THE EFFECT OF A BRIEF MINDFUL BREATHING EXERCISE ADDED TO A READING FLUENCY INTERVENTION FOR STUDENTS WITH SIGNIFICANT ATTENTIONAL DIFFICULTIES

by

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Abstract

Cognitive theories of reading acquisition emphasize cognitive processes such as attention and working memory, which could be problematic for students with significant attentional difficulties. Mindfulness interventions have been associated with improvements in executive functioning and positive academic outcomes. An alternating treatment design comparing a reading fluency intervention with and without an exploratory brief mindful breathing exercise was conducted with four elementary-aged students identified by classroom teachers as demonstrating difficulty with reading fluency and attention. It was hypothesized that participants would show greater gains in reading fluency, as measured by number of words correct per minute (WCPM), when they received the brief mindful breathing exercise compared to when they did not. It was also hypothesized that students would show increased attention and decreased feelings of stress, as indicated by self-report ratings, after participating in the brief mindful breathing exercise. The exploratory mindful breathing component was cost-efficient, and simple to implement. It appeared to benefit one student in increasing attention and decreasing feelings of stress. It did not, however, result in significant improvements in students' rate of accurate oral reading, though the difference in WCPM between the first and third read-through of passages suggested that students benefitted from the reading fluency intervention regardless of condition. Future research examining the dosage of mindful breathing training required to see meaningful changes in cognitive processes, and in the intersection of mindful breathing and academic interventions for students, is recommended.

Preface

Data collection for this project was approved by the University of British Columbia's Research Ethics Board (certificate no. H13-03605) and was supported by the Social Sciences and Humanities Research Council of Canada. The study design and instructional procedures were developed collaboratively between the lead author and research supervisor, Dr. Sterett Mercer, with input from Dr. Kimberly Schonert-Reichl. All written content of this thesis represents my original, unpublished work.

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I. Introduction

Reading is a complex skill that many students have difficulty learning to master (National Reading Panel [NRP], 2000). Statistics Canada (2009) found that 30% of Canadian 15 year olds were not meeting reading proficiency expectations. Learning to read can be particularly problematic for students with significant attentional difficulties (Ghelani, Sidhu, Jain, & Tannock, 2004; Willcutt et al., 2001). For example, children with Attention Deficit Hyperactivity Disorder (ADHD) typically have difficulties with executive functioning (EF), including working memory, self-regulation, and attention (Barkley & Murphy, 2011; Willcutt, Nigg, Faraone, & Pennington, 2005). These executive functions are also cognitive processes considered important in cognitive theories of reading development (e.g., LaBerge & Samuels, 1974; Perfetti, 1985), meaning students with attentional difficulties may be at greater risk for reading difficulties (Ghelani et al., 2004; Willcutt et al., 2001).

One purpose of the present study is to investigate ways to improve the effectiveness of reading fluency interventions for children with significant attentional difficulties. Reading fluency has been identified as an important component of reading achievement and comprehension (Daly, Chafouleas, & Skinner, 2005). Reading fluency interventions are typically composed of evidence-based instructional strategies such as timed repeated readings (Morgan & Sideridis, 2006; Samuels, 1979; Therrien, 2004); however, they typically do not contain components targeting attention specifically. Comprehensive mindfulness intervention programs have been shown to improve executive functioning (Flook et al., 2010), and commonly include focused breathing components. It is therefore possible that a brief mindful breathing exercise component, which is posited to target executive functions like attention and working memory (e.g., Chambers, Lo, & Allen, 2008; Flook et al., 2010; Semple, 2010), added to a reading

fluency intervention, could result in greater gains in fluency for students who display significant attentional difficulties.

The present study will explore the intersection of academic intervention and mindfulness research. What follows is a review of the relevant literature discussing theories of reading acquisition, effective reading instruction, reading fluency, and the relations of executive functions with reading achievement. A review of mindfulness research will be provided, with a focus on mindful breathing interventions for children with attentional difficulties and immediate outcomes of brief mindfulness interventions. The rationale and relevant research questions for the current study will be outlined.

Effective Early Literacy Instruction

Research on reading acquisition emphasizes systematic and explicit instruction of early literacy skills, which lay the foundation for future success with reading. These skills include phonological awareness, or the awareness of and ability to manipulate the phonological segments of spoken words, and the alphabetic principle, or knowledge of letter-sound correspondence (Ehri, Nunes, Stahl, & Willows, 2001; NRP, 2000). Research suggests that students who master these skills by Grade 1 are more likely to become proficient readers as they continue in school (Torgensen, 2000).

Good instruction in phonological awareness consists of teaching students to isolate sounds in spoken words, and to blend sounds to form words. Students should be taught that letters correspond to sounds, explicitly and systematically. Such a code-emphasis approach (i.e., looking at sounds and words in isolation) is recommended for early reading instruction, as opposed to a meaning-emphasis approach (Ehri et al., 2001; NRP, 2000). Should educators find that children have not mastered these early literacy skills, the earlier they intervene the better

with regards to future reading success (Torgensen, 2000). Children who struggle with reading and who do not receive intervention are likely to experience reading difficulties that continue over time (Torgensen, 2000), even into adulthood (Pratt & Brady, 1988).

Cognitive Theories of Reading Acquisition

Cognitive theories of reading acquisition suggest that as these basic early literacy skills become more automatic, more cognitive resources (e.g., attention and working memory) are then free to be used for comprehension and other reading skills used by successful readers (NRP, 2000). For example, in their theory of automatic information processing, LaBerge and Samuels (1974) suggested that component processes of reading, such as letter or word identification, require less of a reader's already limited cognitive resources as students become more proficient with them. More resources are then put towards understanding what was read. Perfetti's (1985) verbal efficiency model suggested that other components of reading (e.g., verbal efficiency), not just word recognition, can become increasingly automatized, thereby freeing attention and working memory resources that can then be used for reading comprehension.

Accurate word decoding is necessary but not sufficient for reading comprehension. If a student's word decoding is accurate yet laboured, cognitive resources required for comprehension become limited. Working memory is important for word reading and comprehension. It is used to store and manipulate information within a sentence or from previous sentences to facilitate understanding of a reading passage (Perfetti, Landi & Oakhill, 2005). For the fluent reader, cognitive resources of attention and memory are allocated differently: because words are recognized more automatically, these cognitive resources can be used for purposes such as attending to syntax, or interpreting text (NRP, 2000).

Reading Fluency

Reading fluency is the ability to decode words accurately and fluidly, and with good expression (Daly et al., 2005; Kuhn & Stahl, 2003). Foundational skills required for successful reading fluency include phonological awareness and the alphabetic principle as described above (Ehri et al., 2001). Reading fluency, as opposed to accurate word decoding alone, is a prerequisite for the target goal of reading comprehension (Daly et al., 2005; Fuchs, Fuchs, Hosp, & Jenkins, 2001; Pikulski & Chard, 2005). After being recognized as one of five essential reading skills identified by the National Institute of Child Health and Human Development (NICHD; NRP, 2000), reading fluency has gained importance and attention as a skill that is critical to reading proficiency (Fuchs et al., 2001; NRP, 2000).

Reading fluency has been identified as an important component in reading achievement and in comprehension, and reading will continue to be effortful and slow for those children who do not develop fluency. Students in elementary school must learn to read so that they can ultimately read to learn, and reading more fluently allows children to better use reading as a tool for learning (Daly et al., 2005). Children who read more fluently are more likely to choose to read for pleasure (Skinner, 1998). Those children who are behind their peers in terms of basic early literacy skill development do not have as much practice in reading (Allington, 1984), which is critical in developing reading fluency.

Reading Fluency Interventions

Reading comprehension improves when reading becomes less effortful for students, and more cognitive resources are put towards providing meaning to text (LaBerge & Samuels, 1974; Samuels, 1979). Automaticity and fluency in reading skills are typically viewed on a continuum, as aspects that can improve gradually with practice (NPR, 2000). For example, Samuels (1979)

found that it is possible to see a gradual, continuous improvement in reading rate with practice, and that other aspects of reading fluency can show gradual improvement as well; however, not all practice is considered equal. For example, simply studying word lists has been shown to be insufficient for improving reading fluency (LeVasseur, Macaruso, & Shankweiler, 2008). Students are likely better off reading text in which words are provided in a meaningful context (Fleischer, Jenkins, & Pany, 1979). Curriculum-based measurement of oral reading fluency (ORF), in which students are required to orally read short, standardized, and grade-specific passages, is a commonly used and efficient indicator of the rate and accuracy dimensions of reading fluency. Measurement of skill with reading fluency is usually based on number of words read correctly in one minute (WCPM; Fuchs et al., 2001; Pikulski & Chard, 2005) on short and meaningful reading passages.

It is important that instructional approaches targeting increasing reading fluency be evidence-based and efficient, and that they target not just accuracy, but also reading rate and expression (Begeny, 2009; Daly et al., 2005; NPR, 2000). Oral reading fluency interventions typically include a repeated readings component, in which students re-read short passages until they reach fluency. Reading passages repeatedly gives the student the opportunity to practice difficult words and phrases (Samuels, 1979) and has been found to be effective in improving reading fluency, as well as word recognition and comprehension (NRP, 2000). There are several strategies, or components, that will be used in the present study that have been shown to help improve reading fluency in children, including modeling and goal-setting. Modeling, also known as passage previewing, occurs when students listen to the passage read to them by a more skilled reader. This helps students improve reading fluency by giving them an opportunity for extra reading practice through listening and following along (Begeny, Krouse, Ross, & Mitchell,

2009). Phrase-drill error correction procedures occur when teachers first model how to read a word or phrase with which the student is having difficulty, and then ask the student to repeatedly practice reading the word or phrase (Begeny, 2009). This strategy has been shown to be important for helping students improve their reading fluency (Begeny, Daly, & Valleley, 2006). Performance feedback procedures involve explicitly telling the student their WCPM scores and showing them their progress using a visual representation, for example a graph, along with positive praise statements when students show improvement (Begeny, 2009). Such procedures are most effective when used in conjunction with goal-setting procedures, in which students are encouraged to reach a specific goal of WCPM (Morgan & Sideridis, 2006). Meta-analyses by Morgan and Sideridis (2006) and Therrien (2004) have identified the components described above as effective when combined with repeated readings strategies.

Attention Difficulties and Reading Fluency

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by deficits in attention and hyperactivity-impulsivity (American Psychiatric Association, 2013). Deficits are also seen in executive functions, which involve the self-regulation of attention, cognition, emotion and behaviour (Barkley & Murphy, 2011; Haydicky, Wiener, Badali, Milligan, & Ducharme, 2012; Zelazo & Lyons, 2012). Children who have been diagnosed with ADHD tend to have greater difficulty reading fluently, and are at greater risk for reading failure (Ghelani et al., 2004; Willcutt et al., 2001).

Students who struggle with inattention, specifically during the time at which they are learning early literacy skills, are at greater risk for reading difficulty as they continue in school (Willcutt et al., 2007). Theories of reading acquisition emphasize the role of cognitive resources of attention and working memory in learning to reading fluently and with automaticity (LaBerge

& Samuels, 1974; Perfetti, 1985). If a child has limited attention and cognitive capacity for more basic reading skills like word decoding, constructing meaning from text becomes difficult (LaBerge & Samuels, 1974; Samuels, 1979). Attention is also important in the development of self-regulation of cognition and behaviour, which along with working memory, are cognitive processes associated with reading achievement (Blair & Razza, 2007; Garrison Institute, 2005; Ghelani et al., 2004; Swanson, Saez, & Gerber, 2004; Willcutt et al., 2001; Zelazo & Lyons, 2012; Zylowska, 2008).

Self-regulation is associated with impulse control and inhibition. More generally, it is the ability to execute an action while overcoming genetic or environmental factors that might be distracting (Zylowska, Smalley, & Schwartz, 2009). Self-regulation results from active or effortful engagement of cortical structures associated with cognitive, emotional, and behavioural regulation (Diamond, 2002). Of increasing interest to researchers are treatment programs that target increasing self-regulating capacity in children with ADHD, for example interventions targeting working memory, as opposed to pharmacological treatment alone (Klingberg et al., 2005). Self-regulation has been shown to predict reading skills for younger children (Blair & Razza, 2007). It is therefore possible that a brief mindful breathing component added to a reading fluency intervention, which may target executive functions, could result in greater increases in fluency for students who display attentional difficulties.

Additionally, the specific cognitive deficits associated with ADHD, for example working memory and attention, are dimensional (Marcus & Barry, 2011). Therefore, students with sub-clinical ADHD are not entirely different from students with diagnosed ADHD, and may have similar reading difficulties requiring similar instructional or intervention strategies. For example Ek, Westerlund, and Fernell (2013) found that children with mild attentional difficulties had

similar profiles on the Wechsler Intelligence Scale for Children, Third Edition (WISC-III) compared to children with ADHD diagnoses, in that both groups had measures of working memory and processing speed that were lower than would be expected by their general cognition score (i.e., discrepant). This implies that children with milder attentional difficulties, such as those who participated in this study, may benefit from similar intervention as those used for children with ADHD.

Mindfulness Interventions and Academic Outcomes

Research suggests that participation in contemplative programs such as mindfulness interventions can lead to higher grade point averages, better work habits, and greater cooperation among students (Benson et al., 2000). While many researchers have looked at the effects of mindfulness interventions on academic outcomes (e.g., Benson et al., 2000; Linden, 1973; Salomon & Globerson, 1987), few, if any, have explored the integration of mindfulness practice with academic interventions. Mindfulness intervention programs in schools vary in duration, running from a single session to several months of practice (Greenberg & Harris, 2011), and involve multiple methods of teaching mindfulness including psychoeducation (Greenberg & Harris, 2011) and mindful meditation, in which meditators learn to notice rather than judge their thoughts, sensations, and emotions (Kabat-Zinn, 1990). Because interventions have largely been evaluated as full programs, without component analyses, it can be difficult to ascertain which parts of the intervention programs are effective and which are not. While it is thought that repetition of mindfulness training may be required if neural activity is to be altered, more research is needed to examine the differential effects of dosage on mindfulness training outcomes (Greenberg & Harris, 2011). What follows is a description of the contemplative

practice of mindfulness, how it is currently being used with children with attentional difficulties, and a review of studies looking at immediate effects of mindfulness training with adults.

What is Mindfulness?

The term mindfulness has been defined in a variety of ways, though most commonly, definitions refer to the act of bringing attention and awareness to the present moment (Garrison, 2005; Zelazo & Lyons, 2012). Mindfulness is commonly referred to as a meta-awareness, or an ability to become aware without evaluating or judging a situation or thought (Kabat-Zinn, 2003). In contrast to mindfulness, mind*less*ness is defined as the pulling away of attention from that which one is currently experiencing, for example ruminating about past events or feeling anxiety about future events (Salomon & Globerson, 1987). Though the concept of mindfulness originates from Buddhist tradition, its modernized form is frequently used in clinical settings and in psychological research (Kabat-Zinn, 2003; Zelazo & Lyons, 2012). Zylowska and colleagues (2009) define mindfulness as a type of attention regulation training, representing an individual's ability to select the most relevant sensations, memories, and stimuli among those that are being experienced.

There are a variety of procedures currently used to foster mindfulness (Zylowska et al., 2009); however, most techniques share a common goal of focusing attention on something, such as the breath or a sound, and increasing awareness of one's thoughts (Greenberg & Harris, 2011). Focusing on your body and acting as a witness to your own experiences by becoming accepting of your present thoughts and feelings are also important elements of the practice of mindfulness (Kabat-Zinn, 1990). According to Napoli, Krech, and Holley (2005), one of the key elements of mindfulness practice is focusing on one's breath. Breathing is important to the regulation of the autonomic nervous system, and deep and rhythmic breathing has been shown to increase self-

awareness and improve focusing of the mind (Davidson et al, 2003; Napoli et al., 2005; Salmon, Santorelli, & Kabat-Zinn, 1998). Typically, mindfulness interventions for children and adolescents occur in small group settings and involve activities such as mindfulness meditation, breathing exercises, and yoga (Greenberg & Harris, 2011). It is important to use simple instructions with children (Zelazo & Lyons, 2012), and props such as musical instruments can be useful for encouraging focus on breathing and attention by helping children direct their attention to something concrete (Kaiser-Greenland, 2010).

Mindfulness and Attention

Children with significant attentional difficulties may benefit from practicing mindfulness. Evidence suggests mindfulness practice can increase the ability of children to control their attention, enhance executive functioning, and improve working memory (Chambers et al., 2008; Flook et al., 2010; Semple, 2010). Mindfulness interventions have also been found to help children improve on measures of attention and behaviour (Semple, 2010). Executive functioning and social-emotional processes thought to improve through mindfulness training are also important for academic success and reading achievement (Blair, 2010; LaBerge & Samuels, 1974; Perfetti, 1985).

There are several reasons why mindfulness interventions might be effective for improving symptoms for children with significant attentional difficulties. Mindfulness practice is thought to help individuals experience the self-observation necessary to monitor and regulate cognitive responses (Garland, Gaylord, & Fredrickson, 2011; Jha, Krompinger, & Baime, 2007). Age-appropriate mindfulness interventions may be beneficial in helping children develop the ability to better reflect on their present experience, which could result in the development of better self-regulation by increasing top-down (controlled) influences on behaviour, and lessening

bottom-up (automatic) influences, such as anxiety and stress (Zelazo & Lyons, 2012). Mindfulness practice itself involves repeatedly employing processes of EF, including attention and cognitive inhibition, thus strengthening these processes, which in turn increases self-regulation (Flook et al., 2010; Zelazo & Lyons, 2012).

In sitting meditation, a common form of mindfulness meditation, attention is focused on an attentional anchor or focus point such as the breath or a ringing instrument. This is meant to practice overcoming distraction and returning attention to the anchor. Mindfulness practices often involve the training of attention through repeatedly returning focus when attention has wandered. This practicing of controlling attention is meant to help children become better able to accomplish what they need to in school by helping in the development of a more flexible mindset, which helps children learn from mistakes and adapt their plans of action when they reach potential roadblocks (Flook et al., 2010; Napoli et al., 2005; Zelazo & Lyons, 2012).

Effectiveness of Mindfulness Interventions for Increasing Attention

Though few in number, recent studies have examined the effectiveness of mindfulness interventions in individuals with significant attentional difficulties, including those with ADHD, and have found a variety of positive outcomes including improvements in attention, anxiety, depression, self-reported ADHD symptoms, cognitive inhibition, and executive functioning (e.g., Haydicky et al., 2012; Jha et al., 2007; Semple, 2010; van de Weijer-Bergsma, Formsma, Bruin, & Bogels, 2012; Zylowska, 2008). Mindfulness exercises, such as the mindful breathing protocol, employed in the present study are designed to help students pay attention to their own attention (Zylowska et al., 2009). For example, Jha and colleagues' (2007) eight-week mindfulness training study showed improvements in two types of attention: orienting attention, or the ability to disengage and re-engage attention, and conflict attention, or the inhibiting of

automatic responses for responses that are less automatic. In their study, Napoli and colleagues (2005) examined a 24-week mindfulness intervention, which focused on increasing awareness of all five senses and practicing distancing oneself from thoughts that are intrusive. Elementary school students who participated in the mindfulness condition showed improvements in attention as measured by three attention scales completed by students and their teachers.

The studies referred to above vary greatly in terms of their design procedures, duration, and the intervention components included. No component analyses were conducted to determine which aspects of the mindfulness intervention programs, for example mindfulness meditation or psychoeducational components, were responsible for the observed changes in attention and behaviour. Napoli and colleagues (2005) suggest that repetition is key for developing mindfulness and that a series of 8-10 consistent classes is the minimum number of sessions required for an effect. However, more research is needed on the differential effects of dosage of mindfulness practice to affect change (Greenberg & Harris, 2011) and on possible immediate outcomes from mindfulness meditation.

Brief Mindfulness Interventions

The majority of studies with children and mindfulness interventions are multi-week, multi-component interventions (e.g., Haydicky et al., 2012; Napoli et al., 2005; van der Oord, Bögels, & Peijnenburg, 2011); however, there is some evidence from studies conducted with adult populations to suggest that it is possible to see immediate effects in outcome variables such as memory after short mindfulness practice sessions (e.g., Alberts & Thewissen, 2011). Additionally, shorter sessions of mindfulness practice may be more developmentally appropriate for children, who typically have a harder time sitting comfortably and focusing on their breath for more than three minutes (Burke, 2010). Though all studies reviewed in this section make use

of adult samples, it is possible that similar results may also be demonstrated by school-aged children.

Studies that employ brief sessions of mindfulness training vary in dosage, length, and in terms of when participants are tested, for example immediately following training sessions, or at the end of a series of training sessions. Tang and colleagues (2007) demonstrated that integrative meditation training delivered across five, 20-minute sessions resulted in improved attention and decreased anxiety, depression, anger, mood, and fatigue, compared to students who were given relaxation training. Participants were measured after the final mindfulness training session. A component analysis was not conducted to examine which aspects of their mindfulness training program were effective in producing outcomes. Similarly, Zeidan and colleagues (2010) utilized a weeklong mindfulness meditation intervention that was implemented for four, 20-minute sessions. The authors found that mindfulness training significantly improved working memory, executive functioning, and visio-spatial processing in undergraduate students as measured by timed and speeded tasks administered before training and again after the final session.

Testing participants after a series of mindfulness training sessions means that the variation between sessions is missed and it becomes difficult to rule out session effects (Johnson, Gur, David, & Currier, 2013). Some researchers (e.g., Alberts & Thewissen, 2011; Mrazek, 2012) administered one mindfulness session in an attempt to rule out session effects. Mrazek (2012) found that participants improved in sustained attention immediately following an eight-minute mindful breathing exercise compared to relaxation and reading control groups, indicating that it is possible to see immediate effects on attention from one session of mindfulness practice. Similarly, Alberts and Thewissen (2011) investigated the link between mindfulness and memory using a single session mindfulness intervention. Participants in the mindfulness condition

listened to a 12-minute recording instructing them to focus on their breathing and to notice arising thoughts without evaluation or judgment. Participants were then asked to remember neutral, positive, and negative words for a test of declarative episodic memory. Findings suggested that those in the mindfulness intervention condition recalled significantly fewer negative words than those in the control condition. The authors suggested that the mindfulness intervention might have neutralized the perceived negativity of the negative words, and that they were perhaps not processed as deeply. One implication of the studies described above is that brief mindful interventions focusing solely on the breath, as in the present study, may show immediate results in areas such as sustained attention and memory bias.

The Present Study

Several questions need addressing regarding school-based mindfulness interventions, such as how to successfully integrate mindfulness with academics, and the amount of time required for these practices to show an effect (Garrison, 2005). Several studies employing multi-week, multi-component mindfulness interventions have shown positive effects on academic outcomes (Benson et al., 2010; Greenberg et al., 2003), and on measures of executive functions including self-regulation, working memory, and attention, which are important cognitive processes for reading (Flook et al., 2010; Napoli et al., 2005; Zeidan et al., 2010; Zelazo & Lyons, 2012). Because mindfulness interventions have largely been evaluated as full programs without component analyses, it can be difficult to ascertain the most effective components or practices in multi-component mindfulness intervention that may lead to behavioural changes such as improvements in academic achievement (Alberts & Thewissen, 2011; Howell & Buro, 2011; Meiklejohn et al., 2012). Additionally, few studies have investigated dosage effects in mindfulness training.

The present study will expand on previous studies of immediate outcomes from brief mindfulness interventions by exploring the intersection of mindfulness research with academic intervention research. An exploratory brief mindful breathing exercise will be added to evidence-based strategies to improve reading fluency (Begeny, 2009; Begeny et al., 2006; Morgan & Sideridis, 2006; Therrien, 2004) to see whether the intervention becomes more effective for children with significant attentional difficulties. Two intervention conditions will be compared: a reading fluency intervention alone, and a reading fluency intervention plus a brief mindful breathing exercise. A randomized alternating treatment design will be employed to help tease apart differential treatment effects (Barlow, Nock, & Hersen, 2009; Oghena & Edgington, 1994), and to determine whether a brief mindful breathing exercise can produce immediate effects on an academic outcome, specifically reading fluency. The following research questions will be addressed:

1. *Does adding a brief mindful breathing exercise to a reading fluency intervention enhance reading fluency?*

It is hypothesized that the reading fluency intervention with the brief mindful breathing exercise will enhance reading fluency more than the reading fluency intervention alone.

2. *Does participation in the brief mindful breathing exercise result in an increase in attention and reduction in stress as indicated by student self-report?*

It is hypothesized that the reading fluency intervention with the brief mindful breathing exercise will result in an increase in self-reported attention, and a decrease in self-reported stress**.**

II. Method

Participants

Four students, ranging from Grades 3 to 5, were selected as participants for this study. Students were from an independent, Catholic elementary school in Vancouver, British Columbia and were known to their classroom teachers as demonstrating attentional difficulties when in the classroom, as indicated through teacher ratings on the Disruptive Behavior Disorder (DBD) rating scale (Pelham, Gnagy, Greenslade, & Milich, 1992). Participating students were instructional at or below their grade level for reading fluency. To be eligible to participate in the study, students were also required to read at least 40 words correctly per minute (WCPM) on Grade 1 level reading probes, which is suggested as the minimum level for which students benefit from fluency targeted reading interventions as opposed to early literacy skill instruction (Daly et al., 2005). Finally, students needed to score no lower than two standard deviations below the mean on two subtests from the Kaufman Brief Intelligence Test, Second Edition (KBIT-2; Kaufman & Kaufman, 2004), an abbreviated test of cognitive functioning. Students scoring below this cutoff on the KBIT-2 likely require more intensive treatment than the present intervention could provide. Participant demographics and selected results from the screening assessment are presented below in Table 1. Pseudonyms are used in place of participants' real names. One additional Grade 5 student took part in the screening assessment but did not meet criteria to participate in the study.

Table 1.

Student Demographics and Screening Results

Student Name	Grade	Language at Home	Instructional Reading Level[a]	Verbal Knowledge Standard Score (SS)[b]	Matrices SS[b]	DBD Inattention Subscale Rating[c]
Claire	3	English	2	105	98	4
Emma	4	English	3	110	74	8
Henry	4	Filipino	4	105	92	7
Jacob	5	English	5	105	94	5

Note. [a]Based on survey-level assessment, [b]Subtests from Kaufman Brief Intelligence Test, Second Edition (KBIT-2), [c]Inattention subscale score out of a possible 9 on the Disruptive Behavior Disorder (DBD) Rating Scale.

Measures

In order to verify whether students met inclusion criteria, measures of teacher-rated attention, oral reading fluency (ORF), and cognitive functioning were administered as part of the initial screening assessment process. A questionnaire was developed and administered to participants during the screening process to get an idea of their previous exposure to contemplative practices such as yoga or meditation. During the reading intervention phase, ORF probes from the Dynamic Indicators of Basic Early Literacy Skills 7th ed. (DIBELS Next; Good & Kaminski, 2011) were administered, and words read correctly per minute (WCPM) was used as the primary dependent variable. Two items measured state levels of attention and stress before and after the brief mindful breathing exercise component, serving as secondary dependent variables.

Disruptive behavior disorder rating scales. During the initial screening assessment, classroom teachers completed behaviour ratings using the inattention and hyperactivity subscales of the Disruptive Behavior Disorder (DBD) rating scale (Pelham et al., 1992). The inattention subscale consisted of nine items pertaining to ADHD inattention symptoms as per the Diagnostic

and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria for diagnosis. Items are rated on a scale from 0 ("Not at All") to 3 ("Very Much"). The counting symptoms method was used to determine whether students met inclusion criteria. A score of six or more items out of nine endorsed as either "Pretty Much" or "Very Much" is the minimum score required to meet criteria for ADHD Predominantly Inattentive Type. For the purposes of this study, participants were eligible if they were endorsed as 'Pretty Much" or "Very Much" for five or more items, since it is not necessary that they meet the full requirements for diagnosis of ADHD, but that they demonstrate difficulties with attention.

Mindfulness activities screening questionnaire. A short questionnaire was created to see whether students had previously engaged in or been exposed to contemplative practices such as yoga or meditation training, where attending to thoughts and regulating attention are often emphasized (Shapiro et al., 2014). Another purpose of the questionnaire was to help build relationships with participants and get to know them better. First, students were asked which activities they like to do for fun and in their spare time. Second, students were asked whether they took part in specific contemplative practices such as yoga or meditation (Garrison, 2005; Shapiro et al., 2014). Students were also asked whether they had any martial arts training (e.g., Tae Kwon Do). Many types of traditional martial arts training practices involve focusing attention and cultivating a present-focused mindset, which has been shown to help children improve on aspects of executive functioning including self-regulation (Diamond, 2012; Lakes & Hoyt, 2004). If students indicated they participated in these activities, they were asked how long they have participated in the activity. Finally, students were asked whether their parents engaged in activities such as yoga, martial arts, or meditation as an indication of whether students have

had exposure to such practices through their parents' involvement. Responses were noted and used to aid in the interpretation of results.

Cognitive functioning. The Verbal Knowledge and Matrices subtests from the Kaufman Brief Intelligence Test, Second Edition (KBIT-2; Kaufman & Kaufman, 2004) were administered as brief indicators of cognitive functioning during the screening assessment. These subtests were selected because they represent two of the four abilities (comprehension-knowledge and fluid reasoning) most closely correlated with general intelligence (Kaufman & Kaufman, 2004). The KBIT-2 is a standardized, norm-referenced, brief intelligence test designed for individuals aged 4 years to 90 years, 11 months. The KBIT-2 has demonstrated good reliability, with internal consistency of the IQ Composite of .93 (internal consistency of the nonverbal subtest of .88, and of the verbal subtests of .91). Validity evidence demonstrates that the KBIT-2 has strong correlations with other tests of intelligence including the Wechsler Intelligence Scale for Children - Fourth Edition (WISC-IV; $r = .77$) and the Wechsler Adult Intelligence Scale - Third Edition (WAIS-III; $r = .89$).

Reading fluency. Oral Reading Fluency **(**ORF) probes from the Dynamic Indicators of Basic Early Literacy Skills, 7th ed. (DIBELS Next; Good & Kaminski, 2011) were administered to determine whether participants met inclusion criteria, to determine the instructional level of participants, and as indicators of reading fluency throughout the intervention. During screening procedures, three passages were administered to each student at their grade level. For this procedure, oral reading fluency was measured using words correct per minute (WCPM). The median WCPM and words read incorrectly per minute (WIPM) across the three passages were used to make decisions about instructional levels for the intervention as described in the Procedure section. DIBELS Next ORF passages were used as a measure of rate of accurate oral

reading during the screening assessment, and during intervention sessions in order to track changes.

DIBELS ORF passages, available for Grades 1 through 6, are curriculum-based measures of student reading accuracy and rate with connected text. Errors include words that are mispronounced, substituted, omitted, reversed, or not read as whole words, as well as hesitations lasting longer than three seconds (Hosp, Hosp, & Howell, 2005). WCPM is calculated by subtracting the number of errors made from the total number of words read in one minute (Good & Kaminski, 2011). For DIBELS Next reading probes, WCPM appears to be a reliable measure of rate of accurate oral reading, with *r*s > .90 for test-retest and inter-rater reliabilities, and *r* > .84 for alternate forms reliability. Validity evidence indicates that WCPM on DIBELS ORF passages is moderately to strongly correlated with other measures of overall reading (Good & Kaminski, 2011; Reschly, Busch, Betts, Deno, & Long, 2009).

Attention and stress measures. During each intervention session, students were asked two questions to determine whether the brief mindful breathing exercise had an effect on the ability of the participant to pay attention to the present moment, and their level of stress. These items acted as state level measures of attention and stress. Students rated, on a scale from 0% to 100% (0% = Extremely Difficult and 100% = Extremely Easy), the item: "How easy is it for you to pay attention, right now." Next they rated, on a scale form 0% to 100% (0% = Extremely Relaxed and 100% = Extremely Stressed), the item: "How stressed do you feel, right now." Students indicated their ratings by moving a bead on a wooden board slider (see Appendix to see the visual scale used by participants). In the Reading Fluency Only (RF Only) condition the attention and stress items were asked before the reading fluency intervention was administered. In the Reading Fluency plus Brief Mindful Breathing Exercise (RF + MB) condition the

attention and stress items were administered before and after the brief mindful breathing exercise in order to ascertain whether there were differences in pre- and post- brief mindful breathing exercise measures, and whether there were differences in pre-reading measures between conditions.

Procedure

Recruitment and screening. Once participants were identified by their classroom teacher as being good candidates for participation in the study, active consent was obtained from a parent or guardian through a signed form. Student assent was obtained prior to working with participants after the study was explained to them verbally. Following the consent process, screening assessments were conducted to ensure that participants met inclusion criteria. During screenings, the KBIT-2 was used as a brief test of cognitive functioning, and two items were administered to measure perceived attention and stress in order to ensure participants understood these items and the response format before the intervention was implemented. A questionnaire was administered to students to see whether they engage, or have engaged, in activities associated with cultivating mindfulness such as yoga (Diamond, 2012; Shapiro, 2014).

Screening assessments were used to determine each participating student's current and instructional reading level using a survey-level assessment (Shapiro, 2011). During the assessment, students were asked to read three DIBELS Next passages at their grade level for a period of one minute each. For the purposes of the present study, if the student had a median WCPM score that fell within the 25th percentile for fall grade level norms, and the 75th percentile for spring grade level norms using AIMSweb national norms (AIMSweb, 2012), that level was considered to be the student's instructional level. The procedure was repeated, either moving up or down in grade level, until an instructional level was found for each student. A colleague

independently determined instructional level based on a review of the collected data to check agreement.

Intervention implementation. Interventions began once an instructional reading level was identified for each student. Intervention sessions were conducted at the school of participating students, twice per week for a period of six weeks and a total of 12 sessions each. Sessions were administered by the author, a graduate student enrolled in the School Psychology program at the University of British Columbia. Intervention sessions lasted approximately 12 minutes for the RF Only condition, and approximately 15 minutes for the RF + MB condition. All sessions were audio recorded.

A restricted alternating treatment design (ATD; Barlow et al., 2009; Onghena & Edgington, 1994) was used in order to examine the effectiveness of the brief mindful breathing exercise component. Each student received multiple sessions of both treatments, alternating the independent treatment conditions of a reading fluency intervention alone with a reading fluency intervention plus a brief mindful breathing exercise. The two treatment conditions were randomly presented and randomly ordered within subjects. Randomization occurred in pairs for each student to prevent the situation of having one treatment, for example treatment B, being concentrated at the beginning of the study (e.g., BBBBBCCCCC), and resulting in a more acceptable sequence (e.g., BCBCCBBCCB; Barlow et al., 2009; Onghena & Edgington, 1994). A detailed description of the intervention procedures can be found in Appendix A.

Reading fluency intervention only (RF Only). The reading fluency intervention was composed of instructional strategies aimed at improving reading fluency including timed repeated readings, modeling, and phrase-drill error correction. These strategies have been shown to increase reading fluency in students (Begeny, 2009; Begeny et al., 2006; Daly & Martens,

1994; Daley et al., 2005). The intervention is similar in content and ordering of components to that of the effective Helping Early Literacy with Practice Strategies (HELPS) intervention (Begeny, 2009; Begeny, Mitchell, Whitehouse, Samuels, & Stage, 2011; Begeny, Ross, Greene, Mitchell, & Whitehouse, 2012); however, DIBELS Next progress-monitoring materials were used as instructional passages rather than the HELPS passages. This was due to the fact that HELPS passages steadily increase in difficulty, whereas DIBELS passages are standardized and calibrated for each grade level. Additional deviations from the HELPS procedure included that no reading goals were set other than to encourage the student to improve in WCPM from their first reading to their third reading, and a rewards procedure was not included.

During intervention sessions, students were required to complete three repeated readings of one passage, which were timed for one minute each. After the first timed reading, students were asked a comprehension question in which they were required to tell the administrator everything they remembered from the passage. Students then listened as the passage was modeled to them by the administrator, who paused periodically to let students fill in missing words to ensure they were following along. After the second repeated reading, students participated in a phrase-drill error correction procedure, in which they re-read the more difficult words or phrases aloud, three times each. After students completed the third repeated reading, there was a performance feedback component in which their performance on the first and third readings were graphed in terms of WCPM and number of errors. Positive praise statements were used throughout the reading intervention.

Reading fluency intervention plus brief mindful breathing exercise (RF + MB). In the RF + MB condition, participants began the intervention session with a brief mindful breathing exercise before receiving the reading fluency intervention. The brief mindful breathing

exercise procedure was adapted from the MindUP Curriculum (Hawn Foundation, 2011) and required the student to practice breathing and then sit and listen to the sound of a chime for as long as they could, while focusing on the rise and fall of their breath. They were instructed to bring their attention back to their breath when their mind began to wander. This exercise is posited to help students focus on their breath, increase self-awareness, and regulate the autonomic nervous system (Napoli et al., 2005; Salmon, Santorelli, & Kabat-Zinn, 1998). A more detailed description of the brief mindful breathing exercise is presented in Appendix A.

Treatment integrity and inter-scorer agreement. The critical steps necessary to complete the two treatment interventions are outlined in Appendix A. Following each intervention session, the interventionist completed a checklist of the critical intervention steps. Throughout the intervention 100% of steps were completed. Intervention sessions were audio recorded, and 33% of sessions (i.e., four out of 12 sessions for each participant) were examined by another graduate student, who confirmed that 100% of critical steps were completed by the interventionist for each session reviewed.

Audio-recorded screening assessments and intervention sessions were also examined by another graduate student to determine inter-scorer agreement on oral reading fluency measures. Inter-scorer agreement was calculated for each of the three readings per session reviewed, by dividing the lower value WCPM score by the higher value WCPM score, and multiplying by 100 to yield a percentage of agreement between raters. Agreement ranged from 97%-100% for each passage, indicating good agreement (Kratochwill et al., 2010).

Overall inter-rater agreement for reading fluency was measured by calculating the concordance correlation coefficient (CCC). The CCC indicates how close the agreement was between raters by looking at the differences between observed values (Lin, 1989; Quinn, Haber

& Pan, 2009). In comparison, the Pearson and intra-class correlation coefficients would indicate whether scores calculated by the two raters varied in the same direction, or differed by a fixed value, respectively, which were considered less useful pieces of information for this study. Overall inter-rater agreement was calculated as CCC = .995, with a 95% confidence interval of .992-.997, suggesting good agreement (Quinn et al., 2009) between raters overall and exceeding minimal thresholds outlined by Kratochwill and colleagues (2010) of greater than 0.80-0.90 on average.

Data analysis. Data from each intervention session were graphed and analyzed using visual analysis techniques. Graphs were examined for clear separation between conditions and variability of data (Barlow et al., 2009; Gorman & Allison, 1996).

III. Results

Screening Assessment Results

For the screening assessment, DIBELS Next Oral Reading Fluency (ORF) probes (Good & Kaminski, 2011) were administered in order to determine students' instructional reading levels, using a survey level assessment procedure (e.g., Shapiro, 2011). Results of the survey level assessment indicated that two students (i.e., Claire and Emma) were instructional one level below grade level. The remaining two students (i.e., Henry and Jacob) were instructional at their respective grade levels.

Cognitive assessment results using the KBIT-2 (Kaufman & Kaufman, 2004) suggested age-appropriate abilities on the Verbal Knowledge and Matrices tasks for Claire, Henry, and Jacob. Emma displayed age-appropriate abilities on the Verbal Knowledge task; however, her performance on the Matrices task was in the low range compared to most other children her age. Because her score was not below the cutoff of two standard deviations below the mean, and because motivation appeared to play a large role in her low score on this task, Emma continued to meet criteria as a student who might benefit from this intervention.

The Disruptive Behavior Disorder (DBD) rating scale (Pelham et al., 1992) was completed by classroom teachers to identify whether students were displaying attentional difficulties in the classroom. Three students (i.e., Emma, Henry and Jacob) met the cutoff criteria of at least five of the Inattention symptoms rated as "Pretty Much" or "Very Much." An exception was made for Claire, whose classroom teacher endorsed four symptoms as "Pretty Much" or "Very Much" on the Inattention Subscale of the DBD rating scale, and five additional symptoms as "Just a Little". It was decided to include Claire as a participant because she was close to the cutoff and she did demonstrate at least some inattentive symptoms.

A questionnaire was administered to students regarding their hobbies and previous experience with activities associated with mindfulness and attention training (Diamond, 2012). One student, Henry, had participated in the MindUp curriculum (Hawn Foundation, 2011) at his previous school, and stated that he did engage in a short mindful breathing exercise before hockey practices and games. None of the other participating students reported having participated in activities associated with contemplative practice. See Table 1 for a summary of screening assessment results in the Method section.

Intervention Results

The RF Only condition consisted of the administration of the reading fluency intervention alone, while the RF + MB condition consisted of the administration of a brief mindful breathing exercise, followed by the same reading fluency intervention used in the RF Only condition. See Table 2 for means and standard deviations of words correct per minute for each student, first for the third and final read-through of the passage, and second for the difference in words correct per minute between the first and third read-through of the passage. Figures 1 and 2 present graphical representations of words correct per minute for each participant, per session. Figure 1 presents WCPM for the third and final read-through of the passage, while Figure 2 presents the difference in WCPM between the first and third read-through of the passage. Table 3 presents the means and standard deviations of self-reported ratings (on a scale from 0-100%) of ability to pay attention and feelings of stress. Figure 3 displays graphs of attention ratings provided by each participant across intervention sessions, and Figure 4 displays graphs of ratings of stress for each participant. Results are presented by dependent variable, beginning with reading fluency and followed by the self-reported measures of feelings of stress and attention.

Reading fluency.

Table 2

Means and Standard Deviations of Reading Fluency Measures Across Conditions

	Mean WCPM – 3rd read (SD)		Mean WCPM – Difference Between 1st and 3rd read (SD)	
Student	RF Only	RF + MB	RF Only	RF + MB
Claire	115.5 (3)	112.3 (12)	34.0 (2)	35.2 (8)
Emma	118.5 (5)	113.7 (11)	18.7 (12)	15 (11)
Henry	126.3 (15)	133.0 (12)	25.5 (14)	26.5 (10)
Jacob	146.3 (11)	153.8 (18)	33.8 (23)	32.8 (7)

Note. WCPM = Words correct per minute; RF Only = Reading Fluency Only; RF + MB = Reading Fluency plus Mindful Breathing.

Third read-through WCPM.

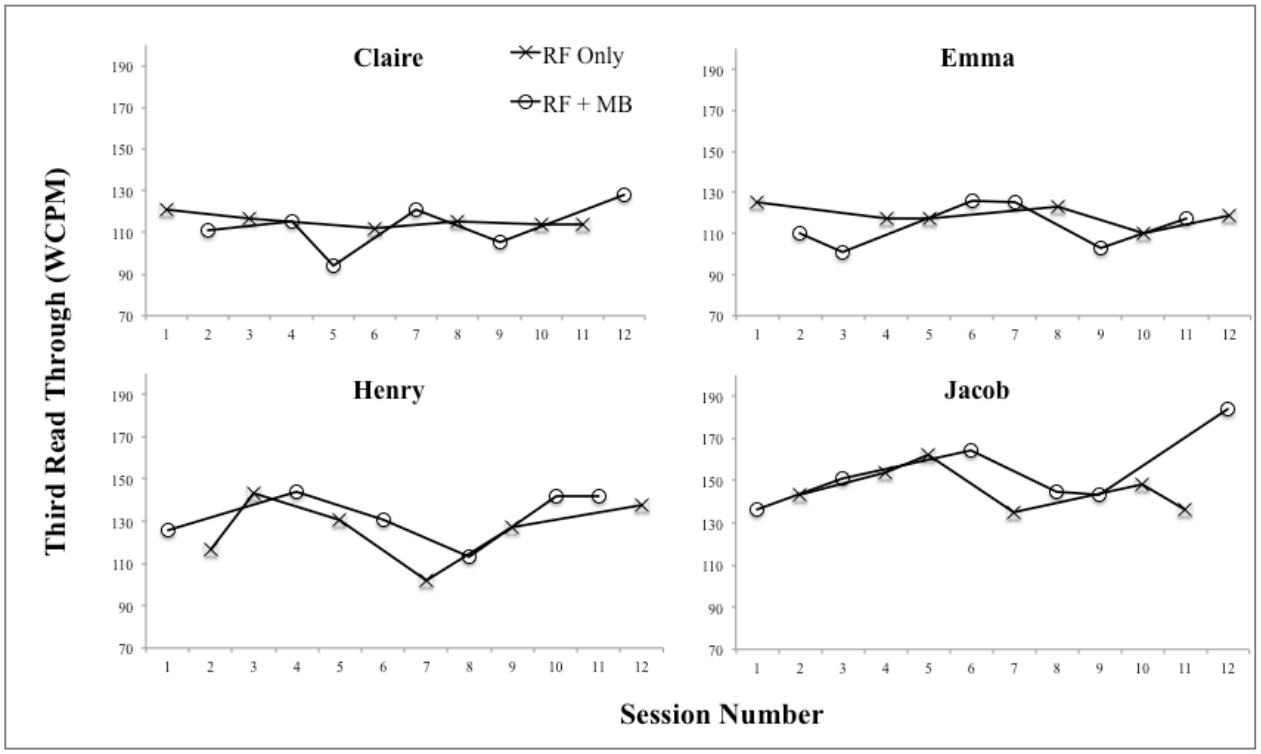
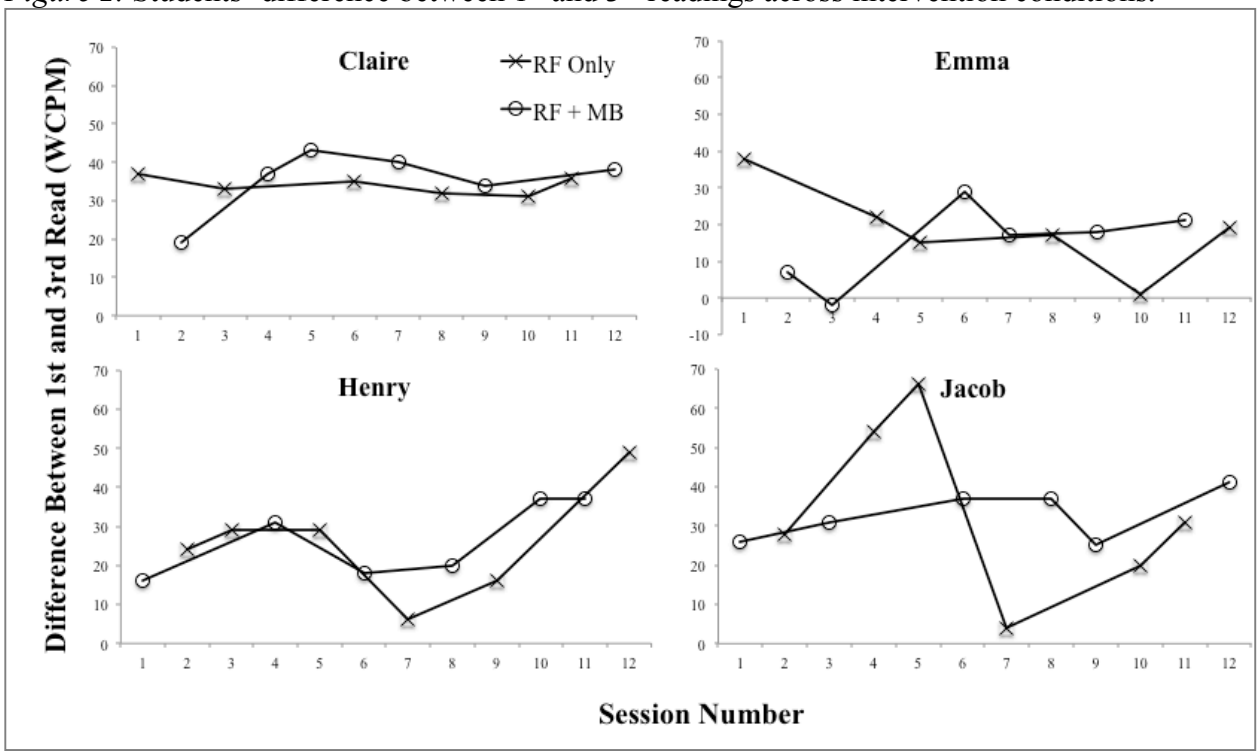


Figure 1. Students' WCPM on the third read-through across intervention conditions

Graphic results of students' oral reading fluency, measured by words correct per minute, across both intervention conditions on the third read-through of the passage are displayed in Figure 1. Overall, there was a high amount of overlap and little to no discrimination between conditions for all four participants. Both Claire and Emma had a higher average WCPM for the reading fluency only condition (Claire: $M = 116$; Emma: $M = 119$), compared to when they also participated in the brief mindful breathing exercise (Claire: $M = 112$; Emma: $M = 114$); however, a visual analysis of the data shows very little separation between conditions. Both Claire and Emma showed more variability in reading performance when they participated in the brief mindful breathing exercise (Claire: $SD = 12$; Emma: $SD = 11$), compared to when they did not (Claire: $SD = 3$; Emma: $SD = 5$). For both Henry and Jacob, their average performance was higher in the RF + MB condition compared to the RF Only condition; however, there was not clear separation in performance across sessions. Henry and Jacob both read more WCPM in the RF + MB condition (Henry: $M = 133$; Jacob: $M = 154$), compared to the RF Only condition (Henry: $M = 126$; Jacob: $M = 146$). Though two students (i.e., Henry and Jacob) read, on average, more words correct per minute when the brief mindful breathing exercise was added, compared to when it was not, based on a visual analysis of the graphic display of data for the third read-through of the passage, there was no clear difference between conditions.

Difference between first and third read-through WCPM.

Figure 2. Students' difference between 1st and 3rd readings across intervention conditions.



When looking at the difference between the third and first read-through of the reading passage, patterns of performance varied among participants. For Claire, there was little difference in average performance between conditions (RF Only condition: $M = 34$ vs. RF + MB condition: $M = 35$), though she showed more variability when she participated in the brief mindful breathing exercise ($SD = 8$), compared to when she did not ($SD = 2$). For sessions four through 10, there did appear to be some separation between conditions, with a larger difference observed between the first and third read-through for the reading fluency plus brief mindful breathing exercise condition; however, this separation did not continue across the remainder of sessions. There was no difference between conditions for Henry ($M = 23$ for both the RF Only and RF + MB Conditions). Henry demonstrated a high degree of variability (RF Only: $SD = 33$; RF + MB: $SD = 24$) and overlap between conditions, though there was some separation observed from

sessions seven through 10, indicating a greater difference observed for the reading fluency plus brief mindful breathing exercise condition compared to the reading fluency only condition, which as with Claire, was not maintained. Jacob also demonstrated high variability in both conditions, with more variability observed when he received the reading fluency intervention only (*SD* = 19) compared to when he also participated in the brief mindful breathing exercise (*SD* = 12). Jacob showed little difference in WCPM between the first and third read-through when he did not participate in the brief mindful breathing exercise (RF Only: *M* = 34) compared to when he did (RF + MB: *M* = 33). Finally, Emma also displayed a greater difference between the first and third read-through when she received the reading fluency intervention only (RF Only: *M* = 19) compared to when she also received the brief mindful breathing exercise (RF + MB: *M* = 15). Though there was some separation observed for two participants (i.e., Claire and Henry) in the middle of the intervention, based on visual analyses and looking at average performance between conditions, overall there did not appear to be a clear difference observed between conditions based on the difference between the first and third read-through of passages read; however, the difference scores show that regardless of condition, the reading fluency intervention appears to have been effective for students.

Attention and stress measures.

Table 3

Means and Standard Deviations of Attention and Stress Measures Across Conditions

	Mean Attention rating (SD)		Mean Stress rating (SD)	
Student	RF Only	RF + MB	RF Only	RF + MB
Claire	90 (6)	88.3 (8)	20 (9)	18.3 (8)
Emma	71.7 (22)	80 (32)	51.7 (39)	75 (35)
Henry	46.7 (12)	48.3 (17)	23.3 (33)	23.3 (24)
Jacob	41.7 (17)	83.3 (10)	63.3 (19)	18.3 (12)

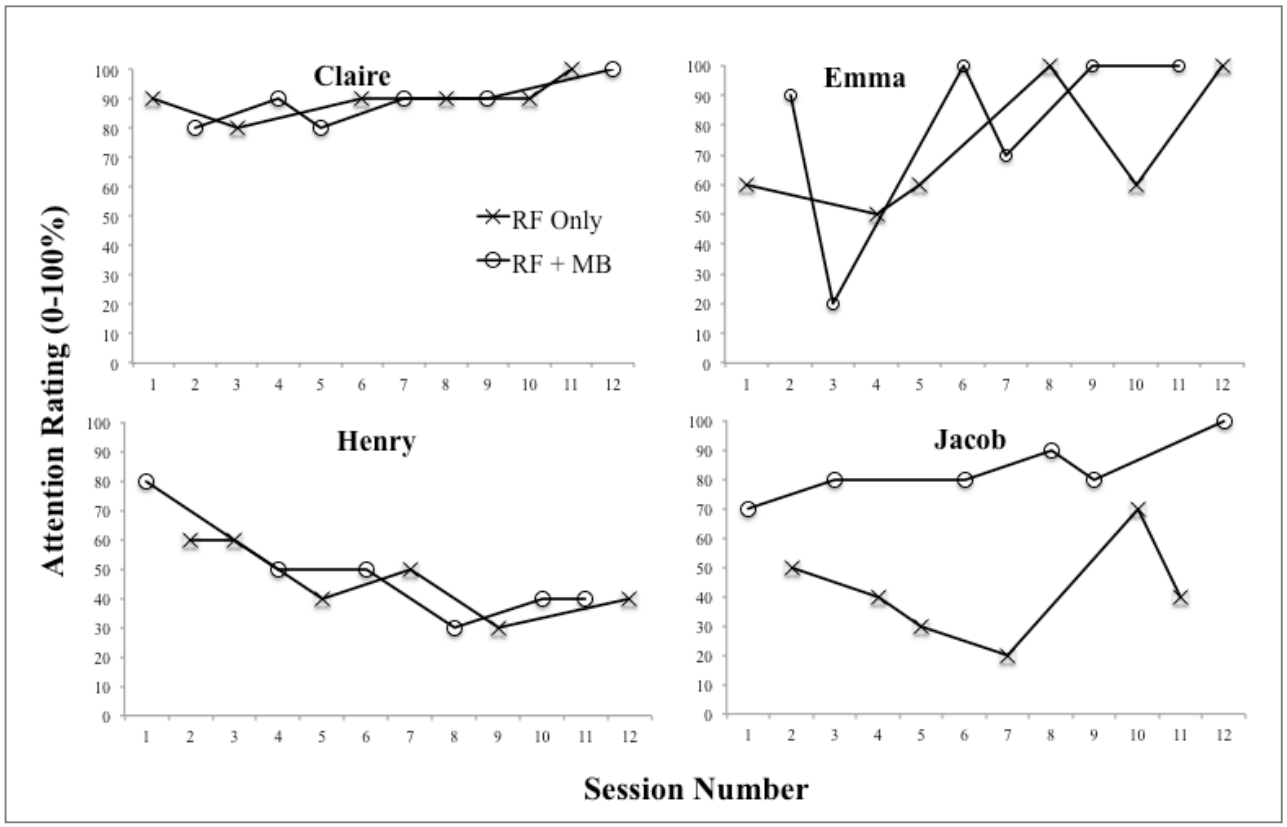


Figure 3. Students' attention ratings across intervention conditions.

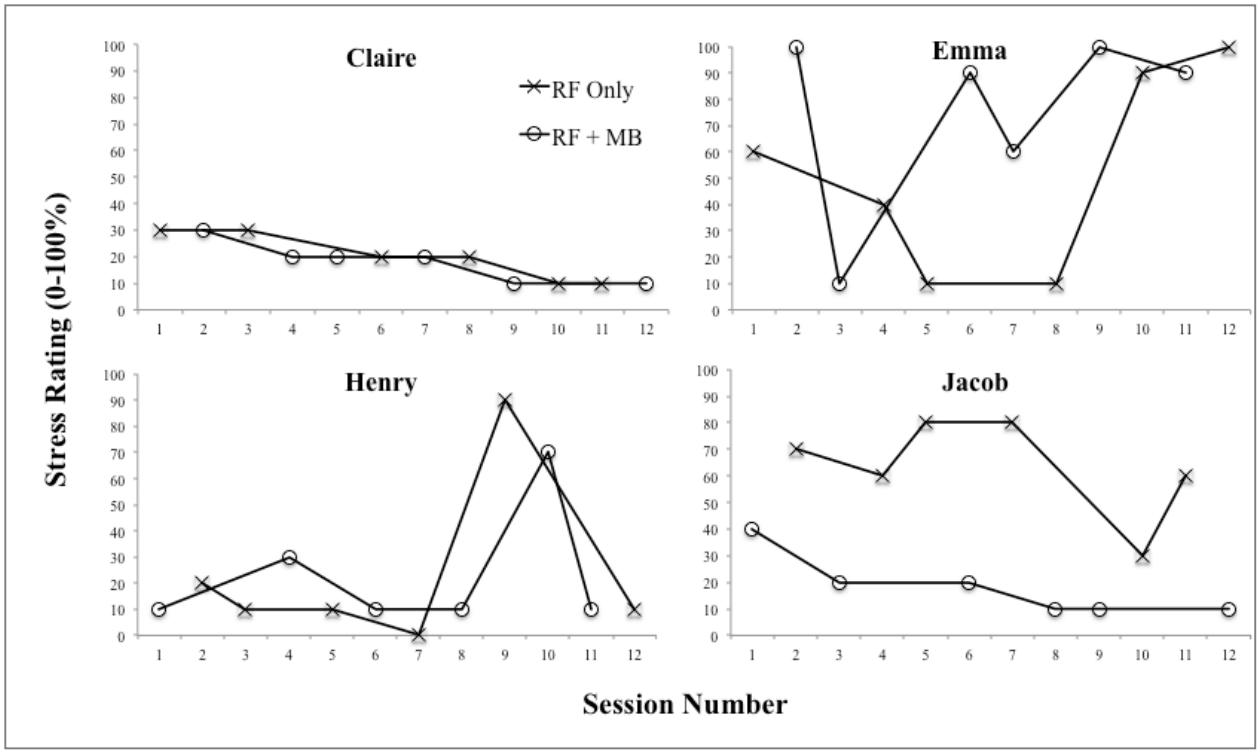


Figure 4. Students' stress ratings across intervention conditions.

Students' self-reported attention and stress ratings are displayed in Figures 3 and 4. Claire's self-reported level of attention and feelings of stress were comparable across conditions, with no separation and high overlap between conditions. Her self-reported attention ratings were slightly higher in the reading fluency only condition ($M = 90$) compared to the reading fluency plus brief mindful breathing exercise condition ($M = 88$), and her self-reported level of stress was slightly higher in the reading fluency alone condition (RF Only: $M = 20$; RF + MB: $M = 18$). Similarly, Henry showed a high degree of overlap and little separation between conditions for his self-report ratings of attention (RF Only: $M = 47$; RF + MB: $M = 48$) and feelings of stress (RF Only: $M = 23$; RF + MB: $M = 23$). Jacob demonstrated the least amount of overlap, and clear separation between conditions for both self-report ratings of his ability to pay attention and feelings of stress. Ratings indicated Jacob felt better able to concentrate when he received the brief mindful breathing exercise (RF + MB: $M = 83$) compared to when he did not (RF Only: *M*

= 42), and reported less feelings of stress after participating in the brief mindful breathing intervention (RF + MB: *M* = 18) compared to when he did not (RF Only: *M* = 63). Emma's self-reported attention rating was higher, on average, when she received the brief mindfulness intervention (*M* = 80) compared to when she did not (*M* = 71), however there was a large amount of overlap and little separation between conditions. Emma reported feeling a higher degree of stress before the reading intervention on sessions after which she participated in the brief mindful breathing exercise (*M* = 75), compared to when she did not (*M* = 52). The brief focused breathing exercise appeared to benefit two students (i.e., Emma and Jacob) in terms of average ratings of ability to pay attention and just one student (i.e., Jacob) in terms of feelings of stress. Overall, there appeared to be a clear difference for self-report ratings of stress and attention for just one student (i.e., Jacob) based on average ratings between conditions and on visual analyses revealing clear separation between conditions for both variables.

IV. Discussion

This purpose of this study was designed to examine the immediate effects of an exploratory brief mindful breathing exercise on reading fluency (as measured by words read correctly per minute on passages at the students' instructional level), and on self-reported ratings of perceived ability to pay attention in the present moment, and feelings of stress. It was hypothesized that the reading fluency intervention with the added brief mindful breathing exercise would enhance reading fluency beyond the reading intervention alone, and result in students feeling less stress and better able to pay attention compared to when they did not participate in the brief mindful breathing exercise. In this section, the major findings, limitations, and implications of the present study will be discussed, along with recommendations for future research.

Major Findings

Judging by visual analyses of the graphed data, there did not appear to be compelling evidence, in terms of gains in reading fluency, for the inclusion of a brief breathing exercise of this kind. There was no clear separation between conditions for any participating student in terms of rate of accurate oral reading, meaning there was no clear evidence to suggest that the reading fluency intervention with a brief mindful breathing exercise was more or less effective in building reading fluency than the reading fluency intervention alone. When looking at the difference scores, (i.e., the difference between the first and third read-through of the passage), there did appear to be gains in rate of accurate oral reading, regardless of condition. For one student (i.e., Jacob) there was clear separation between conditions for self-report ratings of his ability to pay attention and perceived feelings of stress. For the three remaining participants,

there was no clear difference between conditions for either the attention or stress dependent variable based on visual analyses of the graphed data.

Reading fluency. The first dependent variable examined in terms of reading fluency was words correct per minute (WCPM) for the third (i.e., final) read-through of the passage. For this variable, two of the four students (Henry and Jacob) read more WCPM on average in the RF + MB condition compared to the RF Only condition; however, there was no clear separation between conditions, for either student, judging by visual analysis of graphed data. All four participants demonstrated a high degree of overlap between conditions. Claire and Emma showed more variability in performance, and read less WCPM on average in the RF + MB condition compared to the RF Only condition. Both Emma and Claire appeared to be uncomfortable with the brief mindful breathing initially, and their unfamiliarity with such mindful breathing exercises could have contributed to this variability.

The second dependent variable examined was the difference between the first and third read-through of the reading passage. Both Claire and Henry showed some separation between conditions in the middle of the intervention; however, this separation did not continue for the remainder of sessions. Additionally, there was no difference in average WCPM difference scores between conditions for either Claire or Henry. Claire, again, showed more variability when she engaged in the brief mindful breathing exercise compared to when she did not. For Emma and Jacob, there was no separation between conditions and based on average WCPM, both showed a greater difference between the first and third read-through in the RF Only condition compared to the RF + MB condition, which was the opposite of what was hypothesized. Even so, the difference scores suggest that regardless of condition, students seemed to experience gains in reading fluency across the intervention.

Attention and stress measures. Only one out of four students (i.e., Jacob) showed a difference between conditions in terms of self-report ratings of attention and stress. For the remainder of participants, there was no separation observed between conditions for either the attention or stress measures. Jacob was also the oldest participant in the present study. Emma reported, on average, increased feelings of stress following the brief mindful breathing exercise, compared to when she did not participate in the exercise. She vocalized that she did not enjoy the brief mindful breathing exercise during the first few sessions, though she did eventually appear to warm up to the activity, expressing disappointment on sessions when she did not participate in the exercise. To help her warm up to the exercise, the interventionist allowed her to ring the chime herself after sessions. Emma's self-reported attention and stress ratings, out of all participants, were the most variable and seemingly random, even with encouragement by the examiner to provide accurate ratings. It is possible that Emma did not completely understand the ratings system, or think it was important to provide accurate ratings. Both Claire and Henry showed a high degree of overlap between conditions. Claire's ability to pay attention did seem to improve, regardless of condition, and her feelings of stress seemed to decrease across the intervention. Henry's attention ratings seemed to decline across the intervention, regardless of condition. His ratings of stress seemed to vary, and were related to events going on his life that he would discuss with the interventionist, for example an upcoming hockey game.

Limitations

Several limitations are useful to note with regards to the present study. First, it is possible that reading fluency (i.e., rate of accurate oral reading), was not the best measure to use as an immediate outcome following a brief mindful breathing exercise of this kind. Sometimes after the brief mindful breathing exercise, students reported feeling more relaxed, which could have

led to them reading slower. It would have been valuable to include additional variables measuring reading achievement, for example reading comprehension, or other aspects of reading fluency, for example prosody and expression in reading.

The self-report ratings for stress and attention were created by the researcher. This was because no repeatable state-level mindfulness measures for children were available in the literature. The two items used to measure stress and attention within intervention sessions were not piloted, meaning these results should be interpreted with caution. It was debated whether the items and rating system used would be appropriate for the entire range of ages of participating students. Jacob was the oldest participant, and the only participating student to exhibit a clear difference in self-report ratings between conditions. It is possible he could have had more insight into the purpose of the mindful breathing exercise and answered items accordingly, or it is possible that the rating system was not developmentally appropriate for the younger students participating in the study. Though the interventionist took great care in explaining the concepts of stress and attention in an age-appropriate manner, using explicit instruction, modeling, and providing examples, it is possible that students did not completely comprehend the items they were rating. Children, especially younger children, have variable language comprehension skills (Sturgess, Roger, & Ozanne, 2002). A lack of understanding could have contributed to the observed variability in self-report ratings by some students.

Additionally, students in this study were rated as demonstrating difficulty with attention, indicating possible deficits in executive functioning including the self-regulating and self-monitoring skills necessary to provide accurate self-report ratings (Barkley, 1981; Barkley & Murphy, 2011; Willcutt et al., 2005; Zucker, Morris, Ingram, Morris, & Bakeman, 2002). For example, adults with ADHD were found by Manor and colleagues (2012) to underestimate the

extent of their own symptoms and impairments. However, Klimkeit and colleagues (2006) found that the children in their study made more accurate self-report ratings than expected. For example, participating students with ADHD reported experiencing more disruptive and impulsive behaviour, and poorer communication skills, compared to students without ADHD. Regardless of the accuracy of self-report ratings, it would be useful in future research to include outcome variables tapping into mindfulness and attention from informants other than the participating student, for example the interventionist or classroom teacher.

Another potential limitation of the present study was that students may have been reading too well to observe changes in rate of accurate oral reading between conditions. Two students, Henry and Jacob, were instructional at their grade level, while the other two students, Claire and Emma, were instructional just one level below grade level. As previously mentioned, the students' school was a private school that was generally high achieving. It is possible that such an intervention could have been more beneficial for students who were weaker in reading than the students who participated in the present study. It is also possible that we may have seen greater differences between conditions for both reading fluency variables had the students worked on more difficult passages. Studies examining EF training interventions have found that more change is typically observed when students are pushed to their limits on outcome measures (Davis et al., 20ll; Diamond, 2012; Diamond, Barnett, Thomas, & Monro, 2007).

Participating students were enrolled in a religious school and were led in prayer at regular points throughout the school day. Recent research has identified a type of prayer, known as meditative prayer, as a contemplative practice similar to mindfulness that may help strengthen attention (Blanton, 2011; Jankowski & Sandage, 2014; Lutz, Slagter, Dunne, & Davidson, 2008). In meditative prayer, rather than attention and awareness being placed on something like the

sound of a chime, attention is focused on a Divine presence (Blanton, 2011; Lutz et al., 2008). Though it is not possible to determine whether the students in the present study participated in meditative prayer at school, it is possible they have had more exposure to contemplative practice through prayer compared to children who do not attend a religious school, thereby potentially diluting the effect of the brief mindful breathing exercise on outcome variables.

Lastly, it is possible that the dosage of mindful breathing practice was not large enough to yield a real change in reading fluency, or on perceived feelings of attention and stress. While a handful of studies have found evidence for immediate outcomes on cognitive processes such as memory after brief mindfulness interventions (e.g., Alberts & Thewissen, 2011; Mrazek et al., 2012), generally, mindfulness training was employed for longer (i.e., 12-20 minutes) than in the present study (i.e., 3-5 minutes). Perhaps 3-5 minutes was not long enough to see immediate effects in outcome variables, and it would have been better to employ the brief mindful breathing exercise for a longer period of time. It is also possible that participants did not receive enough sessions of mindfulness training to show an effect. According to Napoli and colleagues (2005) 8-10 consistent sessions of mindfulness training may be the minimum number required to see any effect of training. Therefore, it is possible that the intervention should have been continued beyond the 12 sessions in order to see separation between conditions.

Implications

Mindfulness training is increasingly being used by teachers in classroom settings (Garrison Institute, 2005; Greenberg & Harris, 2011; Hawn Foundation, 2012). Results of the present study indicated that the addition of an exploratory brief mindful breathing exercise of this kind did not seem to result in improvements in terms of rate of accurate oral reading over and above a reading fluency intervention alone. However, the addition of the exploratory brief

mindful breathing exercise did not appear to have a negative impact on student rate of oral reading across the intervention, and the observed difference between the first and third read-through of passages indicated that the reading fluency intervention resulted in improvements of rate of oral reading regardless of condition. Therefore, it might still be worthwhile for interventionists to include a component similar to the brief mindful breathing exercise, aimed at targeting attention, before beginning a similar reading intervention. Mindful breathing exercises may be useful if the student is distracted, upset, or unfocused at the beginning of a session. Students could also be taught how to engage in the practice by themselves, or to request such exercises on days when they feel they need it. This may be especially valuable for students who struggle with attention, and who therefore may be at greater risk for reading difficulty (Willcutt et al., 2007).

Cognitive theories of reading acquisition suggest that automatizing component skills of reading leads to more cognitive resources being available for understanding text (LaBerge & Samuels, 1987; Perfetti, 1985). Mindfulness training has been posited to increase the ability of children to control their attention, enhance executive functioning, and improve working memory (Chambers et al., 2008; Flook et al., 2010; Semple, 2011), suggesting that exercises such as the one used in the present study may be beneficial for students struggling with reading fluently. It is also possible there could be differential effects for students with executive functioning or working memory concerns in addition to reading difficulties. A brief mindful breathing exercise is an easy-to-implement and inexpensive activity that could be useful for an entire class as a way to target attention and other executive functions, not only those students who struggle with attention.

Additionally, results indicated that similar brief mindful exercises may not lead to self-

perceptions of improved attention and stress reduction in the same way for all students who participated. For example Emma's ratings were, on average, higher in terms of feelings of stress when she participated in the brief mindful breathing exercise compared to when she did not. In the present study, the mindful breathing exercise employed was likely too brief to result in meaningful change of the cognitive processes associated with reading. While it may be important to develop intervention procedures for individuals, small groups and classes that focus on building mindfulness and focusing attention (Chambers et al., 2008; Flook et al., 2010; Semple, 2011), it might be useful for teachers employing such techniques to understand that such exercises might not resonate with, or be appropriate for use with, all students.

Recommendations for Future Research

The following recommendations for future research are made in light of the results of the present study. It would be useful to replicate the study to include additional measures of reading achievement, for example comprehension and prosody, to see whether a brief mindfulness exercise has immediate effects on such variables. Rate of accurate oral reading is only one aspect of reading fluency (Daly et al., 2005; Kuhn & Stahl, 2003), and may not have been the best outcome measure for the purpose of the present study. Prosody, defined as reading a piece with feeling and the same rhythmic intonations as one would when speaking naturally (Goering & Baker, 2010), incorporates aspects of speech such as stressed syllables, timing, and intonation (Holliman et al., 2014) that may be useful to evaluate. It is sometimes measured in research through the use of eye tracking (e.g., Ardoin, Binder, Zawoyski, Foster, & Blevins, 2013), and ratings scales, for example examiner ratings of students' choppiness, number of false starts (including hesitations, or re-reading a phrase from the beginning), number of pauses in the middle of phrases, and whether the student reads in two to three word phrases (based on fluency

ratings from the National Association of Educational Progress [NAEP], 1995). More objective measures of reading prosody incorporate computer software used to obtain more accurate measures of variables that have been shown to be highly related to reading comprehension, including variations in pitch and decreasing pitch at the end of declarative sentences (i.e., final pitch declinations; Benjamin & Schwanenflugel, 2010; Miller & Schwanenfluegel, 2006).

It would also be valuable to replicate the present study with an extended brief mindfulness exercise. As mentioned above, it is possible that the dosage of mindfulness training in the present study was not large enough to see a clear difference between conditions in terms of reading fluency measures. Participants such as Emma and Claire seemed reluctant to engage in the brief mindful breathing activity in the first few sessions. Both students seemed to enjoy the exercise more by the end of the intervention. Perhaps students would have benefitted from more time practicing and becoming comfortable with the breathing exercise. It is also important for future researchers to examine the possibility that different measures of mindfulness may be more appropriate for older versus younger students, and how to effectively and repeatedly measure the construct of mindfulness, or mindful feelings, for students in elementary school.

Finally, the exploratory brief mindful breathing exercise employed in this study was simple to implement and did not require a significant amount of extra time or preparation. It did appear to benefit some of the participating students in terms of perceived attention and stress. It might therefore be useful to develop this area of intervention and research this area further. It might also be useful to examine the characteristics of students who may benefit most from intervention components aimed at increasing feelings of mindfulness and attention. For example, it is possible that older students, or students with limitations in executive functioning including working memory, may benefit more from components of this kind. For example, in a review of

EF training interventions, Diamond (2012) found that students with greater EF deficits tended to demonstrate greater progress in outcome measures after participating in training activities. With that in mind, one might have expected that students in the present study who were rated as struggling the most with attention and hyperactivity (i.e., Emma and Henry) would have made greater gains in outcome measures compared to the other participating students (i.e., Claire and Jacob). This was difficult to determine due to the lack of discrimination observed between conditions for all participants.

Conclusion

In the present study, there was no clear separation between conditions for either of the dependent variables measuring oral rate of accurate reading. The exploratory brief mindful breathing exercise employed in the present study did not greatly enhance participants' reading fluency, and only seemed to have an effect on feelings of stress and ability to pay attention for one of the four participating students. It is therefore difficult to make a link between reading fluency and mindful breathing exercises, especially with the lack of research in this area. However, findings suggested that adding components aimed at mindful breathing to reading fluency interventions did not negatively affect reading fluency, and so the addition of simple to implement mindful breathing exercises may still be worthwhile for students struggling with attention. Despite limitations associated with the present study, there remains a need for more research about effectively integrating mindfulness into the classroom, and the dosage required for practices to be effective, as well as practical and time-efficient for teachers to employ throughout their busy day. Future research could also focus on the effect of mindful breathing exercises on other aspects of reading achievement, including comprehension, prosody and expression, as well as ways to better measure feelings of mindfulness for children that can be

used repeatedly, as was required in the present study. It is hoped that further exploration into the intersection of mindfulness training and academic achievement will help enable educators to more effectively engage students in learning, particularly those students with more difficulty paying attention in the classroom.

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APPENDIX A: Critical Steps for Intervention Conditions RF Only and MB + RF

B. Reading Fluency Intervention Alone Condition

Time:

- Approximately 12 minutes.

Materials Required:

- Stopwatch
- Student DIBELS Next Progress Monitoring Passages
- Teacher DIBELS Next Progress Monitoring Passages
- Different Coloured Pens (three)
- Intervention Procedure Checklist
- Scripted Directions
- Student Graph

Steps:

1. Place student copy of the DIBELS Next Progress Monitoring passage in front of the student. Hide examiner copy behind a clipboard so as to remove it from the student's view.

2. Tell the student they will be reading a passage to you aloud:

    - **"When I say 'begin,' read out loud, starting at the top, and reading across the page** (*indicate with finger*). **Try to read each word. If you come to a word you do not know, I will tell it to you. Be sure to do your best reading. Be ready to tell me about what you have read when you are finished. Do you have any questions? Begin."**

3. Begin timing as the student says the first word of the passage. Allow student to read aloud for one minute. If the student hesitates on a word for more than three seconds, supply the word to him or her.

4. Ask the student what he or she remembers about the passage.

    - **"Please tell me as much as you remember about the story you just read."**

5. Model fluent oral reading of the passage, pausing to let the student fill in a word every so often.

    - **"This time I am going to read the story out loud to you. Please follow along with your finger because sometimes I will stop reading and ask you to tell me the next word in the story."**

6. The student is asked to read the passage a second time using abbreviated instructions, and timed for one minute. If the student hesitates on a word for more than three seconds, supply the word to him or her.

    - **"I am going to ask you to read this story for me again. Please do your best reading. Begin."**

7. Errors are reviewed with the student using the phrase drill error correction procedure from Daly and colleagues (2005) and Begeny (2009).

    - Read a word or phrase said incorrectly or not fluidly to the student and point to it: **"We are going to practice some of the more difficult words. This word is _____/ This says _____."**
    - Have the student repeat the 3-5 word phrase containing the misread word three times aloud: **"Repeat after me (***Read the 3-5 word phrase)***…again…again…"**

8. The student is asked to read the passage a third time using abbreviated instructions, and timed for one minute. If the student hesitates on a word for more than three seconds, supply the word to him or her.

    - **"I am going to ask you to read this story for me again. Please do your best reading. Begin."**

9. Record the WCPM for the student's first and third readings on the student graph, using positive praise statements and feedback.

C. Reading Fluency plus Brief Mindful Breathing Exercise Condition.

Time:

- Approximately 17 minutes.

Materials Required:

- Stopwatch
- Student DIBELS Next Progress Monitoring Passages
- Teacher DIBELS Next Progress Monitoring Passages
- Different Coloured Pens (three)
- Intervention Procedure Checklist
- Scripted Directions
- Student Graph
- Ringing Instrument

Steps:

1. Invite the student to sit comfortably with their back against the chair, feet flat on the ground, and hands held loosely in their lap.

2. Invite the student to take several breaths, breathing in through their nose and out through their mouth:

    - **"Let's take some deep breaths. Breathe in through your nose and out through your mouth. In 1, 2, 3, out 1, 2, 3. In 1, 2, 3, out 1, 2, 3. When you breathe in, take the breath all the way down to your tummy. In 1, 2, 3, out 1, 2, 3.**

3. Ask the student to close their eyes and listen to the sound of the ringing instrument for as long as they can while paying attention to their breath:

    - **"You will listen to the sound of this chime for as long as you can, while paying attention and focusing on the rise and fall of your breath."**

4. Ring chime for the first time.

5. Remind the student that if their mind wanders, it is alright. They just need to bring their attention back to their breath:

    - **"It's alright if your mind begins to wander. Just bring your focus back to your breathing. Feel the rise and fall of your breath in your tummy."**

6. Tell student before ringing the chime a second time that they are to listen to the sound as long as they can, focusing on their breath and to raise their hand when they can't hear it anymore:

    - **"I am going to ring the chime again. Listen to the sound for as long as you can. When you can't hear the sound any more, you can raise your hand."**

7. Ring chime for the second time.

8. Once student has raised their hand, invite the student to focus again on their breathing:

    - **"Now slowly move your hand to your chest or tummy and feel your breathing. Just breathing in…just breathing out…"**

9. Take another 30-45 seconds to come back to the room.

10. Proceed with the oral reading fluency procedure in Condition A as described above.

APPENDIX B: Stress and Attention Visual Scale

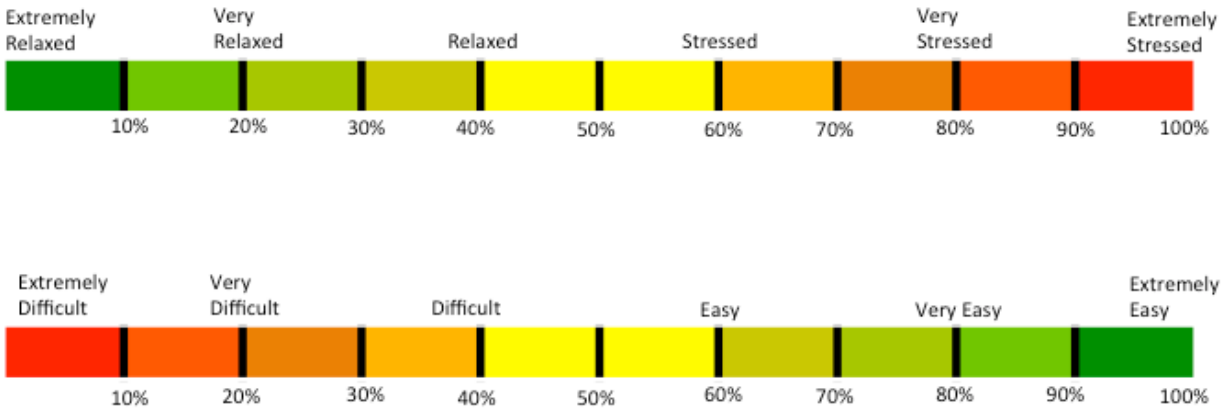

Figure 5. Visual scale used by participants to make stress and attention ratings.