is one component of this intervention rather than the sole focus. Mindfulness-based interventions have been researched thoroughly with adults and are currently gaining empirical evidence for use with students (Flook et al., 2010; Schonert-Reichl et al., 2015; Shonin et al., 2014; Stuart et al., 2017).

Mindfulness in Schools

For successful implementation, peer-reviewed literature suggests specific recommendations for including mindfulness programs school-wide. Positive effects include cognitive improvement, stress resilience, improved executive functioning, fewer attention problems, and reduced anxiety (Felver et al., 2013; Sapthiang et al., 2019; Stuart et al., 2017). Felver et al. (2013) suggested incorporating mindfulness practices into already existing social-emotional learning curriculums to "enhance the intervention's effectiveness and also promote generalizations on skills," (p. 536). Another advantage to implementing a school-wide approach is presenting the mindfulness-based practices in a less-threatening manner, rather than singling out those that need intervention, and potentially subjecting those marginalized students to therapy sessions which may bring up traumatic past experiences (Stuart et al., 2017). Stuart et al. (2017) further argued that mindfulness exercises are a "strength-based intervention rather than one focused on pathology," (Stuart et al., 2017, p. 19) making it a more proactive than reactive approach to addressing the needs of all students. This literature suggests including mindfulness-based practices for an entire school to yield positive results with an inclusive approach. In contrast to Stuart et al. (2017), Sapthiang et al. (2019) offered suggestions supporting using MBIs to promote resiliency and treatment for adolescents directly struggling with mental health problems. Much like Stuart et al. (2017) though, Sapthiang et al. (2019) also provided suggestions for designing, implementing, and evaluating a school-based mindfulness intervention program, agreeing with the benefit of using it universally with all students.

Literature also supports using MBIs at the Tier 2 and 3 levels. Felver et al. (2013) and Sapthiang et al. (2019) make four recommendations: (1) creating a safe space; (2) involving multiple staff for optimal support; (3) scheduling time out-of-class for more intense intervention

so that trust can be built between the program facilitator and students; (4) altering curriculum with minor changes to meet the specific needs of the participants. Students with anxiety, chronic pain, attention deficit hyperactivity disorder, depression, and externalizing behaviors can benefit from targeted small-group mindfulness sessions when symptom reduction occurs after learning mindfulness techniques (Felver et al., 2013). Using a mindfulness-based approach that has already been studied and validated and ensuring that staff conducting the interventions is properly trained, is also recommended (Sapthiang et al., 2019). Although this literature provided recommendations for implementing a school-based mindfulness intervention program and the potential benefits, the information is theoretical and further evidence is needed. More large-scale research is necessary to gain empirical data to determine the positive effects on student academic achievement and social success. There is a wide variety of research on the impacts of specific mindfulness-based programs on the development of attention, behavior, and academics, but studies on the development of EF skills, as a whole, are currently emerging.

Impacts of Mindfulness-Based Interventions on Behavior and Academics

The majority of research for mindfulness interventions focuses on behavior skills and stress management, while a limited number of studies include measures of academic progress. Common research designs include collecting quantitative data through experimental studies, but the mindfulness programs, intervention delivery, data measures, and results range widely. Limited qualitative data has been collected throughout the following research studies.

Napoli et al. (2005) was one the of the first to research the impact of a mindfulness-training program, *The Attention Academy*, on the attention and anxiety management skills of elementary students. A total of 194 first, second, and third grade students were included in this study. Mindfulness lessons were provided to a randomized experimental group of 97 students

during physical education classes for 45 minutes, twice per month for a total of 12 sessions. The control group of 97 students read or completed other quiet activities in a separate classroom during this time. The mindfulness lessons were taught by trained, experienced instructors. Their study collected data on selective (visual) attention and sustained attention through the *Test of Everyday Attention for Children (TEA-Ch)*. The *ADD-H Comprehensive Teacher Rating Scale (ACTeRS)* was also used to assess classroom behaviors and evaluate individual student behavior. The *Test Anxiety Scale (TAS)* was adapted from a true/false version to a 4-point Likert-type format, and focused on (1) self-evaluation, (2), worry, (3) physiological reactions, and (4) concerns about time limits or constraints. SPSS-Compare Means were used to analyze the data set for each group on pairs of pre-test and post-test difference scores. Paired t-tests were conducted for each group and results for the TEA-Ch selective attention subscale were $t_{(diff)}$ =7.94 with a p-value < 0.001 and Cohen's d = 0.60, the ACTeRS Attention Subscale were $t_{(diff)}$ =,-8.21 with a p-value < 0.001 and Cohen's d = 0.49, and the ACTeRS Social Skills Subscale were $t_{(diff)}$ = -7.19 with a p-value < 0.001 and Cohen's d = 0.47. These indicated positive effects for the experimental group; however, no significant differences were measured for the sustained attention scale (Napoli et al., 2005). Researchers found it difficult to find instruments that were appropriate to measure attention traits for students that did not have ADHD and the authors recommended including both the classroom teacher and a trained instructor so that the teacher may be trained simultaneously, and more residual effects could occur.

Since Napoli et al.'s study, further research of the effects of mindfulness on attention, behavior, and academics has emerged. Carboni et al. (2013) conducted a single subject design of four 8-year-old males with a primary diagnosis of ADHD. Participants were provided mindfulness training from a trained school psychologist for 30-45 minutes twice per week until

improved behavior allowed for cessation of the program. The intervention was partially based on a MSBR approach developed specifically for children. Instruments used were the BASC-2 and the Behavioral Observation of Students in Schools (BOSS; Shapiro, 2004a), specifically the subcategories of *active engaged time* (AET) and *passive engaged time* (PET). Observations were conducted three times per week for 15 minutes in the academic area in which behavioral difficulties occurred most often to collect percentage interval data. Regarding BOSS results, participant 1, following three intervention sessions, on-task behavior increased from 40.76% to 60%, and was at 49% at the follow-up which was two weeks after cessation of the intervention (Carboni et al., 2013). For participant 2, following 17 sessions, the percentage increased from 45% to 60%, and was 56.5% at follow-up. For participant 3, after 15 intervention sessions, the percentage of intervals of on-task behavior improved from 46% to 62%, and was 60% at the follow-up. For participant 4, after four sessions, the percentage increased from 54.8% to 75%, and was 68% at the follow-up (Carboni et al., 2013). Regarding the BASC-2 results, ratings showed a decrease in hyperactive behaviors, but improvement in pre- and posttest ratings on the Attention Problems Scale were not significantly quantified (Carboni et al., 2013). These results indicate conflicting outcomes between the two measurements regarding attention skills, and Carboni et al. commented on many limitations including accounting for medication administered or missed dosages, and the lack of generalizability in a single-subject methodology.

In contrast to Carboni et al., Black & Fernando (2014) conducted a larger-scale study when they examined the effects of the 5-week *Mindful Schools* (MS) program on classroom attention and behavior. The participants were 409 students in grades kindergarten through 6th at a school in Richmond, California. All classrooms were randomly assigned to receive the regular MS curriculum for the 5 weeks, or the *Mindful Schools* plus (MS+) which provided an additional

7 weeks of classes for a total of 12 weeks. The instructors were trained, experienced meditation teachers, but the classroom teachers also participated in the lessons. The Student Behavior Rubric by Kinder Associates, LLC (2007) was used to assess four categories of behavior rated by the teacher at three different times (pre-intervention, posttest, and follow-up after the additional 7 weeks). Students were rated on (1) paying attention, (2) self-control, (3) participation in activities, and (4) caring and respect for others. Each item is ranked on a Likert-like scale, 0-4, with higher scores indicating more positive behavior. Analyses were performed in SPSS version 20 (IBM Corp., Armonk, NY). Cohen's d was calculated adjusting for the dependence of observations. Teacher-reported improved outcomes for both groups from pre- to post-intervention for paying attention (MS group: M = +.32, $p < .01$, Cohen's $d = .42$; MS+ group: M = +.25, $p < .01$, Cohen's $d = .33$), self-control (MS group: M = +.34, $p < .01$ and Cohen's $d = .43$; MS+ group: M = , $p < .01$, Cohen's $d = .42$), participation (MS group: M = +.28, $p < .01$, Cohen's $d = .37$; MS+ group: M = +.34, $p < .01$, Cohen's $d = .45$), respect for others (MS group: M = .20, $p < .05$, Cohen's $d = .25$; MS+ group: M = .24, $p < .01$, Cohen's $d = .33$), and the sum of scores (MS group: M = +1.14, $p < .01$, Cohen's $d = .50$; MS+ group: M = +1.16, $p < .01$, Cohen's $d = .52$). Results indicate that from baseline to immediate posttest after the initial 5 weeks, all four categories for student behaviors improved, however the added sessions did not show a significant effect, except that paying attention continued to increase slightly (Black & Fernando, 2014). Limitations of this study were that no control group without any mindfulness intervention was used as a comparison group, teachers were not blind to the intervention, and in fact participated in the lessons themselves (Black & Fernando, 2014). This could provide an advantage in the generalization of the mindfulness practices into the regular classroom, but also

increases potential bias. Another limitation of this study was the use of only one reporting measure since data was collected on such a large sample.

Similar to Black & Fernando, Harpin et al. (2016) used the *Mindful Schools* program, however blended it with another mindfulness program, *MindUp,* in a pilot study. Harpin et al.'s research studied the impact of mindfulness on elementary students' prosocial behaviors, emotion regulation, and academic achievement. In the experimental design, one group of 18 fourth-grade students received 10 weeks of the mindfulness training delivered two times each week for 20-30 minutes by a certified mindfulness instructor, while the comparison group of 12 fourth-grade students participated in business-as-usual morning check-in routines. Unlike previous studies, both quantitative and qualitative data were collected from three surveys: The *FasttrackTeacher Social Competence Survey* (FTSC), the *Child Assent Mindfulness Measurement Survey* (CAMM), and the *Mindful Schools Survey*. Factor analysis and Cronbach's alphas were conducted on all scales to verify the original FTSC cohort data and paired student's t-tests for across-group and within-group analyses as items were deemed normally distributed for the FTSC and CAMM scores. Frequencies and univariate statistics were used for items in the Mindful Schools Survey and the researchers also provide qualitative examples of responses from the open-ended questions. The intervention group saw statistically significant increases in every category of the FTSC, while the comparison group scores did not reach significance. For within-group analyses at post-intervention, statistically significant increases in prosocial behaviors (mean change= -2.19, p= 0.00), emotional regulation (mean change- -0.98, p=0.00), and teacher's report of academic achievement (mean change= -1.33, p=0.00) occurred, while the comparison group scores did not reach significance for prosocial behaviors (mean change = -0.49, p= 0.07), emotional regulation (mean change= 0.19, p= 0.53), and teacher's report of

academic competency (mean change= -0.15, p= 0.61) (Harpin et al., 2016). Cohen's d was calculated by the researcher based on pooled standard deviation for each category and found effect size to be significant for prosocial behaviors (*d*= 2.15) and emotional regulation (*d*= 1.78) and academic competency (*d*= 1.00). There were no significant differences in baseline, or post-intervention outcomes for the CAMM within the intervention group (mean difference= 0.11, p= 0.69) as compared to the comparison group (mean difference= 0.33, p= 0.08). Sample responses from the Mindful Schools Survey were reported, however no thematic coding of these responses was provided within the study. Students and teachers in the experiment group reported improvement in prosocial behaviors, emotion regulation, and academic competence (Harpin et al., 2016). Although the sample responses provided were positive, the lack of qualitative coding is a limitation of this study.

Tarrasch (2018) researched the impact of a mindfulness workshop adapted for children from the MBSR method. One-hundred one third, fourth, and fifth grade students were included in the study. The experimental group consisted of 58 fourth graders who participated in the 10-week mindfulness workshop which consisted of games and exercises centered on breathing awareness, mindful eating, walking meditation, listening to the here and now, basic yoga, imagining one's own safe and peaceful place, and meditation bubble. Computerized Performance Task (Rosvold et al, 1956) and Conjunctive Visual Search Task (Treisman & Gelade, 1980) measures were used to collect data on the sustained and selective attention of elementary students. With age as the covariate, differences were assessed between the two groups in the pre-measures with one-way ANCOVAs. Repeated measures of ANCOVAs were performed to assess the effects of the workshop on sustained and selective attention between the two groups, before and after the workshop, controlling for age. Regarding sustained attention, a significantly larger

decrease in the percent of commissions in the mindfulness group occurred from pre- to posttest as compared to the control group ($F(1,90) = 5.93$, $p < .05$). Tukey's HSD revealed a significant reduction in the commissions rate in the mindfulness group only ($p < .001$, Cohen's $d = 0.89$). No significant differences occurred for the percent of omissions or standard deviation of response time. Regarding selective attention, there was higher accuracy in the mindfulness group as compared to the control group for trials including 8 displays, with ($F(1,90) = 4.38$, $p < .05$) and without target ($F(1,90) = 4.57$, $p < .05$). No significant differences occurred for trials including 16 or 32 displays. Results indicate an improvement in attention as measured by both assessments for the experimental group, although natural maturation was also considered (Tarrasch, 2018). Limitations of the study include the differences in age between the experimental and control groups and the lack of data collected from teachers or parents (Tarrasch, 2018). The use of a computerized program, however, provides strong quantifiable data. The mindfulness intervention is developmentally appropriate for elementary students and a strong example of including all senses within mindful practices.

Similar to Tarrasch (2018), Suarez-Garcia et al. (2020), studied the impacts of mindfulness practices on students aged 7-10 years. Classroom teachers were trained to provide direct delivery of the *MindKeys Training,* during an 8-week intervention to 73 students. The researchers used a switching replications design for the experimental (EG_1) and control (EG_2) groups. Data instruments were attention problems, self-control deficits, and aggressiveness subscales collected from the Evaluation System for Children and Adolescents (SENA) which were completed by the teachers. Both groups showed a decline in attention problems (EG_1: $t = 4.364$, $p < 0.001$, Cohen's $d = 0.446$; EG_2: $t = 4.878$, $p < 0.001$, Cohen's $d = 0.385$) and self-control deficits (EG_1: $t = 7.388$, $p < 0.001$, Cohen's $d = 0.965$; EG_2: $t = 5.863$, $p < 0.001$,

Cohen's $d = 0.614$), as compared to their baseline scores, however no significant change occurred for aggressiveness (EG_1: $t = -0.560$, $p < 0.575$, Cohen's $d = 0.062$; EG_2: $t = -2.325$, $p < 0.020$, Cohen's $d = 0.151$) (Suarez-Garcia et al., 2020). Improvements in self-control over time however were not sustained and even worsened slightly as the initial experimental group showed signs of an increase in self-control deficits once the follow-up data was collected (Suarez-Garcia et al., 2020). This experimental design is a strong example for using a wait-list control group and including lasting effects tested on the first experimental group.

More recently, Sciutto et al. (2021) investigated the effects of an 8-week mindfulness program using combined lessons from *MindUp* and *Mindful Schools* with 136 students in kindergarten through second grade. Using a quasi-experimental pretest-posttest design with a delayed intervention group model, the research focused on teacher ratings of student behavior as measured by the Strengths and Difficulties Questionnaire (Goodman, 1997). Results indicated an increase in students' prosocial behavior as rated by the teachers $F(1,95.84) = 22.43$, $p < 0.001$ and teacher ratings of externalizing behaviors decreased $F(1,92.87) = 6.16$, $p = 0.015$. Teacher ratings of students' internalizing behavior $F(1,85.46) = 1.73$, $p = 0.192$ did not reach a level of significance. The authors concluded there was a positive but small to moderate effects with a decrease in students' externalizing behaviors of hyperactivity and conduct problems and an increase in prosocial behaviors (Sciutto et al., 2021). Overall, data showed the greatest effects in first-grade students, with the least amount of change measured with kindergarten students (Sciutto et al., 2021). Although measures of fidelity implementation were included in this study, limitations of the research include potential rater bias and only one measure of data (Sciutto et al., 2021).

Although much of the research on mindfulness practices provides support for using this intervention to improve behavior skills and academics; research specifically conducted on the development of executive functioning skills could provide empirical support for including mindfulness practices in a school's core curriculum for academic, behavioral, and social success. Studies are currently emerging for this research.

Executive Functioning Interventions

Research indicates a variety of interventions used to improve EF skills. These include computer-based training, games, exercise, martial arts, mindfulness, and school curricula (Diamond & Lee, 2011; Benzing et al., 2019; Flook et al., 2010; Schmidt et al., 2015). Computer-based training is among the most heavily researched and has been found to be successful in improving working memory and cognitive flexibility, however there is limited success with developing inhibition (Diamond & Lee, 2011; Benzing et al., 2019). Benzing, et al., (2019) studied the impacts of a game-based cognitive intervention to improve EF in elementary students. Participants were 118 students ages 10-12 years from eight classrooms in which half of the students served as the experimental group and the other half were a wait-list control group. Students were administered computerized assessments using E-Prime Software (Psychology Software Tools, Pittsburgh, PA, USA) before and after the six-week intervention. The experimental group participated in two 30-minute sessions of board or card games which increased with difficulty over the six weeks to enhance the cognition required to play. One-tailed ANCOVAs, using pre-test performance as covariates and post-test performance as dependent variable, were conducted separately for each computerized test. Results indicated an improvement in the intervention group for updating ($F_{1,115} = 3.42$, $p = .034$, $\eta^2_p = .029$) and shifting ($F_{1,115} = 7.54$, $p = .004$, $\eta^2_p = .062$), but there were no significant differences found for

inhibition ($F_{1,115} = 0.45$, $p = .252$, $\eta^2_p = .004$). (Benzing et al., 2019). The outcomes of this study indicate that EF can be improved in older elementary students, but success is limited to improving working memory and cognitive flexibility.

Schmidt et al. (2015) investigated the effects of physical activity on EF skills in 181 students ranging from 10-12 years of age in a 6-week study. Students were divided into three groups consisting of a "Team games" group which involved high aerobic and cognitive engagement, an "Aerobic exercise" group which involved high aerobic, but low cognitive engagement, and a "Control condition" group which involve typical physical education lessons. At baseline there were no significant differences between the three experimental conditions with respect to age, gender distribution, children with ADHD, pubertal status, socioeconomic status, body mass index, academic achievement, and aerobic fitness. While a battery of assessments was completed with regards to background variables at baseline, EFs were measured using E-Prime Software (Psychology Software Tools, Pittsburgh, PA) and child-adapted Flanker tasks (Jäger et al., 2014). From pre- to post-test, results indicated improvement in shifting for the Team games (M= -202.63, SD= 217.52) and Aerobic exercise (M= -125.90, SD= 184.72) as compared to the Control condition (M= -107.28, SD= 209.61). Results for updating and inhibition did not reach significance for all three treatments (Schmidt et al., 2015).

Meijer et al. (2021) studied the effects of aerobic versus cognitively demanding exercise interventions on EF in a randomized controlled study of 856 third and fourth grade students. Students were divided into aerobic intervention, cognitively demanding exercise intervention, and control groups for a 14-week period. Measures included a Stop Signal Task, Grid Task, Digit Span, WISC-III Information and Block Design, and Attention Network Test. The authors hypothesized that the aerobic and cognitively demanding exercise groups would show greater

improvement in neurocognitive functioning than the control group, with the cognitively demanding exercise group showing the greatest improvement in EF. Results of linear mixed model analysis comparing the three groups on the neurocognitive function components are as follows: information processing and control d= 0.001, interference control d= 0.040, attention accuracy d= -0.40, visuospatial working memory d= -0.024, verbal working memory d= 0.028, and attention efficiency d= -0.002. According to Meijer et al. (2021), no significant effects were detected between the exercise groups and the control groups. Evidence from the aforementioned studies would suggest that impacts of physical activity on development of EF skills is inconclusive and more research is needed to find interventions for specifically developing inhibition and interference control.

Impacts of Mindfulness-Based Interventions on Executive Functioning

Flook, et al. (2010) researched the impact of mindful awareness practices (MAPs) on the development of executive functions (EF) in children. The authors developed an experimental study with 64 second and third grade students. The experimental group was provided MAPs training, while the control group was given silent reading time, for a period of 8 weeks. Teachers and parents completed the Behavior Rating Inventory of Executive Functioning (BRIEF) prior to the program, and upon completion of the 8-week training. A multivariate analysis of covariance (MANCOVA) was performed with teacher rating posttest scores for the Metacognition Index $F(1,63) = 6.94$, $p = .011$, Behavioral Regulation Index $F(1,63) = 5.45$, $p = .023$, and Global Executive Composite $F(1,63) = 13.63$, $p < .001$, as outcome variables. Similarly, a MANCOVA was performed with parent rating posttest scores for the Metacognition Index $F(1,63) = 6.18$, $p = .016$, Behavioral Regulation Index $F(1,63) = 8.97$, $p = .004$, and Global Executive Composite $F(1,63) = 8.31$, $p = .006$, as outcome variables. Cohen's d was calculated between groups by the

researcher based on Flook et al's (2010) teacher-rated results for the Metacognition Index (pretest d = 0.21; posttest d = 0.33), the Behavioral Regulation Index (pretest *d* = 0.37; posttest *d* = 0.49), and the Global Executive Composite (pretest d = 0.31; posttest d = 0.45). The results show that students with initially lower rates of EF, improved this after the MAPs training, as compared to the control group (Flook, et al., 2010). MAPs training did not show a discernable difference in children scoring a higher or average EF on the initial questionnaire. The correlation between the teacher and parents' observations further supports that the introduction to MAPs, through developmentally appropriate activities and games, could be a valuable tool in increasing executive functioning in elementary students (Flook et al., 2010). Flook et al. (2010) indicated that mindfulness training may improve executive functioning, metacognition, and self-regulation for students who have deficits in these areas, but further research may need to be done to see the effects of using it as a Tier 1 behavior support.

Schonert-Reichl et al. (2015) researched the impact of an integrated Social-Emotional Learning (SEL) and mindfulness program, on EF, stress management, social-emotional skills, and academic competence. The authors developed a randomized controlled trial with 99 children from four classrooms of fourth and fifth graders. Two classrooms were provided the intervention program MindUp, while the other two classrooms (BAU) were provided the district's typical social responsibility program. The programs were implemented for twelve weeks, and results were collected through a variety of measures including computer-based EF assessments, salivary cortisol samples to detect stress levels, multiple self-reported surveys completed by the participants, peer-reported socialization surveys, and end-of-the-year math grades reported by the teachers. Percentage of correct responses and reaction time (RT) in milliseconds were analyzed. On the flanker switch trials, students in the MindUp scored 86% while the BAU group scored

87% for accuracy. However, students in the MindUP group showed shorter RTs than the BAU group, $F(1, 92)$ 4.32, $p = .04$, $d = -.21$. Although percentage of accuracy on the flanker versus reverse flanker trials (MindUp: 91%; BAU: 91%), and hearts and flowers congruent versus incongruent trials (MindUp: 84% ; BAU: 80%) showed little difference, the MindUp group also outperformed the BAU group for RT on the incongruent flanker and reverse flanker trials as well $F(1, 92)$ 5.54, $p = .02$, $d = .31$. In summary, the results show there was no significant difference for EF in regard to accuracy, however the faster response time calculated on the computer-based assessments may indicate a greater ability to selectively attend and inhibit distractions for those who had completed the MindUp program (Schonert-Reichl et al, 2015). Salivary cortisol results were ambiguous because both groups had similar pre-test levels, however levels differed between the groups during different times of day during the post-tests, resulting in conflicting outcomes. The child self-reported questionnaires showed a significant improvement in empathy, perspective-taking, optimism, emotional control, school self-concept, and mindfulness, for the children engaged in the MindUp intervention, contrasting with the results from the students in the control group (Schonert-Reichl et al, 2015). Likewise, the participants from the MindUp group displayed a decrease in depressive symptoms, but the control group did not. Data from the peer surveys of prosocial behavior indicated improvements in all areas for students completing the MindUp program, while those who participated in the typical social responsibility program showed they were liked less by peers on the post-test (Schonert-Reichl et al., 2015). Data analyzed from the end-of-year math grades indicated a trend of higher scores from the group who participated in the MindUp intervention. These results indicate that mindfulness training included in a social emotional learning program may provide significant improvement in executive functioning, positive behavior, and cognitive skills. A strength of this study is the

multiple measures of data, and the results indicate positive outcomes with this small study, but further research is needed to see the effects in a larger sample.

Similar to Schonert-Reichl et al., Thierry et al. (2016) also used the MindUp program, but with prekindergarten students to study the effects of executive functioning and language skills. A quasi-experimental design was used with two cohorts of students, one serving as the experimental group, while the other was the control group. Quantitative data were collected on the 47 participants during their prekindergarten and kindergarten years. The experimental group was provided the mindfulness-based intervention, MindUp, for 15 lessons that were 20-30 minutes each, over the span of the entire prekindergarten school year. Core breathing practices were continued in kindergarten for the experimental group. The Behavioral Rating Inventory of Executive Functions for Preschoolers (BRIEF-P), and Peabody Picture Vocabulary Test (PPVT-4) were completed at the beginning and end of their prekindergarten year. Istation's Indicators of Progress (ISIP) Early Reading Assessment was administered at the end of their kindergarten year. According to the teacher BRIEF-P the MindUP program had a positive effect on executive function skills, especially with the working memory and plan/organize scales as the experimental group saw a decrease in scores, while the control group saw an increase (WM: MindUp d = -0.41; BAU d = 0.71; Plan/organize: MindUp d = -0.54; BAU d = 0.58) (Thierry et al., 2016). All students showed growth in receptive vocabulary according to the PPVT-4 results. In addition, students in the MindUp cohort scored higher at the end of their kindergarten year on the ISIP reading assessment as compared to the BAU group (Thierry et al., 2016). This research is an example of a long-term study and was able to show benefits with continued mindfulness practices. Limitations include the small sample size and lack of generalizability, so future studies with larger samples sizes is recommended (Thierry et al., 2016). Another limitation of the study

includes possible bias of the teachers' ratings on the BRIEF-P since they were the implementers of the curriculum.

Ritter & Alvarez (2020) researched the impact of a simple, web-based mindfulness program, Mind Yeti, on EF on 177 third, fourth, and fifth grade students. A quasi-experimental design was used with the Executive Function Student Questionnaire (EFSQ), a self-report measure consisting of 18 Likert scale questions adapted from the Behavior Rating Inventory of Executive Functions- Adult Version and the Executive Function Skills Questionnaire (Dawson & Guare, 2009). The Mind Yeti curriculum consisted of 30 (5-7 minute) lessons delivered twice each day for 6 weeks. Paired-sample t-tests were used to assess the significance of pretest–posttest changes in EF subdomain scores. Using Cohen's *d*: small effect 0.2; medium effect = 0.5; large effect = 0.8; results indicated improvements in three of the EF areas: inhibition (*d*= 0.40), cognitive flexibility (*d*= 0.30), and working memory (*d*= 0.30) (Ritter & Alvarez, 2020). The Mind Yeti program is cost effective, developmentally appropriate, and easy to implement as teachers would not need any formal training; however, this conflicts with the recommendation of Kabat-Zinn (2003) that those administering mindfulness interventions should be practitioners themselves. Data was also collected from self-report measures which could be biased.

All of the aforementioned studies include quantitative data regarding the impact of mindfulness interventions on executive functioning in elementary students, however there was a lack of qualitative data. Perceptions of the inclusion of mindfulness practices within the school day could strengthen the use of this intervention in schools for positive benefit.

Perceptions of Mindfulness from Students and Teachers

One example of qualitative data collected within a mindfulness study is exemplified by Sheinman et al. (2018) when they reviewed the effects of using mindfulness with a whole-school

approach. Implementation of the Mindful Language program, which was designed as part of the whole school mindfulness in education model, was compared between three Israeli public schools containing 646 students ranging in age from 9-12 years old. One school had been using Mindful Language for 13 years, while the second school had completed its first year of the program, and the third school was used as a control group as they had not adopted the program yet. Evaluators used qualitative thematic coding to analyze student responses from an open-ended questionnaire to determine the propensity to use mindfulness practices in challenging situations. The results indicate that the school with the longest-standing experience using the Mindful Language program had the strongest correlation with student responses reflecting the use of mindfulness-based coping strategies (Sheinman et al., 2018). The school that had completed one year of implementation showed a higher tendency for mindfulness-based responses as compared with the control group (Sheinman et al., 2018). The responses were also analyzed for trends relating to age and gender differences. Ten-year-old children showed the greatest use of mindfulness-based strategies, and girls had a higher propensity than boys, no matter the age (Sheinman et al., 2018). The results support long-term positive trends when using mindfulness school-wide, with an emphasis on the correlation between years of practice and the disposition for using these techniques when responding to stressful situations. Student perceptions were gained through this research; however, teachers and parents were not included in this study to gain their perspectives.

Similarly, McCabe et al. (2017) conducted a qualitative study to gain student perceptions after the implementation of a 6-week mindfulness program. A sample group of 30 students aged 9-12 years were selected from the 96 students who participated in the mindfulness lessons. Individual semi-structured interviews with open-ended questions were conducted with

participants after the completion of the program. Thematic analysis was conducted with external consultation as a validation measure. Common themes identified that mindfulness "is good," "helps with relaxing," and participants reported feeling better, having more confidence, and less conflict after completing the program (McCabe et al., 2017, p. 5). Like Sheinman et al. (2018), student perceptions were gained, however teacher and parent perspectives were not included in this study.

Dariotis et al. (2017) explored the implementation factors, from the teachers' and students' perspectives, of a school-based mindfulness and yoga program through qualitative means. Inductive coding and thematic analysis were conducted to identify four broad themes: program delivery, implementer communication with teachers, promoting program buy-in, and instructor qualities. These themes led to the following specific suggestions: (1) mindfulness opportunities should be incorporated into physical education or health curriculum so that they do not conflict with times such as lunch or special area classes (art, music, library, etc.); (2) communication with teachers regarding the program's goals, information concerning students, and the logistics of the program were also identified as essential for teacher support; (3) promoting the generalization of skills in the classroom; (4) providing teacher training; (5) beginning the program at earlier grades (Dariotis et al., 2017). Dariotis et al.'s research provides teacher and student input; however, it does not include parent perspectives. Further qualitative research combining student, teacher, and parent perspectives would provide stronger support for mindfulness implementation in schools.

Table 1
Summary of Mindfulness and Executive Functioning Interventions

Study	Intervention & Focus	Participants	Duration/ Frequency of Intervention	Measure	Quantitative Findings
Napoli et al., 2005	Mindfulness on Attention & Anxiety Skills	n = 97; age= 6-9 years	45 mins/ 2x per month/12 sessions	TEA-Ch Selective Attention Subscale; ACTeRS Attention Subscale	Selective Attention *d*= 0.60 Attention *d*= 0.49
Carboni et al., 2013	Mindfulness on Behavior	n = 4; age= 8 years	30-45 mins/ 2x per week until improvement was made/ range of 3-17 sessions	BASC-2; BOSS	% On-Task Increase Participant 1 = +8.24% Participant 2 = +11.5% Participant 3 = +14% Participant 4 = +13.2%
Black & Fernando, 2014	Mindfulness on Attention & Behavior	n = 409; age= K-6 grade	(MS) 15 mins/ 3x per week/5 weeks/ 15 sessions (MS+) 15 mins/ 3x per week for 5 weeks/ + 15 mins 1x per week for 7 additional weeks/22 session	Student Behavior Rubric	MS group: Attention *d*= 0.42 Self-Control *d*= 0.43 MS+ group: Attention *d*= 0.33 Self-Control *d*= 0.42
Harpin et al., 2016	Mindfulness on Behavior, Emotion, & Academics	n = 30; age= 4th grade	20-30 mins/ 2x per week/10 weeks/20 sessions	FastTrack Teacher Social Competency Scale (FTSC)	Prosocial Behaviors *d*= 2.15* Emotional Regulation *d*= 1.78* Academic Competency *d*= 1.00*
Tarrasch et al., 2018	Mindfulness on Attention	n = 101; age= 3rd, 4th, & 5th grade	45 mins/ 1x per week/ 10 weeks/10 sessions	Computerized Performance Task; Conjunctive Visual Search Task	CPT: Reduction in commissions rate in the mindfulness group *d* = 0.89. CVST: 16 displays: *d* = 0.46

					32 displays d = 0.85
Suarez-Garcia et al., 2020	Mindfulness on Attention & Behavior	n = 73; age= 7-10 years	60 mins/ 1x per week/+ 10 mins/ 4x per week /8 weeks	Evaluation System for Children and Adolescents	Attention Problems: EG_1: d = 0.446 EG_2: d = 0.385 Self-Control Deficits: EG_1: d = 0.965 EG_2: d = 0.614
Sciutto et al., 2021	Mindfulness on Behavior	n = 136; age= K, 1st, & 2nd grade	20 mins/ 2x per week/ 8 weeks/ 16 sessions	Strengths and Difficulties Questionnaire	Prosocial Behavior: $p < 0.001$ Externalizing Behaviors: $p = 0.015$ Internalizing Behavior: $p = 0.192$
Benzing et al., 2019	Game-Based Cognitive Intervention on EF	n= 118; age= 10-12 years	30 mins/ 2x per week/ 6 weeks/ 12 sessions	Computerized tasks through E-Prime Software	Updating: $\eta^2_p = .029$ Shifting: $\eta^2_p = .062$ Inhibition: $\eta^2_p = .004$
Schmidt et al., 2015	Physical Activity on EF	n= 181; age= 10-12 years	45 mins/ 2x per week/ 6 weeks/ 12 sessions	Computer-based tasks through E-Prime Software	Team Games: Updating: d= 0.27* Shifting: d= 0.93* Inhibition: d= 0.17* Aerobic Exercise: Updating: d= 0.29* Shifting: d= 0.68* Inhibition: d= 0.17*
Meijer et al., 2021	Physical Activity on EF	n= 856; age= 3rd & 4th grade	30 mins/ 4x per week/ 14 weeks/ 56 sessions	Stop Signal Task; Attention Network Test	Information Processing and control d= 0.001; Interference Control d= 0.040; Attention Accuracy d= -0.40; Attention Efficiency d= -0.002

Flook et al., 2010	Mindfulness on EF	n= 64; age= 2nd & 3rd grade	2x per week/ 8 weeks/ 16 sessions	Behavior Rating Inventory of Executive Functioning	Metacognition Index *d*= 0.33* Behavioral Regulation Index *d*= 0.49* Global Executive Composite *d*= 0.45*
Schonert-Reichl et al.,	Mindfulness on EF, Stress Management, SEL Skills, and Academics	n= 99; age= 4th & 5th grade	50 mins/ 1x per week/ +9 mins practice daily/ 4x per week/ 12 weeks/ 12 sessions + 36 mins practice time weekly	Computer-based EF Tasks	RT flanker switch: *d* = -0.21 RT incongruent flanker and reverse flanker: *d* = 0.31
Thierry et al., 2016	Mindfulness on EF & Language Skills	n= 47; age= Pre-K-K	20-30 mins/ 1x every 2-3 weeks/ 15 sessions/ +3 mins practice daily each week	BRIEF-P	Working Memory: MindUp *d* = -0.41 BAU *d* = 0.71 Plan/Organize: MindUp *d* = -0.54 BAU *d* = 0.58
Ritter & Alvarez,	Mindfulness on EF	n= 177; age= 3rd, 4th, & 5th grade	5-7 mins/ 2x per day/ 3x per week/ 6 weeks/ 36 sessions	Executive Function Student Questionnaire (self-report measure)	Inhibition: *d*= 0.40; Cognitive Flexibility *d*= 0.30; Working Memory *d*= 0.30

*Effect Size computed by researcher

Summary

Research supports the use of mindfulness practices in addressing the needs of all students and especially those with EF deficits (Flook et al, 2010). *MindUp,* an integrated program of mindfulness and social-emotional learning, found positive effects on EF development, stress management, social-emotional skills, and academic achievement (Harpin et al., 2016; Schonert-Reichl et al., 2015). *Mindful Schools,* a program implemented school-wide, also yields effective results in paying attention, self-control, participation rates, and respect for others (Black & Fernando, 2014; Harpin et al., 2016). Sheinman et al. (2018) found that implementing the *Mindful Language* program long-term yielded the best results for students potentially using mindfulness-based coping strategies in stressful situations. Flook et al. (2010) examined the development of EF in children when trained to use mindful awareness practices and found students with poor EF skills benefit the most. Although positive results are found in multiple studies, research overwhelmingly indicates the need to further study these effects to gain empirical data with respect to mindfulness practices (Flook et al., 2010; Sapthiang et al., 2019; Schonert-Reichl et al., 2015; Sheinman et al., 2018; Stuart et al., 2017). For example, Sapthiang et al. (2019) states, “However, notwithstanding these beneficial facets, there remains a need to conduct large-scale empirical investigations that seek to evaluate the effectiveness of school-integrated MBIs at a regional or national level,” (p. 117). Furthermore, Schonert-Reichl et al. (2015) contends “Future research is needed to replicate the findings on EF and also to identify the “active ingredients” in the curriculum leading to these specific outcomes,” (p. 62). Flook et al. (2010) suggests, “Further investigation of EF in elementary school samples would be useful to tease apart potential sources of variance,” (p.80).

In conclusion, much of the current research spans a variety of demographics using various mindfulness programs; however, most of the sample sizes are small, long-term effects have not been researched, much of the data is quantitative, and most research focuses on student impact within the school environment. Qualitative data from teachers, students, and parents could further enhance present research, and offer perspectives of how mindfulness impacts students outside of the educational setting.

Chapter III. Methodology

The purpose of this research was to analyze executive function skills of elementary students and the impact that a short-term mindfulness-based practice had on inhibition and interference control. A mixed methods approach included collecting further quantitative data on the impact of mindfulness on the executive functions of inhibition and interference control through a behavior rating instrument and Stroop Effect task. Both quantitative and qualitative data will further our knowledge of student, teacher, and parent perspectives of mindfulness practices. This information was collected through interviews and surveys. The dependent variables in this study included inhibition and interference control of students and student, teacher, and parent perceptions of mindfulness practices. The respective independent variable included developmentally appropriate mindfulness-based practices. This chapter presents a description of the mixed methods research used in relation to the proposed research questions, the research design, a description of the participants, the instrumentation, the data analysis, and coding methods used in this study. Ethical considerations and assumptions of the researcher are also outlined in this chapter.

Research Questions

1. What is the impact of a short-term mindfulness-based practice on inhibition and interference control in third grade students?
2. What are student, teacher, and parent perceptions of including mindfulness-based practices in a school setting?

Research Design

A mixed methods design was chosen for this research to increase knowledge in a meaningful way which included collecting both qualitative and quantitative data. This method

was best suited to study the proposed research questions. There is limited qualitative research regarding the implementation of mindfulness-based practices within schools from the perspective of students, teachers, and parents (Dariotis, 2017). Although outcome-based research has shown positive benefits to including mindfulness practices in schools, it is important to understand the perspectives of those participating and implementing the practices (Dariotis, 2017). Qualitative data on these perceptions was collected through open-ended surveys and interviews. A quasi-experimental design to measure the impact of a short-term mindfulness-based program was selected to gain further quantitative data. Specifically, a static-group comparison design was used with two intact classrooms. Both groups were administered the treatment, however one group also served as a wait-list comparison group to increase the sample size, but still allow for comparison. This design was selected due to the inability to randomize classrooms once students were assigned a general educator for the school year. Quantitative data was collected through the Behavior Rating Inventory of Executive Function- 2 (BRIEF-2; Gioia et al., 2015), a behavior rating scale completed by the classroom teachers. Student selective attention was quantified through the administration of the Stroop Color and Word Test for Children (Golden et al., 2022). These data quantify the impact of the short-term mindfulness-based practices on inhibition and interference control.

Participants & Sampling Technique

Participants in this study were selected through a nonrandom convenience sampling technique. Students in two third grade classrooms were recruited through a verbal presentation, followed by the distribution of an informational parent letter and consent forms sent home with students. Once parental consent was granted, students were provided with assent forms. From the two third grade classes, 25 third-grade students aged 8-9 years and their respective parents were

used in this research. Of the 25 students, 36% were male and 64% were female. Forty-four percent of students were signed up for free/reduced lunch and 32% were identified as having a disability. The participants were 48% Caucasian, 20% Black, 16% Multiracial, 12% Hispanic, 4% Asian. Two third grade general educators with 15 years of teaching experience were also included in the study. This sample population was selected for convenience sampling due to the familiarity of the researcher with the third-grade educator colleagues and the current employment of the researcher within the chosen school district. The first intact classroom will be referred to as Group A while the second intact classroom will be referred to as Group B. The teachers of these classrooms will be respectively referred to as Teacher A and Teacher B.

Ethical Considerations

Ethical considerations included minimal levels of risk in identification of participants, physical risk, and psychological risk. Identification of students was mitigated through assigning each student a number so that confidentiality was maintained while collecting quantitative data from the BRIEF-2 and Stroop Color and Word Test for Children. Parent surveys were completed anonymously. Social risks included acceptance from peers for participation in mindfulness activities, so these were mitigated through the use of appropriate research and evidence-based mindfulness practices developed to align with current social emotional learning standards for elementary students. Only those students for whom parent permission and assent was obtained were included in this research.

Instrumentation & Data Sources

Collection of both quantitative and qualitative data for this research required multiple data sources. Quantitative data was collected pre- and post-intervention to measure the impact of mindfulness practices on student inhibition and interference control. One instrument used was

the Behavior Rating Inventory of Executive Function- 2nd Edition (BRIEF-2; Gioia et al., 2015), specifically the Inhibit Subscale which consists of 8 statements rated as "never," "sometimes" or "often." An additional instrument, the Stroop Color and Word Test for Children (Golden et al., 2022) was used to collect selective attention and interference control data. These instruments were selected to answer the first research question, "What is the impact of a short-term mindfulness-based practice on inhibition and interference control in third grade students?" Previous research includes the first edition of the BRIEF (Flook, et al., 2010; Van De Weijer-Bergsma et al., 2012), the BRIEF-SR which is a self-report measure completed by older students (Lam & Seiden, 2020), and the BRIEF-P which is a preschool version of the standardized measure (Thierry et al., 2016). The BRIEF-2 is the most current version of the EF measure, it was standardized (N = 3,603 total ratings) with reliability and validity statistics, and it takes less than ten minutes to administer which was convenient for the classroom teachers. According to Gioia et al. (2015) coefficients were high for all index scores of internal consistency in both the clinical and standardization samples with all Parent and Teacher form index coefficients above .90 and Self-Report index coefficients in the mid .80 to high 90s. In terms of interrater reliability, the correlations between parent and teacher ratings were moderate with an overall mean correlation of .64 for the typically developing sample and .34 for the clinical sample (Gioia et al., 2015). Test-retest reliability was examined through a subsample within a three-week period. The mean test-retest correlation coefficient within the parent form was .79, within the teacher form was .82, and within the self-report form was .74 (Gioia et al., 2015). Validity measures for the BRIEF-2 have been verified internally through item-total correlations and intercorrelations. Exploratory principal factor analysis was also completed to compare relationships with other widely used behavior rating scales including the Child Behavior Checklist, Behavior Assessment

System for Children-2nd Ed., Conners-3, and ADHD-Rating Scale-IV. Consistent strong support for valid interpretation was established through this exploratory factor analysis (Gioia et al., 2015). The Stroop Color and Word Test for Children (Golden et al., 2022) was standardized with 111 participants ages 4-14. According to Golden et al. (2022), the structure was examined, and scales demonstrated significant correlation and moderately strong internal consistency with Cronbach's alpha = 0.846. Test-retest reliability of the Stroop was moderate-to-strong with approximately 0.78 to 0.95 for interclass correlation coefficients and concordance correlation statistics.

Quantitative and qualitative data was collected through interviews and a survey. The researcher conducted individual interviews with open-ended and Likert-type questions with each student to ensure accurate responses from the participants. Individual interviews with the classroom teachers were also conducted to gain qualitative data. A mixed survey including open-ended and Likert-type questions was administered to the parents of student participants. Questions for both instruments were developed by the researcher to answer the second research question, "What are student, teacher, and parent perceptions of including mindfulness-based practices in a school setting?" Figure 1 below shows the specific student interview questions. The first question was asked in a Likert-type phrasing to gain an understanding of the overall level of enjoyment each student experienced. This provided a measure of engagement and acceptability from the student perspective. Acceptability data is positively linked with efficacy of intervention implementation (Eckert & Hintze, 2000). The second and third questions were asked to gain descriptive information regarding each student's experience. Interview questions 4-7 were asked to measure the application of the mindfulness practices from the student perspective.

The final question sought to understand the benefits of mindfulness practices from the student perspective.

Student Interview Questions:

RQ 2: What are student perceptions of including mindfulness-based practices in a school setting?

1. Please rate your enjoyment of participating in the mindfulness activities.
    a. I did not enjoy the mindfulness activities.
    b. I somewhat enjoyed the mindfulness activities.
    c. I enjoyed the mindfulness activities very much.

2. A. What was your favorite mindfulness activity?
   B. What did you enjoy most about this activity?

3. A. What was your least favorite mindfulness activity?
   B. Why did you dislike this activity?

4. How often do you use mindful breathing?
    a. Never
    b. 1-3 times per week
    c. 4-6 times per week
    d. Every day

5. Give an example of when you used mindful breathing. Tell what was going on and why you used mindful breathing.

6. How often do you take a mindful minute (meditation break)?
    a. Never
    b. 1-3 times per week
    c. 4-6 times per week
    d. Every day

7. Give an example of when you took a mindful minute (meditation break). Tell what was going on and why you took a mindful minute.

8. How do you think the mindfulness activities help you throughout your day?

Figure 1. Research Question 2 in Relation to the Student Interview Questions

Figure 2 below shows the specific parent survey questions. The first question was asked in a Likert-type phrasing to gain an understanding of the overall level of awareness each parent has of their child's experience with mindfulness-based practices. The second question was asked to gain descriptive information regarding each student and parent's understanding of mindfulness-based practices. The next two survey questions were asked to measure the students' application of mindfulness practices at home. The final question sought to understand the benefits of mindfulness practices from the parent perspective.

Parent Survey Questions:

RQ 2: What are parent perceptions of including mindfulness-based practices in a school setting?

1. How often has your child discussed mindfulness practices at home?
    a. Never
    b. 1-3 times per week
    c. 4-6 times per week
    d. Every day

2. Regarding mindfulness practices, what information has your child shared with you?

3. How often have you observed your child using mindful breathing?
    a. Never
    b. 1-3 times per week
    c. 4-6 times per week
    d. Every day

4. How often have you observed your child taking a mindful minute (meditation break)?
    a. Never
    b. 1-3 times per week
    c. 4-6 times per week
    d. Every day

5. Do you think mindfulness activities have helped your child? If so, please describe how you think these activities have helped.

Figure 2. Research Question 2 in Relation to the Parent Survey Questions

Figure 3 below shows the specific teacher interview questions. The first and second questions were asked to gain descriptive information regarding their student's experience. The next question sought to understand the benefits of mindfulness practices from the teacher perspective. The final question was asked to gain an understanding of the perceived challenges which may interfere with implementing mindfulness-based practices within a school day.

Teacher Interview Questions:

RQ 2: What are teacher perceptions of including mindfulness-based practices in a school setting?

1. From your perspective, did students have an overall favorite mindfulness activity? If so, please explain.

2. From your perspective, did students have an overall least enjoyed mindfulness activity? If so, please explain.

3. Do you think mindfulness activities have helped your students? If so, please describe how you think these activities have helped.

4. What are the barriers (if any) to including mindfulness-based practices within your classroom?

Figure 3. Research Question 2 in Relation to the Teacher Interview Questions

Data Collection Procedures

Two classroom teachers and their students were chosen by convenience sampling due to the familiarity of the researcher with those colleagues. The two classroom teachers completed the inhibit subscale of the BRIEF-2 on each student and the researcher administered the Stroop Color and Word Test for Children before the intervention started. Group A was administered the intervention first, while Group B served as the waitlist control group. After the 6 weeks of intervention, both teachers completed a second inhibit subscale on the BRIEF-2 and the researcher administered the Stroop Color and Word Test for Children respectively. Group B was

then administered the intervention and post-intervention data was collected after six weeks to increase the overall sample size. Following the intervention implementation, students and teachers were interviewed by the researcher (see Table 2). Interviews were conducted individually, one time, in-person at the elementary school. Interviews were recorded to ensure accuracy of responses from each student and teacher. Parents were given a paper version of the follow-up survey after the intervention implementation. Students were responsible for hand-delivering their parent's survey at home and were rewarded with the school's Positive Behavior Intervention and Supports reward system upon returning the completed survey. The teachers, students, and parents were not compensated financially for participation in the study.

Table 2
Data Collection Schedule

Time Point 1 (Pre-intervention)	Time Point 2 (6-weeks)	Time Point 3 (12-weeks)
A (baseline)	A (post-intervention)	A (lasting effects)
B (baseline)	B (pre-intervention)	B (post-intervention)
	A (interviews/surveys)	B (interviews/surveys)

Data Analysis

Data collected from the four instruments were analyzed to answer the two research questions and generate study results. The quantitative data obtained through the BRIEF-2, Stroop Color and Word Test for Children, and Likert-type questions on the interviews and surveys were analyzed with descriptive and inferential statistics. The inhibit subscale raw scores of the BRIEF-2 and the calculated T-scores of Stroop Color and Word Test for Children were analyzed by comparing mean values for pre- and post-intervention. Mean scores were also analyzed between Group A and Group B. The Likert-type questions were analyzed by comparing the mode of responses.

The first research question sought to study the impact of mindfulness-based practices on the inhibition and interference control of elementary students. According to Salkind & Frey (2020) "Descriptive statistics are used to organize and describe the characteristics of a collection of data," (p. 8). A double-entry verification procedure was used in Microsoft Excel to ensure accuracy of data input. Paired t-tests with an alpha of .05 were conducted to analyze data collected from the BRIEF-2 and Stroop Color and Word Test for Children. The first paired t-test compared data collected before the intervention to post-intervention for both groups independently to determine if a statistically significant difference occurred overall after the implementation of the intervention. Data included the raw scores on the inhibit subscale of the BRIEF-2 and the converted T-scores of Stroop Color and Word Test for Children. The overall class mean of the raw scores collected on the inhibit subscale of the BRIEF-2 and the mean of T-scores from the Stroop Color and Word Test for Children were also computed for each group at the pre-intervention, at 6 weeks. A second t-test with an alpha of .05 was used to determine if a statistically significant difference occurred between the intervention Group A and the control Group B. A third t-test with an alpha of .05 was used to determine lasting effects of Group A at 12 weeks. A Bonferonni correction was applied to alpha to address multiple comparisons. As a result of the correction, alpha is set at 0.0166. Cohen's *d* was calculated for the data sets and correlations were analyzed from all t-test results.

The second research question sought to explore student, teacher, and parent perceptions of including mindfulness-based practices within the school day. Quantitative data collected from the Likert-type questions was analyzed using the frequency of response on each item individually and determining percentages by response. Common responses were also identified across student and parent surveys for identical questions. Upon further examination of qualitative

data gathered during student interviews and on parent surveys, the responses were inadequate for qualitative coding, resulting in the omission of these during analysis. Qualitative analysis was conducted on the open-ended interview teacher responses. Recommended by Taylor & Bogdan (1998), three initial steps were followed to analyze the qualitative data collected from the interviews. These included (1) reading and rereading the data; (2) keeping track of hunches, interpretations, and ideas; and (3) looking for emerging themes. The interviews were recorded and transcribed for accuracy by the researcher. During the researcher's transcription, open coding was used to create a bank of commonly used terms between the teacher interviews. Teacher responses were analyzed for significant statements which would identify their perceptions of using mindfulness-based practices in the classroom. Segments were continually compared with other portions of each interview and between the two teacher interviews to determine if the information provided recurring themes (Merriam & Tisdell, 2016; Taylor & Bogdan, 1998). The researcher identified trends for overall qualitative results.

Assumptions

Assumptions were made regarding the quantitative data collected and qualitative responses received. Overall, the researcher assumed honest responses from the teachers of each student's behavior ratings on the BRIEF-2. Assumptions also exist that student participants voluntarily participated in the mindfulness-based practices and performed their best on the Stroop Color and Word Test for Children. Furthermore, the researcher also assumed that honest responses were given by students, teachers, and parents during interviews and survey completion. It is also assumed that teachers seek improvement in their students after completion of an intervention which could affect the responses on both the BRIEF-2 and survey responses. With regards to this assumption, the researcher explicitly explained the study and the need for

honest responses to gain accurate data. With data analysis, when conducting the t-tests, assumptions were made regarding the scale of measurement, normality of the data distribution, adequacy of sample size, and equality of variance in standard deviation.

Trustworthiness

Steps were taken to ensure findings were valid and conclusions were trustworthy. All participants engaged in the same mindfulness-based practices and quantitative data was collected at the same points for each group of students. Teachers were provided identical directions for completing the BRIEF-2 on each student. Prior to conducting the research, the interview and survey questions were created by the primary researcher with the support of her dissertation committee. The questions were determined to provide the appropriate information being researched. The questions for students, teachers, and parents were the same for all respondents in each category, respectively.

Chapter IV. Results

This chapter presents the findings from quantitative and qualitative data collected in relation to two research questions posed. A mixed methods approach was used to address the research questions meaningfully and thoroughly. For my first research question, "What is the impact of a short-term mindfulness-based practice on inhibition and interference control in third grade students?" measurements of inhibition and interference control were collected from the BRIEF-2 rating scales and Stroop Effect tasks. These were analyzed through t-tests comparisons from pre- to post-intervention. For my second research question, "What are student, teacher, and parent perceptions of including mindfulness-based practices in a school setting?" quantitative data was collected through Likert-type and open-ended questions from interviews conducted with students and surveys administered to parents. These responses were converted to percentages and analyzed for the frequency of response. Qualitative data was collected through open-ended interviews with teachers. Interview responses were coded, and trends were identified.

The first instrument, BRIEF-2 is the most current version of the EF measure. This rating scale was used to measure the inhibition of students pre- and post-intervention, as determined by teacher ratings. The Inhibit subscale consists of 8 statements which teachers rated for each child. Scores for each statement were then totaled for a composite raw score for each student. The mean of raw scores were compared through simple t-tests between baseline to intervention for both groups independently to determine if there was an overall statistically significant difference post-intervention. A second t-test between the mean scores of both groups at pre-intervention and post-intervention was completed to determine if there was an overall statistical significance between the treatment group and waitlist control group. A third t-test was run with the treatment

group's data from their post-intervention to the five-week follow-up to determine if there were any statistically significant lasting effects.

The second instrument, the Stroop Effect task, was used to measure the interference control of students. This was completed at pre- and post-intervention and scores were calculated as prescribed to convert to an overall Interference T-score. Like the data analyzation of the first instrument, the mean of T-scores were run through simple t-tests between pre- and post-intervention for both groups independently to determine if there was an overall statistically significant difference after treatment was completed. A second t-test between the mean T-scores of both groups at baseline and post-intervention was completed to determine if there was an overall statistical significance of effect between the groups. A third t-test was run with the treatment group's data from their post-intervention to the five-week follow-up to determine if there were any statistically significant residual effects.

The third instrument collected quantitative data through student interviews and parent surveys with open-ended and Likert-type questions. Responses were converted to percentages by frequency of response. This is due to the unclear meaning that averages for responses such as *never*, *rarely*, or *always* have when applying descriptive statistics (Sullivan & Artino, 2013). Likewise, data may be skewed if responses are clustered at the higher and lower extremes. Thus, statistical experts agree that converting frequency of responses to percentages, rather than using parametric tests, allows for meaningful analysis (Sullivan & Artino, 2013).

The fourth instrument collected qualitative data through teacher interviews. Qualitative analysis was conducted on the open-ended interview teacher responses to identify trends.

Instrument Validity and Reliability

Three separate instruments were used to collect quantitative data in this study, while one instrument was used to collect qualitative data. Two of the instruments were nationally normed, standardized assessments, while the interviews and survey were created by the researcher. Due to the varying nature of the instruments, validity and reliability also varied.

The BRIEF-2 was standardized on a sample of 3,603 total ratings for reliability and validity statistics. Coefficients were high for all index scores of internal consistency in both the clinical and standardization samples with all Parent and Teacher form index coefficients above .90 and Self-Report index coefficients in the mid .80 to high 90s (Gioia et al., 2015). Test-retest reliability was examined through a subsample within a three-week period. The mean test-retest correlation coefficient within the teacher form was .82 (Gioia et al., 2015). Validity measures for the BRIEF-2 have been verified internally through item-total correlations and intercorrelations. Exploratory principal factor analysis was also completed to compare relationships with alternative widely used behavior rating scales (CBCL, BASC-2, Conners-3, and ADHD-RS-IV). According to Gioia et al. (2015) "Collectively the correlational and exploratory factor analyses provide consistent strong support for valid interpretation of BRIEF2 scores based on their relationships to well-established behavior rating scale measures of behavioral, emotional, social, and attentional functioning," (p.138). In this research, test-retest reliability for the BRIEF-2 was measured with Timepoint 1 (baseline) and Timepoint 2 (pre-intervention) scores for Group B. A Pearson correlation coefficient of 0.876 was calculated, indicating a strong reliability measure for this research (Salkind & Frey, 2020).

The Stroop Color and Word Test for Children (Golden et al., 2022) was standardized with 111 participants ages 4-14. According to Golden et al. (2022), the structure was examined,

and scales demonstrated significant correlation and moderately strong internal consistency with Cronbach's alpha = 0.846. Test-retest reliability of the Stroop was moderate-to-strong with approximately 0.78 to 0.95 for interclass correlation coefficients and concordance correlation statistics (Golden et al., 2022). With data collected in this research, test-retest reliability was measured for both baselines of the Stroop task in Group B. A Pearson correlation coefficient of 0.706 was calculated, indicating only a moderate reliability for this research (Salkind & Frey, 2020).

Validity and reliability were also accounted for within the interview and survey development. Instrument validity requires that an instrument measures what it intends to measure. Furthermore, Fraenkel et al. (2019) define validity as "the defensibility of the inferences researchers make from data collected through the use of an instrument" (p. 112). The interview and survey questions were developed to gain information regarding the inclusion of mindfulness practices within a school setting from the perspective of students, parents, and teachers. Consequently, the data collected reflects valid instrumentation.

Research Question 1

The first research question asked: What is the impact of a short-term mindfulness-based practice on inhibition and interference control in third grade students? This research question focused on gaining further quantitative data to measure the effectiveness of mindfulness practices on these two areas of executive functioning in students. This question was answered through data collected on (1) teacher ratings of inhibition as measured through the BRIEF-2 instrument; and (2) interference control as measured by the Stroop Color and Word Test for Children.

Data were collected at three timepoints (see Table 2 in Ch. 3) and first analyzed through two-tailed, paired t-tests for overall statistical difference between pre- and post-intervention. Given the small sample size, statistically significant impact was not expected, thus Cohen's *d* was also calculated for both measures for each group. For Group A, mean scores on the BRIEF-2 were observed decreasing from baseline to intervention, however this was not a statistically significant impact as $p = 0.254 > 0.0166$. There was a small effect size ($d = 0.296$) indicating there may be a difference which may be worth studying with a larger sample size. An overall negative impact on student interference control was measured as mean T-scores for the Stroop effect decreased for Group A ($p = 0.309 > 0.0166$; $d = 0.199$). For Group B, mean scores on the BRIEF-2 yielded overall negative impact on student inhibition as mean scores increased from pre- to post-intervention ($p = 0.355 > 0.0166$; $d = -0.114$). Mean T-scores were observed increasing for Group B's Stroop effect data; however, this impact was not statistically significant as $p = 0.247 > 0.0166$. There was a small effect size ($d = -0.298$) so this may warrant further study with a larger sample size. Results are summarized in Table 3.

Table 3
Pre- to Post Results of Mindfulness Intervention for Both Groups

	BRIEF-2				Stroop Color and Word Test for Children			
	Pretest $\bar{x}$	Post-test $\bar{x}$	p	*d*	Pretest $\bar{x}$	Post-test $\bar{x}$	p	*d*
Group A	11.27	10	0.254	0.296	54.09	51.55	0.309	0.199
Group B	11.64	12.14	0.355	-0.114	51.43	53.29	0.247	-0.289

A second two-tailed t-test between Group A and Group B measured the overall impact of the intervention between the treatment and control groups. Inhibition skills, as measured by the mean scores of the BRIEF-2 teacher ratings, did not yield an overall significant impact for the treatment group as $p = 0.265 > 0.0166$. However, there was a moderate effect size ($d = 0.474$),

indicating that a difference may be occurring and studying this further with a larger sample size may be beneficial. Interference control, as measured by the Stroop Color and Word Test for Children, did not yield an overall significant impact for the treatment group as $p = 0.977 > 0.0166$; $d = -0.012$. Results are summarized in Table 4.

Table 4
Mindfulness Intervention Results Compared Between Groups

BRIEF-2				Stroop Color and Word Test for Children			
Group A $\bar{x}$ (I)	Group B $\bar{x}$ (B_2)	p	*d*	Group A $\bar{x}$ (I)	Group B $\bar{x}$ (B_2)	p	*d*
10	11.64	0.265	0.474	51.55	51.43	0.977	-0.012

A third two-tailed, paired t-test attempted to measure the residual effects of the intervention for Group A at the 12-week timepoint. Inhibition and interference control did not yield significant lasting effects as measured by p-values calculated for both measures. The mean scores on the BRIEF-2 between the end of the intervention to the 6-week follow-up decreased, but this was not a statistical impact as $p = 0.111 > 0.0166$; $d = 0.043$. The mean T-scores for the Stroop effect increased between the intervention and 6-week follow-up, but not statically significant as $p = 0.907 > 0.0166$. There was a small effect size ($d = -0.167$), so this may warrant further research with a larger sample. Results are summarized in Table 5.

Table 5
Lasting Effects of Mindfulness Intervention for Group A

BRIEF-2				Stroop Color and Word Test for Children			
Group A $\bar{x}$ (I)	Group A $\bar{x}$ (R)	p	*d*	Group A $\bar{x}$ (I)	Group A $\bar{x}$ (R)	p	*d*
10	9.45	0.111	0.043	51.55	52	0.907	-0.167

In response to the first research question, data indicate no significant impact of mindfulness practices on inhibition and interference control for the student participants. With the

alpha set at 0.0166, p-values were greater for all BRIEF and Stroop Effect comparisons from pre-to-post intervention in both Group A and Group B, for treatment (Group A) vs. control (Group B), and for Group A with lasting effects. Likewise, Cohen's d ranged from 0.012 to 0.474 for all comparisons, indicating a small to moderate overall effect.

Research Question 2

The second research question asked: What are student, teacher, and parent perceptions of including mindfulness-based practices in a school setting? This research question focused on gaining quantitative and qualitative data to measure the application of mindfulness-based practices, the usefulness of such instruction, and to identify potential barriers in implementing such practices within a school setting.

Student Perceptions of Mindfulness

Student perceptions were gathered through individual interviews consisting of Likert-type and open-ended questions. Students were first asked to rate their level of enjoyment with completing mindfulness activities. This provided a measure of engagement and acceptability from the student perspective. Acceptability data is positively linked with efficacy of intervention implementation (Eckert & Hintze, 2000). The majority, 64%, of students rated that they enjoyed the mindfulness activities "very much," while 36% reported that they "somewhat enjoyed" them.

Table 6
Student Self-Reported Level of Enjoyment of Mindfulness Activities (n=25)

	n	%
Enjoyed very much	16	64%
Somewhat enjoyed	9	36%
Did not enjoy	0	0%

Students were then asked an open-ended question to identify their favorite mindfulness activity. All 25 students were able to name a preferred mindfulness activity. Thirteen students

identified their favorite activity as mindful smelling. Five students chose mindful breathing as their preferred activity. The body scan activity was the identified favorite of 3 students. Two students named mindful hearing as their favorite activity. Mindful seeing and instruction about the brain were also identified as favorite mindfulness activities. Overall, there was not one specific activity that all students favored.

Table 7
Student Self-Reported Favorite Mindfulness Activity (n=25)

	n	%
Mindful Smelling	13	52%
Mindful Breathing	5	20%
Body Scan	3	12%
Mindful Hearing	2	8%
Mindful Seeing	1	4%
Brain Instruction	1	4%

Next, students were asked an open-ended question to identify their least favorite mindfulness activity. All 25 students were able to name a mindfulness activity they enjoyed the least as compared to the other activities. Eight students identified their least favorite activity as mindful breathing. Five students chose mindful smelling while another five identified the body scan activity as their least preferred activity. Mindful hearing was reported as the least favorite of 3 students. Four students named the lessons about the brain as their least preferred activity. No students identified mindful seeing as a least-liked mindfulness activity. Overall, there was not one specific mindfulness activity that all students identified as a least favorite activity.

Table 8
Student Self-Reported Least-Liked Mindfulness Activity (n=25)

	n	%
Mindful Breathing	8	32%
Mindful Smelling	5	20%
Body Scan	5	20%
Mindful Hearing	3	12%
Brain Instruction	4	16%
Mindful Seeing	0	0%

Two questions during student interviews were asked to seek the applicability of mindfulness after taught these practices within the school setting. Students were asked to report their frequency for applying the mindfulness practices taught during classroom lessons. They were asked how often they practiced mindful breathing and mindful minutes throughout the week. Two students reported that they never practiced mindful breathing. Most students reported engaging in mindful breathing 1-3 times per week. Three students reported using mindful breathing 4-6 times per week, while 5 students said they practiced it daily. Regarding mindful minutes, 6 students reported never using this mindfulness practice. Most students responded that they engaged in mindful minutes 1-3 times per week. Two students reported taking mindful minutes 4-6 times per week while another 2 students responded that they did this daily. Results are summarized in Tables 9 and 10 below.

Table 9
Student Reported Frequency of Mindful Breathing (n=25)

	n	%
Never	2	8%
1-3 times per week	15	60%
4-6 times per week	3	12%
Every day	5	20%

Table 10
Student Reported Frequency of Mindful Minute (n=25)

	n	%
Never	6	24%
1-3 times per week	15	60%
4-6 times per week	2	8%
Every day	2	8%

Parent Perceptions of Mindfulness

In addition to gaining student perspectives, the parents of student participants were surveyed. Sixteen of the twenty-five surveys sent home were returned for an overall response rate of 64%. Quantitative data was gathered through Likert-type questions while qualitative data collection was attempted through open-ended questions. However open-ended responses were deemed insufficient for qualitative coding and thus were omitted during analysis.

The first question sought an understanding of the overall level of awareness each parent has of their child's experience with mindfulness-based practices by asking how often students discussed mindfulness at home with a parent. Five parents reported that their child had never discussed mindfulness practices while ten parents reported their child as discussing it 1-3 times per week. One parent reported discussing mindfulness with their child daily.

Table 11
Frequency of Mindfulness Discussed between Student and Parent (n=16)

	n	%
Never	5	31%
1-3 times per week	10	63%
4-6 times per week	0	0%
Every day	1	6%

Two questions on the parent survey sought a measurement of their students' application of mindfulness practices at home. Parents were asked to report the frequency of observing their child engaging in mindful breathing or taking a mindful minute at home. Nine parents reported never observing their child using mindful breath, while five reported never observing their child taking a mindful minute. Five parents reported observing their child engaged in mindful breathing 1-3 times per week, while nine parents reported this same frequency of observing their child taking a mindful minute. One parent reported observing their child using mindful breathing 4-6 times weekly. One parent reported their child engages in mindful breathing daily, while two

parents reported their children as taking a mindful minute every day. Results are summarized in Tables 12 and 13 below.

Table 12
Frequency of Mindful Breathing Observed by Parent (n=16)

	n	%
Never	9	56%
1-3 times per week	5	31%
4-6 times per week	1	6%
Every day	1	6%

Table 13
Frequency of Mindful Minute Observed by Parent (n=16)

	n	%
Never	5	31%
1-3 times per week	9	56%
4-6 times per week	0	0%
Every day	2	12%

Common responses between student interviews and parent surveys were analyzed for overlap on the 16 returned surveys. Data collected for the reported frequency of mindful breathing and mindful minute meditation were compared. There was 25% exact match between student and parent responses for reported frequency of the student engaging in mindful breathing. Regarding the reported frequency of students taking a mindful minute, student interview and parent survey responses matched exactly in 38% of responses. Overall, there appears to be some consistency between student and parent responses for the frequency of mindful breathing and taking a mindful minute.

Table 14
Comparison of Student and Parent Reports for Frequency of Mindful Breathing and Mindful Minutes (n=16)

	Mindful Breathing	Mindful Minute
Exact Overlap	25%	38%

A final question on this survey asked if parents felt mindfulness activities were helpful to their child. Nine out of 16 parent respondents, or 56% indicated that mindfulness was beneficial

for their child with a response of "Yes" while the remaining 7 respondents left this question blank. Acceptability of mindfulness may be associated with this outcome.

Teacher Perceptions of Mindfulness

In addition to quantitative data collected through student interviews and parent surveys, two teacher interviews were conducted to answer the second research question. Interview responses were initially coded during transcription to create a bank of commonly used terms between the two teachers. Teacher responses were then analyzed for significant statements which would identify their perceptions of using mindfulness-based practices in the classroom. Segments were continually compared with other portions of each interview and between the two teacher interviews to determine if the information provided common themes (Merriam & Tisdell, 2016; Taylor & Bogdan, 1998). Two major themes were identified within the interviews which answered the second research question.

Theme 1: Benefits of Mindfulness. The first theme identified perceived benefits of mindfulness practices. Both teachers discussed situations in which mindfulness could be and/or was beneficial in relation to this study and for whom mindfulness can benefit. Commonly used keywords identified throughout both interviews included (a) calming, (b) anxiety, (c) stress, (d) students and teachers. For example, Teacher A responded:

> It also involves being quiet and so it's like taking a quiet, calming break for maybe just a couple minutes and I could see that helping all of us, even my own stress levels, to settle down so we can refocus.

Similarly, Teacher B provided multiple responses to support this theme:

> I think we all need to take time to stop and notice what's around us and try to calm the overstimulation that seems to be our world today. And when I think about the students with anxiety or those battling trauma I can really see how it could be helpful.
>
> I have a couple students in here who have more anxiety and I feel the one in particular was a girl- I really think it was a benefit to her and she even reported back to me that she uses the breathing exercises.
>
> But this this could really be beneficial for our students. And even the teachers.

Both teachers identified that mindfulness practices could benefit both students and teachers as these activities could have a calming effect on stress and anxiety levels.

Theme 2: Applicability of Mindfulness in the School Setting. The second theme identified teacher perceptions of including mindfulness practices within the school setting. This theme can be separated into two sub-themes.

Sub-theme 1: Ease of Integrating Mindfulness in the Educational Setting. This sub-theme identified the appropriateness of including mindfulness within the school setting and the most effective mindfulness technique which could be implemented. Both teacher responses included common terms such as (a) appropriate, (b) engaging, (c) helpful, and (d) breathing to support this sub-theme. This is evidenced through the following responses from Teacher A:

> I think it's [mindfulness] totally appropriate and enjoyable for the kids.
>
> Probably the controlled breathing. That can be pretty quick, but it also involves being quiet and so it's like taking a quiet, calming break for maybe just a couple minutes and I could see that helping all of us. And I think just knowing there's different ones that you can follow on short little videos or like with the rainbow breathing- I think that would keep it engaging for the class.

Teacher B's responses under this theme include:

> They seemed pretty engaged and enjoyed having you come in each time.
>
> I know I mentioned the overstimulation and the need to just stop and take a minute to just be present. But I would say that in combination to the different breathing exercises- that would seem doable and helpful.

Sub-theme 2: Perceived Barriers of Integrating Mindfulness in the Educational Setting. The second sub-theme identified perceived barriers of implementing mindfulness during the school day. Common terms identified in both teacher interviews include: (a) time and (b) practice. In addition, both teachers identified the need to learn mindfulness techniques themselves to implement them effectively within the classroom. For example, Teacher A responded:

> But taking the time to learn more techniques myself and then taking time- class time to do them would be the only challenge.
>
> I feel like if they had more practice and even just continued practice throughout each day then maybe I would have seen more of an impact.

Similarly, Teacher B noted:

> Really just making the time to do it and practice it routinely. I think it would be beneficial to do some form of mindfulness multiple times throughout the day.
>
> So time really is the main barrier. And of course ideally we'd have more of you coming into the classrooms to really lead the mindful activities and show us the mindfulness activities we could practice more on our own.

Responses from both teachers indicated acceptability of including mindfulness practices within the school day due to the appropriateness of activities and level of student engagement.

However, both teachers also identified the need for additional practice. Specifically, teachers identified mindful breathing exercises as being the most efficient since time to implement and practice throughout the day was a perceived barrier.

In response to the second research question, data indicated student, parent, and teacher acceptability for including mindfulness practices in the school setting. All student respondents revealed feeling at least some level of enjoyment and all were able to identify a favorite and least-liked mindfulness activity, indicating active engagement during lessons. Applicability of mindfulness practices after lessons were completed was also measured. Seventy-six percent of students reported taking a mindful minute at some point each week, while 92% of students reported engaging in mindful breathing each week. Sixty-nine percent of parents reported their child discussing mindfulness with them weekly. Regarding application of mindfulness, 68% of parents reported observing their child taking a mindful minute, while 43% reported observing their child engaging in mindful breathing. Furthermore, 56% of parents indicated mindfulness as beneficial to their child. Teacher interviews revealed perceived benefits of mindfulness and acceptability through mindful breathing exercises, although time was identified as a potential barrier to implementation.

Summary

The purpose of this research was to analyze the impact of short-term mindfulness-based practices on the inhibition and interference control in elementary students and to gain student, parent, and teacher perceptions of including such practices within a school setting. A mixed methods approach was used to address the two research questions posed in this study. Quantitative data collected through the teacher-rated BRIEF-2 rating scales and researcher-administered Stroop Color and Word Test for Children indicated little to no significant impact of

short-term mindfulness-based practices on student inhibition and interference control. From the perspective of students, parents, and teachers, survey and interview data indicated an overall acceptability of including mindfulness practices in the school setting. Quantitative data would suggest there is little to no impact of a short-term mindfulness-based practice on inhibition and interference control in third grade students, however, qualitative data supports including mindfulness practices within a school setting. Further findings will be explored and recommendations for future research will be considered in Chapter 5.

Chapter V. Conclusions And Recommendations

Research recognizes that loss of instructional time due to inattention and off-task behaviors of students is a well-established problem in the educational environment (Godwin et al., 2016). The development of inhibition and interference control is essential for optimal learning. Educators need an efficient method for assisting students in the development of these executive functioning skills. This research sought to study the impact of mindfulness on the development of inhibition and interference control skills in elementary students when implemented within classroom instruction. This final chapter presents a review of the study, the overall conclusions, recommendations for school professionals, limitations of this study, and implications for future research.

Review of the Study

The purpose of this study was to investigate the impact that a short-term mindfulness intervention had on the executive functioning skills of inhibition and interference control in elementary school children. A mixed methods design was implemented to examine the following research questions:

1. What is the impact of a short-term mindfulness-based practice on inhibition and interference control in third grade students?
2. What are student, teacher, and parent perceptions of including mindfulness-based practices in a school setting?

A mixed methods approach was used to answer the research questions posed in a meaningful way. The first question was researched through a quasi-experimental design that included two in-tact classrooms of third grade students. One classroom received instruction in mindfulness-based practices for six weeks while the second classroom served as a waitlist

control group. Quantitative data on student inhibition and interference control was collected pre- and post-intervention for both groups. Measurements were gathered through the BRIEF-2 rating scales and Stroop Color and Word Test for Children. The second research question posed was studied through student and teacher interviews and a parent survey after the mindfulness practices were implemented. Quantitative data was collected through Likert-type questions from student interviews and parent surveys, while qualitative data was gathered through teacher interviews.

Findings were mixed as quantitative data collected on student inhibition and interference control yielded a small effect, however overall student, teacher, and parent perceptions support the use of mindfulness practices within a school setting. Data analysis of the BRIEF-2 rating scales and Stroop Color and Word Test for Children indicated no significant impact as p-values were greater than alpha ($p < 0.0166$), for all comparisons. However, a small to medium effect size was calculated for some comparisons (Cohen's *d* ranged from 0.012 to 0.474). Overall, acceptability of including mindfulness practices within the school setting was found through student and teacher interviews and parent survey responses. All students rated some level of enjoyment, and they were able to identify a favorite mindfulness activity. Application of the intervention was reported as 76-92% of students engaging in mindfulness practices weekly. Parent survey responses provided further support of application of mindfulness at home as 43-68% of parents reported observing their child engaging in mindfulness exercises weekly. Qualitative data gathered from teacher interviews indicated themes of perceived benefits of mindfulness and applicability within the school environment. This chapter presents an interpretation of the research findings, a discussion of the implications of these findings, and recommendations for future research.

Discussion

The outcomes of this research resulted in mixed findings for the impact of mindfulness on student inhibition, student interference control, and the overall applicability of mindfulness in the school environment. Unanticipated findings led the researcher into new lines of inquiry regarding the research design, the instrumentation and data sources, and implementation factors.

Research Question 1

The first research question sought to study the impact of mindfulness-based practices on student inhibition and interference control. The BRIEF-2 rating scales measured student inhibition, as rated by their teacher. The researcher-administered Stroop Color and Word Test for Children measured interference control. Although the interventions did not yield statistically significant results, effect size (*d*) was also calculated due to the small sample size of participants. Findings were mixed between sample groups and instruments.

Mindfulness Impact on Student Inhibition The teacher-completed BRIEF-2 rating scales measured the inhibition of students at pre- and post-intervention, and at the six-week follow-up for lasting effects with the first intact classroom, Group A. Group B served as the waitlist control group and Teacher B rated student inhibition at the same time points for comparison. For Group A, a medium effect ($d = 0.296$) on inhibition was found pre- to post-intervention. The effect for residual impact, however, was small ($d = 0.043$). For Group B, the unanticipated impact of the mindfulness intervention yielded a small negative effect on student inhibition from pre- to post-intervention ($d = -0.114$). Between group comparisons yielded a medium effect of the mindfulness intervention ($d = 0.474$).

When analyzing the results of the teacher-rated BRIEF-2 scales for inhibition for both intervention periods, previous research indicated moderate effect ($d = 0.49$) when using the same

instrument, however Flook et al. (2010) measured inhibition through the Behavioral Regulation Index of the BRIEF, which also includes the Self-Monitor Subscale. In Flook et al.'s (2010) study, the sample size was slightly larger (n = 64), and the intervention was administered for longer (8 weeks = 16 sessions). These differences could account for the discrepancy in results from previous supporting research, suggesting that with a larger sample and longer intervention administration period, a greater effect may be measured. When comparing between the experimental and control group, a medium effect (d = 0.474) on inhibition was measured for the treatment group which was comparable to Flook et al.'s (2010) research. This correlation along with reliability statistics for this study (r = 0.876) would suggest the BRIEF-2 rating scales are a reliable source for measuring student inhibition.

The question remains, however, why did the impact of the mindfulness intervention on student inhibition have a greater effect for Group A than for Group B? The obvious explanation may be in the differences between the two intact groups as participants were unable to be randomized. Another explanation for the discrepancy may be reporting bias from Teacher A as teachers were not blind to the study. The time of year for intervention administration may have also had an impact. Although both groups were administered the mindfulness intervention in the last trimester of the school year, Group B's intervention period was during the final six weeks of the year. According to Godwin et al. (2016), students exhibit a greater number of off-task behaviors due to self-distractions and environmental distractions at the end of the school year when compared to beginning and middle time periods of the year. Presumably, Teacher B may have observed this phenomenon within her classroom as the end of the school year neared and rated her students accordingly.

Although mixed results were found in this study, previous research supports including mindfulness as an intervention for the development of attention skills in students (Napoli et al., 2005; Flook et al., 2010; Carboni et al., 2013; Black & Fernando, 2014; Tarrasch et al., 2018; Suarez-Garcia et al., 2020). Previous studies of mindfulness interventions ranged in implementation from 5 weeks up to 6 months. While this study's timeframe was limited to 6 weeks, a longer implemented mindfulness-based program may yield more consistent results. Furthermore, when compared to other interventions targeting student inhibition improvement, mindfulness shows a measured greater effect. Schmidt et al. (2015) studied the impact of exercise on student inhibition and found only a small effect (d = 0.17). Likewise, Benzing et al. (2019) studied the impact that board and card game playing may have on inhibition development and found no significant effect (η^2_p = .004).

Overall analysis suggests that mindfulness has a positive impact on student inhibition when instrumentation includes the BRIEF-2 rating scales. However, this may need further studying with a larger sample over a longer intervention period. The time of year for the administration of a mindfulness intervention may also impact the overall effect.

Mindfulness Impact on Student Interference Control The researcher-administered Stroop Color and Word Test for Children measured the interference control of students at pre- and post-intervention for both groups, and at the 6-week follow-up for Group A to investigate residual impact. Group B participants were tested at the same time points to serve as a waitlist comparison group. For Group A, an unanticipated small negative effect (d = 0.199) on interference control was found pre- to post- intervention. The effect for residual impact, however, was a small, expected effect (d = -0.167). For Group B, the impact of the mindfulness intervention yielded a medium effect on student interference control from pre- to post-

intervention (*d* = -0.289). Between group comparisons yielded an unanticipated, negative small effect of the mindfulness intervention (*d* = 0.012). These mixed results required careful analysis when compared to previous research and instrumentation was an identified area to investigate.

Previous research of the impact mindfulness has on student interference control includes measures of selective attention through instruments including computerized tasks, standardized observations, and rating scales. Napoli et al. (2005) found moderate effects (*d* = 0.60) of mindfulness on selective attention through the computerized *Test of Everyday Attention for Children (TEA-Ch)*. Similarly, Tarrasch et al. (2018) found moderate to strong impacts (*d* = 0.46 – 0.85) of mindfulness on selective attention when measured by the Conjunctive Visual Search Task, another computerized instrument. Carboni et al. (2013) found a positive increase in active engaged time of participants (+8.2% – 14%) as measured through the Behavioral Observation of Students in Schools, a standardized observation instrument. Another study using The Student Behavior Rubric, a teacher rating scale, also found moderate effect (*d* = 0.33 – 0.42) of a mindfulness intervention on student attention skills (Black & Fernando, 2014). Similarly, Suarez-Garcia et al. (2020) used a teacher-rated form, the Evaluation System for Children and Adolescents. A decrease in attention problems was measured with a moderate effect (*d* = 0.385 - 0.446). For this study, the Stroop Color and Word Test for Children was selected as a standardized assessment with moderately strong internal consistency (Cronbach's alpha = 0.846) and moderate to strong (0.78 to 0.95) test-retest reliability (Golden et al., 2022). Upon analysis of data collected in this research, test-retest reliability was found to be lower (*r* = 0.706) than the standardization sample. This indicates potential test administration error or implications for increasing reliability of the instrument in future research.

Regarding the first research question, it was determined that the Stroop Color and Word Test for Children was a moderately reliable measure of interference control within this research. According to Salkind & Frey (2020), a strong measure of test-retest reliability is necessary when examining differences in changes over time to determine the changes are real and not random. To increase reliability, the Stroop effect task should be administered multiple times with each participant so that a mean score could be calculated and used within data analysis (Salkind & Frey, 2020).

Research Question 2

The acceptability of school-based interventions can be assessed from multiple perspectives including students, educators, families, and community members (Harrison et al., 2023). The second research question sought to gain an understanding of student, parent, and teacher perceptions of including mindfulness practices within the educational setting. Quantitative data was collected through open-ended and Likert-type questions from student interviews and parent surveys. Qualitative data was collected through semi-structured teacher interviews. Overall findings from all three measures support the inclusion of mindfulness practices within the instructional day.

Student Perceptions of Mindfulness Prior research indicated a need for further studying of student perceptions regarding mindfulness practices (Dariotis et al., 2017; McCabe et al., 2017). Individual interviews were conducted with each student participant to ensure accuracy of responses. Original data within this study included collecting qualitative responses from students, however, the data collected was deemed inadequate for qualitative coding. As a result, student response data included in this research was limited to quantitative responses.

Eckert & Hintze (2000) posit that efficacy of intervention implementation is positively associated with acceptability data. Thus, the first interview question asked students to rate their level of enjoyment when engaging in mindfulness-based practices. All students rated some level of enjoyment when participating in mindfulness activities, indicating acceptability and social validity. The second question, which was purposely left open-ended, asked students to identify their favorite mindfulness activity. All students were able to respond with an identified preferred activity, indicating further social validity. All mindfulness-based practices included during instruction were included in the variety of responses from students, indicating a wide range of appropriate and acceptable activities. To counteract social desirability bias, all students were also asked to identify a least-preferred mindfulness activity. All students were able to name a mindfulness activity they did not like. This supports there was active engagement of mindfulness instruction as they were able to respond to both open-ended questions with a specified activity. According to McCabe et al. (2017), engagement in treatment is only beneficial to those who attend and engage in the intervention; thus, it can be presumed that students engaged in mindfulness may potentially benefit from its assistance.

Data was also collected on the applicability of mindfulness practices from the student perspective. One question asked students to report their frequency of engaging in mindful breathing while a second question required students to report their frequency for taking a mindful minute (meditation break). Overall, 92% of students reported practicing mindful breathing, while 76% percent of students reported taking a mindful minute break each week. Upon reflection of the question phrasing, students may be overreporting if they were including the practice they engaged in during the classroom mindfulness lessons. The interview question could be reworded to clarify that students should be reporting how often they engage in these practices “outside of

the mindfulness lessons." Furthermore, students may be overreporting due to social desirability bias. Direct observations of students, a third-party interviewer, or having students log the frequency of engaging in mindfulness practices, may be a more objective measure of application. It should be noted, however, that many mindfulness practices are covert behaviors which would be challenging to observe, and student logging would also be a self-report measure.

Overall student perceptions support including mindfulness-based instruction and activities in the classroom. This aligns with previous research of student perceptions in which student participants reported feeling better, having more confidence, and less conflict after completing their mindfulness program (McCabe et al., 2017). However, results should be interpreted with caution as the accuracy of mindfulness application, as reported by students, remains unclear.

Parent Perceptions of Mindfulness Prior research lacked parental perceptions of mindfulness practices when implemented within the school setting (Dariotis et al., 2017; McCabe et al., 2017; Sheinman et al., 2018). This research sought to gain parent perceptions of mindfulness and the potential transference and application of practices outside of the educational setting. Original data within this study included collecting quantitative and qualitative responses through a parent survey. However, the qualitative data collected was deemed inadequate for coding. As a result, parent response data included in this research was limited to quantitative responses.

The first survey question sought to gain the level of awareness parents had of their child's experience with mindfulness and the frequency it was discussed by their child at home. Sixty-nine percent of the parents surveyed, reported that mindfulness was discussed by their student at some point during each week. The remaining questions on the survey asked parents to report the

frequency for which they observed their child engaging in mindful breathing or taking a mindful minute at home. Forty-three percent of parents reported observing their child using mindful breathing exercises, while 68% reported observing their child taking a mindful minute meditation break. The exact overlap of reported frequency for the application of mindfulness exercises as reported by students and their respective parents was calculated. Although this is not a statistical calculation of reliability, there was a 25-38% exact match for the two practices, indicating some consistency of response. A final question asked parents to indicate whether they believed mindfulness practices benefit their child. Over half of parent respondents revealed they felt mindfulness helped their child in some way.

Social validity refers to the "extent to which the goals, procedures, and outcomes of our interventions are perceived as acceptable and valuable by the people to whom and for whom they are provided and their networks of stakeholders," (Snodgrass et al., 2021, p. 1). This study sought to include perceptions of parents as previous research lacked the inclusion of this specific stakeholder's perspective. Data collected through parent surveys may indicate support for including mindfulness within the school setting, however Snodgrass et al. (2021) found that going beyond simple questionnaires may provide more rigorous social validation measures. It can be presumed from the data collected within this study, that parents may feel including mindfulness within the school setting as beneficial and acceptable. However, further empirical research with more rigorous social validation measures is needed to conclude this notion.

Teacher Perceptions of Mindfulness Previous research explored implementation factors of a mindfulness program from the teacher perspective (Dariotis et al., 2017). This study sought to gain further evidence to support the inclusion of mindfulness during the regular school day. Individual semi-structured interviews were conducted with each teacher participant to gain

qualitative data. The two major themes of *perceived benefits of mindfulness* and *applicability of mindfulness in the school setting*, were identified.

Both teacher respondents identified situations in which mindfulness may benefit students and for whom this intervention may assist. Respondents felt students and teachers alike may benefit from the anxiety and stress-reducing activities that mindfulness provides. This aligns with student perceptions gained in previous research that mindfulness "helps with relaxing" (McCabe et al., 2017, p. 5). Teacher respondents also described the mindfulness activities as appropriate and engaging for students. This provides further social validity and acceptability which aligns to student perceptions discussed previously. The teachers also identified the need to implement more practice of the mindfulness strategies learned during instruction and by extension the need for further training in the practices to implement mindfulness with their students independently. This aligns with themes identified in previous research as Dariotis et al. (2017) found that providing teacher training and generalization of skills in the classroom were desired. Furthermore, they identified mindful breathing exercises as the most efficient mindfulness-based practice to integrate within the school day due to time being a perceived barrier. Similarly, previous research from educators also identified scheduling as a barrier, but they too suggested using mindful breathing during transitions as a means of fitting it into the school day (Dariotis et al., 2017). These two major themes align with research on acceptability which suggest teachers prefer classroom-based, time-efficient, positive interventions which can be embedded in their instruction with minimal disruptions to their daily practices (Harrison et al., 2023).

Conclusion

Attention skills are essential for effective student learning in the classroom environment. With the variety of conditions that may result in underdeveloped inhibition and interference control skills, educators need efficient and effective methods for bolstering these skills in their students. Research on the inclusion of mindfulness within the school setting is an emerging trend (Flook et al., 2010; Lam & Seiden, 2020; Thierry et al., 2016). This study yielded mixed results for the impact on student inhibition and interference control; however, social validity and acceptability from the perspective of students, teachers, and parents was positive. After a six-week introduction to mindfulness, even a small effect supports the inclusion of these practices within the school setting. The transference of mindfulness from school-to-home, which was reported in this study by both students and parents, provides a model for introducing mindfulness in the school setting. By laying the foundation and practicing mindfulness during daily school instruction, students may potentially benefit further when practiced over a longer period both in and out of school. Thus, this study provides a model for instructing students in mindfulness-based practices which can provide them potential skills they may generalize to any environment.

Recommendations

Based on the results of this study, recommendations on the inclusion of mindfulness practices within the school setting include suggestions for improved implementation. Student, teacher, and parent perspectives indicated acceptability; however, teachers also identified time to implement mindfulness practices and needed teacher training as potential barriers.

Acceptability of the mindfulness exercises within this study may be attributed to the variety of practices presented to students throughout their lessons. Thus, it is recommended that mindfulness instruction include a wide variety of activities to be introduced to students for

optimal engagement. This also allows students to find a preferred mindfulness activity for which they are comfortable practicing on their own, increasing the potential for long-term benefits.

As previous research suggested, this study utilized each class's morning meeting time in which typical social emotional learning (SEL) lessons were occurring (Felver et al., 2013). Instructional SEL time is ideal for mindfulness instruction as many of the components meet Ohio's Social and Emotional Learning Standards. School districts have the flexibility to decide to what extent the standards are implemented, so using mindfulness-based instruction within the state's provided framework would be ideal for systematically fostering environments which will enhance student success and maximize learning. Ohio's SEL standards progress on a continuum through grade-level bands under the five core competencies of self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Ohio Department of Education, 2019). Mindfulness-based practices could address all these competencies as well as foster inhibition and interference control in the elementary grades and beyond. The standards are intended to provide guidance in developing the social and emotional skills students will need to be successful not only during their educational years, but throughout their entire lives (ODE, 2019). Thus, including mindfulness as a part of SEL allows for the time necessary to implement these instructional practices.

Mindfulness should also be practiced multiple times throughout the day with teacher involvement. Teachers are tasked with instruction in Ohio's SEL Standards and mindfulness can benefit them as well as students. Providing teachers with professional development and/or a researched mindfulness curriculum such as *MindUp* or *Mindful Schools*, would allow for full immersion of these practices throughout the school day. Once instruction and techniques have been introduced, time spent engaged in mindfulness can be reduced to practice over the course of

the school year. Additional practice of mindfulness exercises such as mindful breathing or taking a mindful minute can be easily integrated during transitions between subjects or to provide "brain breaks" during longer instructional periods.

Limitations

There are several limitations of the present study which should be noted and addressed in future research. Limitations were identified in the research design, intervention implementation, and with the instruments and data collection procedures. Regarding research design, this study used convenience sampling with two intact classrooms due to the inability of randomization once class lists had been established by building administration. Furthermore, the sample size was small with a limited age range as it included only one grade level of students. Generalization of results may be limited to this age group. Teacher participants were not blind to this study; thus, reporting bias cannot be ruled out regarding results on the BRIEF-2 rating scales. Regarding instrumentation and data collection, the Stroop Color and Word Test for Children was calculated as only moderately reliable in this study. The original research design included collecting qualitative data regarding student and parent perspectives, however, responses were deemed insufficient for thematic coding. Thus, student and parent input were limited to include responses which yielded quantitative data. In addition, the researcher conducted the student and teacher interviews, which could have resulted in social desirability responses. Furthermore, qualitative coding of the teacher interviews was also limited to a single researcher.

Future Research Opportunities

Based on results gained from this study, future research is warranted on the impacts of mindfulness when included in the educational environment. Implications for future research

include addressing limitations, exploring different measures of impact, and gaining further qualitative research from all stakeholder's perspectives.

To address the various limitations of this study, future research should include a larger, randomized sample with a wider age range for broader generalization. The mindfulness intervention should be implemented over a longer period with multiple practice at various times each day. This may yield more consistent quantitative data of the impacts of mindfulness on student inhibition and interference control. In addition, this may potentially provide students with the frequency of practice needed to gain richer qualitative data. Future research including the Stroop Color and Word Test for Children calls for the task to be administered differently. Administering three measures at each timepoint and calculating the means may provide a more reliable interference control measure. Furthermore, using different measures of mindfulness application such as direct observation, a third party-interviewer, or student self-reported logs may provide more objective data. Finally, triangulation of qualitative data should be done for more accurate coding.

Previous research found positive impacts of mindfulness on student attention skills, however this study yielded mixed findings. This research focused on inhibition as measured by the BRIEF-2 rating scale and interference control as measured by the Stroop Color and Word Test for Children. Previous research included computerized tasks, standardized observations, and rating scales in each of their separate studies (Napoli et al., 2005; Carboni et al., 2013; Black & Fernando, 2014; Tarrasch et al., 2018; Suarez-Garcia et al., 2020). Future research may want to explore the impacts of mindfulness on attention skills through different data collection instruments. Not only does instrumentation potentially affect overall results, but finding accurate measures of student attention may be of interest for future research.

Future research also warrants the collection of further qualitative data regarding the perspectives of students, teachers, and parents. This study attempted to gain qualitative information from students and parents, however the data collected was limited and deemed inadequate for qualitative coding. A comprehensive qualitative study could provide rich data gathered from students and parents. This data may further support the use of mindfulness in educational environments and the adoption of such curriculums by school administration.

The data collected and results yielded from this study provides implications for future research. It also potentially provides educators with an easy-to-administer and effective intervention to improve the attention skills in students. This can ultimately lead to the development of executive functioning skills and optimized learning for students.

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