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The Inclusive Nature of Mindfulness-Based Practice: Does Executive Functioning Play a Role in Children's Mindful Experience?

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by

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Abstract

We examined the effects of a six-week mindfulness program in order to assess how executive function level played a role in students' mindful experience. The effects of the mindfulness program were evaluated according to prospective outcomes across students' level of executive function, in comparison to an active control group. Classrooms were randomly assigned to a mindfulness-based program or a health-based active control group. Pre- and early adolescent students in the 5th to 8th grade (N = 52) from two MindfulMe! program classrooms and two HealthyMe! program classrooms (active control group) completed self-reported pretest and post-test measures to assess mindful attention awareness, strengths and difficulties, anxious arousal, rumination, and optimism. A composite score was created from student, teacher, and parent reported BRIEF2 screening forms to determine students' approximate level of executive function prior to the beginning of the program. Results indicated a significant decrease in rumination for students in the mindfulness-based intervention when compared to an active control. Our most notable finding is that executive function can predict an individual's change score in total difficulties, mindful attention awareness, optimism, and anxious arousal, after participating in a mindfulness-based intervention. Mindfulness-based interventions appear to particularly benefit those with higher levels of executive function. Consideration should be given to whether tailored mindfulness programs are more beneficial, seeing as the current study establishes that mindfulness-based interventions are not one-size-fits-all.

Keywords: mindfulness, executive function, children, wellbeing

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The Inclusive Nature of Mindfulness-Based Practice: Does Executive Functioning Play a Role in Children's Mindful Experience?

Mindfulness is suggested to provide a wide range of emotional, physical, and psychological benefits to its participants. It has been conceptualized as a *state*, as experienced during informal or formal mindful practice, and as a *trait*, characterized as an individual's "predisposition to be mindful in daily life" (Kiken, Garland, Bluth, Palsson, & Gaylord, 2015). In the current study, *mindfulness-training* and *mindfulness-based interventions* refer to the intervention taking place, whereas *mindfulness* refers to dispositional (i.e., trait) mindfulness. Researchers believe that repeated mindfulness-based practices contribute to a greater state mindfulness, thereby improving an individual's trait mindfulness as well (Kiken et al., 2015). The growing appeal to engage young children in mindfulness training is often initiated by research emphasizing a decrease in psychological symptoms and an increase in cognitive abilities following mindful practice (Keng, Smoski, & Robins, 2011). Moreover, persistant problems in childhood and early adolescence including aggression, bullying, stress, and mental health problems has drawn attention to potential programs, such as mindfulness-based interventions, in an attempt to reach their students in a meaningful way (Schonert-reichl et al., 2015).

The Secularization of Mindfulness

Mindfulness has grown from its roots in Buddhist traditions and has found its way into clinical and positive psychology contexts (Segal, Williams, & Teasdale, 2002; Lutz, Donne, & Davidson, 2007). In 1881, the technical term "mindfulness", theoretically synonymous to "attention", was first translated by T.W. Rhys Davids (Gethin, 2011). For many years, authors have attempted to universally operationalize the term (Chiesa, 2013; Erisman & Roemer, 2012;

Van Dam et al., 2018). To date, one of the most cited definitions of mindfulness is "the type of awareness that arises through paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4). This definition paved the way for the popularization of mindfulness in the West as its practice made way into domains of both clinical and positive psychology.

While mindfulness associated with Buddhist religious practices seeks to allow the individual to attain nirvana, its secularization has provided an opportunity for the layperson to voluntarily participate in mindful practice, regardless of religious orientation, and for any number of reasons; "to reduce stress, to improve physical and psychological wellbeing; to be more effective, skillful, and kind in relationships, at work, and throughout their lives" (Gunaratana, 2002). In 1979, Kabat-Zinn integrated mindfulness into the treatment of patients with chronic pain by teaching them to manage their pain through self-regulation (Kabat-Zinn, Lipworth, & Burney, 1985). Interventions including Kabat-Zinn's Mindfulness-Based Stress Reduction program (MBSR; Kabat-Zinn, 1990) were introduced with potential use in clinical settings and quickly spread to other hospitals and health problems (Gotink et al., 2018). MBSR is one of the most studied mindfulness-based interventions (Grossman, Niemann, Schmidt, & Walach, 2004, as cited in Imel, Baldwin, Bonus, & MacCoon, 2008) The program takes a group-based psychosocial treatment approach, designed to increase psychological well-being, decrease stress, and promote positive affect (Imel et al., 2008; Kabat-Zinn, 1990).

Following its initial integration into clinical settings, the conception of Mindfulness-Based Cognitive Therapy allowed for a more general incorporation of mindfulness into psychological treatment (MBCT; Teasdale et al., 2000). Since its clinical integration, MBCT has proven to effectively prevent depressive relapse and treat mood disorders in adult populations

(Hofmann, Sawyer, Witt, & Oh, 2010; Kim et al., 2009; Manicavasgar, Parker, & Perich, 2011; Teasdale et al., 2000). The 8-week group training class presents itself as an amalgamation of the techniques used in MBSR and Cognitive-Behavioral Therapy, with the purpose of improving psychological health by increasing mindfulness (Troy, Shallcross, Davis, & Mauss, 2013). While MBCT was first created with depression and somatic disease in mind, alternative applications of the program have been explored. More specifically, Haydicky, Shecter, Wiener and Ducharme (2013) suggest MBCT to be effective in youth with attention deficit hyperactivity disorder (ADHD), such that it "emphasizes self-monitoring, attention training, and repeated practice of metacognitive strategies, making it an appropriate intervention for reducing the core symptoms of ADHD".

Mindful practices have evolved into a vast range of contexts, including hospitals, clinical therapy sessions, and camps. More recently, mindfulness has become integrated into some elementary schools as a means of improving general well-being as opposed to targeted symptom reduction. Mindfulness-based programs in schools generally coincide with social-emotional learning programs (see MindKinder, The Inner Resilience Program, MindUP, Learning to BREATHE) or self-compassion programs (see Cognitively-Based Compassion Training, The Umbrella Project).

One of the greatest discrepancies between mindfulness in children and adults appears to be its introduction; adults tend to seek out mindfulness programs voluntarily, whereas programs are executed in a nested nature of design (brought into pre-existing classrooms) for children. While the evidence surrounding mindfulness-based practice for children should be abundant given its increased integration in to classrooms, there is virtually no evidence on the long-term

effects of teaching mindfulness to children (Butterfield, Roberts, Feltis, & Kocovski, 2020; Knowles, Goodman, & Semple, 2015).

Developmental Perspective

Mindfulness-based practices are being introduced to children and adolescents through interventions and training programs in classrooms, camps, daycare, and more. Piaget's theory of cognitive development (1962) suggests that between the ages of 8 and 12 years, children enter the "concrete operational stage" where they are in a critical period for cognitive and emotional development (Willard; Eccles 1999). Relative to mindfulness, the most commonly promised outcomes include cognitive or emotional benefits (i.e., improved attention, decreased depressive mood, etc.). Further, Flavell, Green, and Flavell (2000) propose the age of at least 8 years to be optimal for a child to recognize and report their "thought content". As such, the administration of mindfulness training to children may be the perfect vehicle to maximize their positive self-perception, self-compassion, and social-emotional development.

An increase of mindfulness-based programming for children has led to scientific research on the benefits, risks, feasibility, and acceptability of the practice (Atreya et al., 2018; Shonin, Gordon, & Griffiths, 2014). Emerson, Nabinger de Diaz, and Sherwood et al. (2020) reviewed mindfulness interventions for children within elementary-, middle-, and high schools. Their review synthesized the implementation of school-based mindfulness-based interventions (MBI), while identifying the effects of mindfulness on mental health outcomes. The systematic review assessed key details of the implementation across Mindfulness-based Interventions on (1) program content and structure, (2) teacher training and competency, and (3) feasibility. Given the child-focused nature of the current study, only results pertaining to school-based mindfulness interventions within elementary schools will be discussed.

Positive benefits in children across MBIs were reported, including a decrease in parent-reported externalizing problems (Fung, Guo, Jin, Bear, & Lau, 2016), improved attention and reduced test anxiety (Napoli, Krech, & Holley, 2005), reductions in stress responses (Gould, Dariotis, Greenberg, & Mendelson, 2015; Long, Renshaw, & Camarota, 2018; Mendelson et al., 2010), improved emotional and behavioral problems (Joyce, Etty-Leal, Zazryn, & Hamilton, 2010; Klatt, Harpster, Browne, White, & Case-Smith, 2013; Waldemar et al., 2016), improvements in hyperactivity, ADHD symptoms, and cognitive inattention (Klatt et al., 2013), and improvements in depressive symptoms (Schonert-reichl et al., 2015; Semple, Reid, & Miller, 2005; Sibinga, Webb, Ghazarian, & Ellen, 2016). Of the thirteen studies pertaining to elementary-school students, one included a clinical population (ADHD; Carboni, Roach, & Fredrick, 20xx), ten were non-clinical in nature (general population), and two included selected exceptional, non-clinical populations: at risk, behind grade, disciplinary problems (Long et al., 2018), and indicated anxiety (Semple et al., 2005). The researchers identified depression, anxiety, and stress as the most commonly measured mental health outcomes pertaining to this review, as per standardized assessment measures. Nevertheless, non-significant findings and those approaching significance included sustained attention, and a decrease in hyperactive behaviors, internalizing symptoms, sleep problems, anger, and aggression.

Sapthiang, Van Gordon, and Shonin (2019) reviewed school-based mindfulness interventions for improving mental health. Their review synthesized qualitative evidence pertaining to students' experiences of school-based mindfulness-based interventions. The authors present four major themes as being relevant to students' mental health, including "(1) using attentional processes to regulate emotions and cognitions, (2) stress reduction, (3) improved coping and social skills, and (4) calming and/or relaxation". In the majority of studies, only

teacher and parent feedback are elicited, omitting a considerably significant voice – that of the students. This was addressed in the current study by providing students with the opportunity to provide written feedback following each weekly activity. In doing so, our "student activity feedback form" aims to acknowledge the aforementioned research gap by exploring student opinions and perceptions regarding the implementation of classroom-based mindfulness practices.

Executive Function

Executive function (EFs; see also executive control or cognitive control) refers to top-down mental processes comprised of inhibitory control (e.g., behavioral and emotional self-control), cognitive flexibility (e.g., ability to switch between, or think about, two concepts simultaneously), and working memory (e.g., component of short-term memory) (Diamond, 2013; Janz, Dawe & Wyllie, 2019). In turn, these three higher-level abilities enable us to problem-solve, plan, self-regulate, and more. Its development is thought to be non-linear, such that children display a "growth-spurt" for distinct components at different ages; inhibitory control and working memory are first observed during infancy, cognitive flexibility appears during preadolescence, and all components continuously develop well into adulthood, until declines are observed around age 70 in typical adults (Diamond, 2013).

The significance of executive function has been established in "just about every aspect of life" (Riggs, Blair, & Greenberg, 2003). Individuals with higher levels of executive function have been associated with a number of positive outcomes, such as a better health-related quality of life, which pertains to an individual's perceived physical and mental health over time (Brown & Landgraf, 2010; Centers for Disease Control and Prevention, 2018). Specific components of executive function (inhibitory control, working memory, cognitive flexibility) have also been

associated with positive outcomes. In particular, inhibitory control is effective in predicting outcomes well through adulthood; such that children who have better inhibitory control are less likely to make risky choices, be overweight, have high blood pressure, or have substance abuse problems (Moffitt et al., 2011). Working memory is the ability to hold information in your mind and includes both verbal and non-verbal factors. Research has shown that working memory has a strong influence on cognitive efficiency, learning, and academic performance (Holdnack, Prifitera, Weiss, & Saklofske, 2016). The third core of executive function, cognitive flexibility, includes skills related to perspective-taking, and task switching. Recent studies have proposed a relationship between flexible thinking and depressive symptoms, such that greater cognitive flexibility may be associated with the "endorsement of more effective coping strategies" (Gabrys, Tabri, Anisman, & Matheson, 2018).

Components of executive function manifest quite variably in atypically developing children. Whereas a typically developing school-aged child should have the cognitive skills needed to write their homework down, clean their room, or appropriately and meaningfully participate in class, atypically developing children may broadly exhibit their dysfunction in these scenarios (U.S. National Library of Medicine, 2020). For example, this might include children who have significant trouble with math, language, or reasoning (e.g., learning disability), attentional, emotional, or self-regulatory challenges (e.g., attention deficit hyperactivity disorder), or behavioral, social, and communicatory difficulties (e.g., autism spectrum disorder). While the aforementioned difficulties and greater diagnoses are typically associated with lower levels of executive function, the current study is interested in how this relates to mindfulness, which has been associated with a number of beneficial outcomes typically lacking in those with atypical development (i.e., self-regulation, attention, etc.).

The role of executive function is often described as a psychological process involved in conscious control of action and thought (Riggs et al., 2003). Conceptually, its relation to mindfulness (briefly, the state of being conscious or aware) has elicited research interest. The majority of research focuses on a unidirectional relationship, such that it tends to evaluate the ability for mindfulness to improve executive function (see Mak, Whittingham, Cunnington, & Boyd, 2018). The current study will examine the relationship in the opposite direction, by evaluating the role that executive function has on an individual's ability to benefit from mindfulness training.

Past research has examined a number of relationships between mindfulness and specific executive control processes (Lu & Huffman, 2017; Lyvers, Makin, Toms, Thorberg, & Samios, 2014). Notably, research concerning the association between mindfulness and executive function during childhood and adolescence is sparse (Riggs, Black, & Ritt-Olson, 2015). Generally, researchers tend to agree that self-regulatory processes (e.g., thought, emotion, behavior, and physiology) are central to the mechanisms involved in mindfulness (Glomb, Duffy, Bono, & Yang, 2011; Keng et al., 2011; Riggs et al., 2015). Oberle (2011) examined the relationship between mindful attention awareness and accuracy in an inhibitory control task in fourth and fifth graders. The results suggest higher levels of self-reported dispositional mindfulness significantly predict greater accuracy in the inhibitory control task. Riggs et al. (2015) examined the interrelationship between the constructs of mindfulness and executive function. A total of 152 young adolescents in grade seven and eight participated in the study. The authors' results propose (1) an association between mindful attention awareness and a higher score on the latent executive function factor (includes: inhibitory control, working memory, and cognitive flexibility), and (2) a positive correlation between mindfulness and working memory and inhibitory control, but not

with cognitive flexibility. More recently, Keulers and Jonkman (2019) evaluated the predictive capacity of specific executive functions on mind wandering tasks in typically developing 9-11-year-old children. The authors describe mind wandering as internally driven thoughts that grab our attention, thereby distracting us from the current task at hand. Their data suggest a number of notable relations between individual differences in executive function and mind wandering tasks. More specifically, inhibitory/interference control capacity significantly predicted mind-wandering frequency in various contexts – during classroom lessons and controlled computerized tasks (Keulers & Jonkman, 2019). Despite the growing evidence for the relationship between mindfulness and executive function, the literature fails to clearly identify the role that cognition has in dispositional mindfulness (Riggs et al., 2015).

Mindfulness in Schools

Mindfulness-based practices are delivered to children in schools in any number of iterations. While some teacher facilitators may strictly follow a manualized program with scheduled activities, others may simply complete yoga sessions with their students and conceptualize this time as a mindfulness-based practice. Further, a "lack of clarity over individual components of mindfulness programs" has been recognized as a barrier to program delivery, such that "programs tend to have very little direction when it comes to intensity, group size, exactly what the activity should look like, and whether the activities are developmentally appropriate for the target age group" (Butterfield et al., 2020). Such inconsistencies in delivery may contribute to inconsistencies found in study results. The mindfulness-based intervention in the current study was delivered to children on a strict schedule, facilitated by trained research assistants.

Purpose of the current study

The current study aims to examine the relationship between children's executive function and the effectiveness of a classroom mindfulness-based program on five domains: mindful attention awareness, physiological symptoms, optimism, strengths and difficulties, and rumination. The rationale for the current study comes, in part, from the limitations observed within child or adolescent training programs; individual differences often present within an elementary classroom are not taken into consideration when administering a mindfulness-based training program. As a result, the "inclusive" mindfulness-based programming is administered in a "one-size-fits-all" manner, and may only benefit neurotypical students, rendering it relatively inaccessible and frustrating for those with exceptional learning circumstances. Research has shown that individuals with lower levels of executive control tend to have trouble suppressing dominant responses to extraneous stimuli, potentially rendering mindfulness difficult or impossible for certain students (Posnet et al., 2017). The current study has 3 research questions:

(1) Does a six-week mindfulness intervention benefit students, in comparison to an active control condition?

    a) We hypothesize that students in the mindfulness condition will experience greater benefits on all outcome measures than their peers in the active control condition.

(2) Does executive function significantly predict change scores in all five outcome measures?

    a) We hypothesize that the higher a student's executive function, the greater they will benefit from the mindfulness program on all five outcome measures, and that these predictions will be less apparent for the active control condition.

(3) How does the activity feedback form contribute to our understanding of students' mindful experience?

a) Based on the weekly activity ratings, we hypothesize that activities requiring more attention, concentration, and stillness will be rated lower than activities allowing movement, imagination, or free discussion by students with lower levels of executive function.

b) Based on the students positive and negative written feedback, we thematically explore their responses with hopes of improving mindfulness-based interventions from first-hand accounts.

Method

Design

The current study employs a mixed design with Program (MindfulMe! vs. HealthyMe!) as a between-subjects variable, Time (Pre, Post) as a within-subjects variable, and composite executive function score as a predictor variable. Five outcome variables (total difficulties, mindful attention awareness, rumination, optimism, and anxious arousal) are used as dependent variables. A cluster (classroom-based) randomized controlled design was used, with assignment to a mindfulness-based classroom program or health education active control program using the randomization function in Microsoft Excel for Mac. This randomization was conducted by the primary investigator prior to having any contact with participating teachers and students.

Participants

All participants (parents, teachers, children) were required to be able to communicate in English and not have any major developmental delays (to the point of inability to properly assent/consent). All children required written consent of a primary caregiver prior to providing

their own verbal assent. All (100%) participants who indicated interest in the current study (i.e. returned a complete consent form) met the eligibility criteria. Between both participating schools, all students between grades 5-8 (N=58) were given a consent form, 52 took part in the study; six students did not provide adequate written consent and/or verbal assent and their data was therefore not collected (see Figure 1). Disproportionate gender distribution in the current study is due to the nature of both participating schools; one was sport-focused and one was for students with learning difficulties.

School Selection

Two urban private and coeducational primary schools from the Kitchener-Waterloo (KW) Region participated in the current study. Once approval was granted by the Wilfrid Laurier University ethics committee, principals were contacted and asked whether they would be interested in participating in the current study. After gaining verbal approval from the principals, the research protocol was described to principals and teachers of fifth, sixth, seventh, and eighth grade. Teachers were made aware that their consent indicated the understanding of a 50% chance of being randomized as an active control comparison classroom. Teachers were only contacted after the respective school principals signed an informed consent form.

Student Participants

There were 52 child participants from 5th-8th grade: MindfulMe! program group, $n = 26$ (20 boys, 6 girls); active control group, $n = 26$ (23 boys, 3 girls). The mean age of the students who participated was 11.51 years (SD = 1.11) with a range of 9 years and 10 months to 14 years and 9 months. Average ages in each condition were relatively similar, MindfulMe! ($M = 11.27$ years, $SD = 1.19$) and HealthyMe! ($M = 11.77$ years, $SD = .99$). The majority of parents (65.4%) reported their child's ethnic background as Caucasian, while the remaining participants either

identified as another ethnicity (7.6%) or did not specify (26.9%). Analyses of variance did not identify significant differences between programs for gender, ethnicity, or age. A Mann-Whitney U test was run to determine if there were differences in allocation of academic grade to the two conditions. Distributions of the academic grades scores to condition were not similar, as assessed by visual inspection. Academic Grade for MindfulMe! (mean rank = 21.65) and HealthyMe! (mean rank = 31.35) were significantly different, U = 212, z = -2.413, p = .016, using an exact sampling distribution for U (Dineen & Blakesley, 1973). An unequal dispersion of grades to condition was expected such that entire classrooms were allocated to condition and some were split grade (i.e. a 5-6 split classroom would have fewer grade six students than a regular grade 6 classroom). Demographic characteristics are found in Table 1.

According to a voluntary declaration of diagnoses in parents' consent forms, a total of 26 students (thirteen students in MindfulMe! and thirteen students in HealthyMe!) were identified as having a formal diagnosis of one or more of the following: ADHD, ASD, Tourette's Syndrome, OCD. Due to ethical considerations, specific diagnoses were not clarified and therefore we are not aware of the number of specific diagnoses, nor the diagnosis associated with any individual participant.

Teacher and Parent Involvement

A total of 53 teacher and parents participated in the current study (teachers, n = 4; parents, n = 48). The extent of their participation was limited to a single assessment administered at Time 1 (pre-test). Of the N = 52 students who participated in the current study, n = 48 (100%) primary caregivers completed a 12-item screening form for the Behavioural Rating Inventory of Executive Function (BRIEF2-P). Note that the discrepancies between student and parent samples are explained by two instances of sibling participants sharing the same caregiver; approximately

8% of students had a sibling pair in the current study. While this is not ideal, we refrained from removing sibling participants due to the already limited sample size. Student participants were randomly allocated to a program with their classroom as a whole; respective teachers (n = 4) participated in the current study by filling out a similar 12-item screening form for each student in their own classroom; on average, teachers filled out approximately ten BRIEF2-T forms and completed between 4 and 15 forms. All parent and teacher BRIEF2 screening forms were filled out without knowledge of program the child was allocated to and were completed prior to the beginning of the program.

Program Implementation

A team of four researchers who underwent an intensive one-day training session for either MindfulMe! or HealthyMe! were provided with a program binder outlining each program lesson, the literature behind each activity, and the goals for each session. Detailed scripts were provided to each member of the team with materials needed to facilitate activities. Due to the nature of the intervention, double blinding is not possible to implement. Blinding was limited to program facilitators, parents, teachers and students having no knowledge of the student's allocation to condition until day one of the program. All coders were blind throughout the entire study and data entry process. As such, all BRIEF2 forms and pre-test outcome measure booklets were completed blindly. To ensure the highest level of neutrality, the primary investigator did not attend the school on days where the post-test measures took place. Compensation was provided to the participating school in the form of a lump sum donation of $50 plus an additional $10 for every participating classroom, regardless of how many students or classrooms agreed to participate. In addition, all teachers were compensated with a $25 Amazon gift card for

completing BRIEF2-T forms for their respective students. No payment or credit was provided to student participants.

Measures

Demographic Information. Information on demographics were collected through consent forms administered to parents. This data includes child gender, birthdate, grade, ethnic background, and a voluntary declaration of diagnoses for autism spectrum disorder, attention deficit hyperactivity disorder, obsessive compulsive disorder, or Tourette's Syndrome.

Cognitive Assessments

Executive Function. For the purposes of the current study, screening forms for the Behaviour Rating Inventory of Executive Function 2 (BRIEF2) were administered to identify the estimated level of global executive function in individual students (Gioia, Isquith, Guy, & Kenworthy, 2016). Students were assessed on their executive function according to a self-report (BRIEF2-SR Screening Form), parent report (BRIEF2-P Screening Form), and teacher report (BRIEF2-T Screening Form). The screening form for students, teachers, and parents contain 12-items and uses a 3-point Likert scale (N= Never, S= Sometimes, O= Often) to measure three items from the BRIEF2 Behavioral Rating Index, four items from the Emotion Rating Index, and five items from the Cognitive Rating Index (Gioia et al., 2016). Higher scores on the composite executive function variable indicate greater levels of potential executive dysfunction.

To the best of the authors' knowledge, there are no existing research studies that have used the BRIEF2-SF, most likely due to the screening nature of the forms. However, the internal consistency reported on the products website is reported to be high, ranging from .87 to .91 in the standardization sample and .80 to .89 in the clinical sample. In the current study, internal

consistency was shown by a high Cronbach's alpha for the BRIEF2-T (α=0.95), BRIEF2-P (α=0.91), BRIEF2-SR (α=0.84), and the composite executive function score (α=0.83).

As per the screening nature of the administered BRIEF2 forms, a composite score was not available to researchers in the assessment itself. To ensure a robust measure of executive function was calculated, the raw score across student, parent, and teacher forms were averaged to create a single composite score. Raw scores across student, parent, and teacher forms were all positively correlated with one another (see Table 2).

Voluntary Declaration of Diagnoses

Self-reports are often considered to have some possibility of bias. Multiple efforts were made to strengthen the variable associated with students' executive function level; (1) we collected and amalgamated scores of self-report assessments on each student from three individuals (student, parent, teacher) rather than the student alone, (2) parents were provided with the opportunity to voluntarily disclose whether their child has previously been diagnosed with a disorder commonly associated with executive dysfunction. To verify the accuracy associated with the composite score created in step one, we conducted a point-biserial correlation between the dichotomous (yes, no) voluntary declaration variable and the continuous composite raw score. According to this calculation, there was a statistically significant correlation between formal diagnoses and executive function, $r_{pb}(50) = .779$, $p < .001$, with formally diagnosed students having a higher composite executive function score (i.e. greater difficulties) than those without a formal diagnoses, $M = 26.85$ ($SD = .67$) vs. $M = 18.474$ ($SD = .68$).

The list of diagnoses included attention deficit-hyperactivity disorder (ADHD), autism spectrum disorder (ASD), Tourette's syndrome, or obsessive-compulsive disorder. The chosen diagnoses on this list are consistent with literature indicating deficits found in individuals

diagnosed with the disorder (Otterman et al., 2019; Tourette Association of America, n.d.). Parents were asked to indicate whether their child (1) has been formally diagnosed with one or more of the diagnoses mentioned above, (2) has not been formally diagnosed with one or more of the diagnoses mentioned above, or (3) they (parent/caregiver) are unsure or prefer not to say. In the current study, no parent who returned consent forms indicated choice (3).

Mindfulness Assessments

Mindful Attention Awareness Scale for Children (MAAS-C). Mindful attention awareness was assessed through the administration of the Mindful Attention Awareness Scale for Children (Benn, 2004) (see Appendix B). The scale is used to determine a total score of dispositional mindfulness. The scale was first developed by Brown and Ryan (2003) for administration to adults and was modified in 2004 to include more age appropriate language so that it may be administered to children. For example, "I drive places on 'automatic pilot' and then wonder why I went there" was modified to say, "I walk into a room and then wonder why I went there". Further, the MAAS-C response format was adapted to make it easier for children to understand. The MAAS, which ranges from 1 =almost always, 2 = very frequently, 3 = somewhat frequently, 4 = somewhat infrequently, 5 = very infrequently, and 6 = almost never, was modified in the MAAS-C that ranges from 1 = almost never, 2 = not very often at all, 3 = not very often, 4 = somewhat often, 5 = very often, 6 = almost always. The current study reverse-scored and summed all items to produce a total dispositional mindfulness score. Higher scores indicate mindfulness whereas lower scores indicate mindlessness.

The MAAS-C has been found to have convergent validity with optimism and autonomy, and was also found to have a negative relation to depression, anxiety, and negative affect (Bernay, Graham, Devcich, Rix, & Rubie-Davies, 2016; Lawlor, Schonert-Reichl, Gadermann, &

Zumbo, 2013). According to Bernay et al. (2016), the MAAS-C was the first mindfulness scale to have a high validity and reliability for children; high internal consistency was reported by Lawlor et al. (2014) (Cronbach's a = .84). For the current study, from pre- to post-test, the Cronbach's alpha ranged from .83 to .87.

Emotional Assessments

Mood and Anxiety Symptom Questionnaire – Anxiety Arousal (MASQ-AA). The Mood and Anxiety Symptoms Questionnaire is a 90-item self-report of mood and anxiety that measures the extent to which individuals experience general distress, specific anxiety, and depressive symptoms. The current study administered a modified version of the scale, specifically consisting of the 10-item Anxious Arousal subscale (ANXAR) used to assess the extent to which participants experience physiological symptoms with minimal association to general negative affect such as anger, disgust, and contempt (Hankin, 2009). These 10 items were chosen in accordance with Hankin (2008) who conducted a factor analysis on the broader 17 items and found these 10 to be the highest loading on the ANXAR factor. Students rated each of the 10 items on a scale ranging from 1 = not at all, 2 = a little bit, 3 = moderately, 4 = quite a bit, 5 = extremely. The total score was the sum of all 10 items, with higher scores on the MASQ-AA reflecting higher anxious arousal and lower scores reflecting lower anxious arousal. Reliability and validity of the MASQ-AA has been shown in previous literature (e.g., Hankin, Wetter, Cheely, & Oppenheimer, 2008; Watson et al., 1995). For the current study, from pre- to post-test, the Cronbach's alpha ranged from .86 to .87.

Children's Response Styles Questionnaire – Rumination Scale-Revised (CRSQ-RSR). The 25-item Children's Response Styles Questionnaire (CRSQ-RSR; Abela, Vanderbilt, & Rochon, 2004) is an age-appropriate version of the Response Styles Questionnaire (Nolen-

Hoeksema & Morrow, 1991). The current study used the rumination subscale of the CRSQ-RSR to evaluate the tendency for participants to engage in repetitive thoughts about the cause of their distress (du Pont, Rhee, Corley, Hewitt, & Friedman, 2019). A 13-item rumination subscale of the CRSQ is used to rate items ranging from 1 = Almost Never, 2 = Sometimes, 3 = Often, 4 = Almost always. A total score is achieved by summing all items, with higher scores indicating higher frequency of ruminative response style. In a sample of primary school students, Cronbach's alphas ranged from .55 to .86 (Verstraeten, Vasey, Raes & Bijttebier, 2010). For the current study, from pre- to post-test, the Cronbach's alpha ranged from .88 to .89.

Resiliency Inventory (RI). The original RI created by Noam and Goldsteirn (1998) was modified by Song (2003). The measure is used to assess six dimensions of resilience, including optimism, relationship with peers, relationships with adults, self-efficacy, interpersonal sensitivity, and emotional control. The current study only used the optimism subscale to assess participants positive present and future perspective on the world (Schonert-Reichl & Lawlor, 2010). The 10-item scale is rated on a 5-point Likert scale by participants, ranging from 1 = not at all like me, 2 = a little bit like me, 3 = kind of like me, 4 = a lot like me, 5 = always like me. Half (5) of the 10 items were reversed scored, for example, “I think things will get worse in the future”. Higher scores represent greater optimism. Song (2003) has shown high internal consistency for the optimism subscale, according to a Cronbach’s alpha of .84. For the current study, the optimism subscale had a Cronbach’s alpha of .62 at both pre- and post-test.

Social Assessments

Strengths and Difficulties. To assess participants’ strengths and difficulties, a brief behavioral screening questionnaire known as the SDQ was used for the present study (see Appendix E). The SDQ was created by Goodman (1997) and has since been modified

(Goodman, 2005). The SDQ assess five dimensions of emotional symptoms (5 items), conduct problems (5 items), hyperactivity/inactivity (5 items), peer problems (5 items), and prosocial behavior (5 reverse scored items), in addition to a total difficulties score (sum of all items except prosocial behavior subscale). The SDQ evaluates an "externalising" and "internalising" score by combining two of the five dimensions. The externalizing score ranges from 0 to 20 and is the sum of the conduct and hyperactivity scales. The internalising score ranges from 0 to 20 and is the sum of the emotional and peer problems scales. According the Goodman and Goodman (2009), using the four separate scales (conduct, hyperactivity, peer problems, and emotional problems) adds value to a potentially high-risk sample. Due to the nature of our sample (i.e., self-reported diagnoses), the current study is predominantly interested in the total difficulties score. Higher total difficulty scores indicate greater difficulties. Cronbach's alpha for each subscale has been reported as appropriate; emotional symptoms (α=0.71); conduct problems (0.59); hyperactivity/inattention (0.65); peer problems (α=0.64); prosocial behaviour (α= 0.65) (Roy, Veenstra & Clench-Aas, 2008). The total difficulties score has also been found to have high internal consistency with a Cronbach's alpha of .78 (Roy et al., 2008). For the current study, from pre- to post-test, the Cronbach's alpha ranged from .77 to .84.

Student Feedback

Activity Feedback Report. The Activity Feedback Report is a 3-item measure designed by the primary researcher to elicit anecdotal feedback of individual MindfulMe! activities. A 5-point Likert scale was created to establish how students felt about the activity immediately after completion, ranging from 1 (I did not like today's activity at all) to 5 (I loved everything about today's activity). The second item allows students to provide feedback for what they enjoyed from the activity; the third, what they did not enjoy from the activity. The second and third items

were thematically analyzed using NVIVO Software. The analyses examined common themes discussed by students and was blindly coded by two separate research assistants who then met with the primary researcher to discuss their chosen themes. Of their chosen themes, inconsistencies were found only in choice of terms but not meaning. For example, one research assistant chose “relaxing” while the other chose “calming”. After meeting, we reached consensus that both are valid considering they may refer to distinct experiences.

Procedure

The BRIEF2 screening form was administered to students, parents, and teachers approximately two weeks prior to the start of the program along with the respective consent form. All BRIEF2 forms were collected at pre-test and those who had returned completed consent and BRIEF2 forms were then provided with an oral description of the study. The children were asked if they would like to participate in the current study as the pre-test questionnaire duotangs were being handed out. The research associates explicitly assured students that they may withdraw their assent and cease participation without penalty at any time.

The five outcome measures (mindful attention awareness, rumination, optimism, anxious arousal, and total difficulties) were administered one week before the program (pre-test) and one week after the program (post-test). Change scores were then created by subtracting the pre-test score from the post-test score. In an effort to strengthen the executive function level variable, parents were asked to voluntarily disclose whether their child had been formally diagnosed with one of four disorders generally associated with low levels of executive function (i.e., OCD, ADHD, Tourette’s Syndrome, Autism Spectrum Disorder). Parents also provided their child’s gender, date of birth, and ethnic background.

All student participants were students at local private schools in Southern Ontario. Over the course of six weeks, the students participated in half-hour activity sessions, once a week. Students whose parents have consented and who have themselves provided verbal assent remained in the classroom. Students whose parents did not consent to their participation and students who did not provide verbal assent were directed to a quiet room with a research assistant where quiet reading, individual schoolwork, or teacher-provided activities (i.e., word search, colouring page) were completed. A brief description of daily activities was provided prior to starting each program session.

Teacher packages were comprised of one short questionnaire; the 12-item BRIEF2-T. The number of BRIEF2-T forms included in the Teacher package was dependent on the number of students in their respective classroom (i.e. teachers were asked to fill out one (1) BRIEF2-T for each participating student in their class). The principal investigator provided each participating student with a Parent Package, which was comprised of the 12-item BRIEF2-P to be reported for their child(ren) and returned the following week. At the end of each session, both the intervention and active control group participants were given the opportunity to rate the current activity on a 5-point scale (1- I did not enjoy the activity at all, 5- I loved everything about the activity) in addition to providing activity-specific feedback in response to two questions; (1) What did you enjoy about today's activity? (2) Is there anything you did not like about today's activity? (see Appendix F).

MindfulMe! Program

The MindfulMe! program was informed by guidelines and resources provided by a mindfulness-based program, MindUP (The Hawn Foundation, 2011). Once a week, for 6 weeks, children in the MindfulMe! intervention group (n = 26) participated in mindful activities with

research associates from the Child Memory Lab. These sessions are comprised of getting to know each other, relaxation practices, and various activities selected as tools for children to learn how to accept and manage their emotions and subsequent behaviour. The topics of lessons covered over 6 weeks included the following: week 1, Introduction to mindful attention awareness; week 2, Let's Move Mindfully; week 3, Learning to Choose Optimism; week 4, Practicing Gratitude; week 5, How to Eat Mindfully; and week 6, Mindful Seeing. For example, during week 4, students engaged in a discussion with the research facilitator about how to recognize what you are grateful for. This conversation included typical responses from students such as: "I am grateful for my family", and by the end of the activity students were able to understand and verbalize unconventional gratitude, such as: "I am grateful for the loud buzzing of my fridge that keeps me up at night because it means I have food to eat". After a thorough discussion, students were provided with a green paper leaf to write down what they are grateful for. Research assistants compiled the leaves and placed them on a cardboard branch cut out to create a "gratitude tree". Due to ethical restrictions, researchers were not able to provide mandatory homework (e.g. daily mindfulness logs) for students to complete outside of the classroom. As such, students were instead provided with a "weekly challenge" to promote the practice of mindfulness outside of the classroom. In week 4, the challenge asked students to think of something you are grateful for each day when you wake up and before you go to sleep. A complete description of activities used throughout the MindfulMe! program is available in Table 3. Of the two classrooms who completed the MindfulMe! Program, both consisted of 13 students each for a total of 26 students.

HealthyMe! Program

The HealthyMe! program served as the active control group in this study and was created specifically for this project using resources from a non-profit children's health system database, KidsHealth®, one of the largest resources online for medically reviewed health information written for parents, kids, and teens. The program focuses on basic hygiene, nutrition, safety and physical health throughout six weekly activity sessions. Two of the HealthyMe! program activities were developed with the newly introduced Canadian Food Guide in mind (Health Canada, 2019). For example, the theme for week 3 was "breakfast". Students took part in a discussion pertaining to the benefits of breakfast, how it makes you feel, and brainstormed scenarios that left students without a breakfast so that they might come up with ways to avoid or deal with said scenarios. Students were then asked to design a menu for "Healthy Harry's Restaurant" that is expanding to include breakfast items. Researchers then facilitated a discussion with students as to why a restaurant should include breakfast, why the options they chose were healthy, and how they can make the menu attractive to customers of all ages. A complete description of activities used throughout the HealthyMe! program is available in Table 3. Of the two classrooms who completed the HealthyMe! Program, one held 10 students and the other consisted of 16 students.

Results

Data Analytic Plan

The dataset was first cleaned to reduce the small number of missing values. Three values were found unreported for the MAAS-C in the active control group only (missing data = no response to an item on the scale). In the current study, all missing values were replaced by the

series mean. For example, if a participant omitted a response, the mean of all other participants who responded was calculated and this was entered in the participant's missing response.

The current study employed a linear regression model. Considering the overarching research question seeks to identify how students with various levels of executive function might benefit from mindfulness, change scores were used in analyses. Research has shown a number of statistical issues that may arise in pre-post-test designs with categorical or continuous predictors. As suggested by Farmus, Arpin-Cribbie, and Cribbie (2019), researchers must adopt a change score model when a predictor correlates with baseline scores. The executive function score correlated with all baseline scores in the current study.

Finally, qualitative data were analysed within the MindfulMe! group. Whereas the data were also collected from the active control condition for consistency, we are not looking to improve the HealthyMe! Program and so this data will not be analyzed or reported. Feedback report forms were independently coded by blind research assistants and evaluated according to what the children liked and did not like for specific activities. This feedback provided insight to future classroom-based mindful curricula as revisions of mindful programs take place.

Preliminary Analyses

Preliminary analyses were conducted to compare baseline scores of participants. Random assignment to either MindfulMe! or an active control group was completed by classroom, rather than individual participants, to maintain external validity. More specifically, when mindfulness programs are implemented in schools they are administered to the classroom as a whole rather than a specific program for individual participants. Therefore, the current study facilitated weekly activities within the pre-existing classroom. To establish baseline equivalence between conditions, an analysis of variance was conducted to assess whether statistical differences exist

on pre-test measures between conditions. No significant condition differences were found at pre-test for the BRIEF2-T, BRIEF2-P, BRIEF2-SR, composite executive function score, SDQ, MAAS-C, RI, CRSQ-RSR, or MASQ-AA (largest F was associated with the CRSQ-RSR; F=5.026, p=.029, Cohen's d=0.18). This result may reflect the efficacy of randomization to condition.

Hypothesis 1

The first hypothesis proposes that students in the mindfulness condition will experience greater benefits on all outcome measures than their peers in the active control condition. Analyses of variance were completed with outcome variables (total difficulties, mindful attention awareness, rumination, optimism, anxiety arousal) as the dependent variable and time (pre-test, post-test), and condition (MindfulMe!, HealthyMe!) as independent variables.

Strengths and Difficulties

There were no outliers, as assessed by boxplot. There was no statistically significant interaction between the conditions and time on total difficulties, $F(1,50) = 1.129$, $p = .293$, $\eta_p^2 = .022$ (see Table 5 for means). The main effect of time showed a statistically significant decrease in mean total difficulties at the different time points, $F(1, 50) = 35.128$, $p < .001$, $\eta_p^2 = .413$ (pre-test $M = 20.19$, $SD = 0.94$; post-test $M = 15.37$, $SD = 1.07$). The main effect of condition did not show a statistically significant difference in mean total difficulties between conditions, $F(1,50) = 2.044$, $p = .159$, $\eta_p^2 = .039$ ($M_{\text{MindfulMe!}} = 19.10$, $SD = 1.30$; $M_{\text{HealthyMe!}} = 16.46$, $SD = 1.30$).

Mindful Attention Awareness

A single outlier in the MindfulMe! condition identified through the visual inspection of a boxplot was not removed due to an already limited sample size (26)[1]. There was no statistically

[1] This outlier did not affect the results.

significant interaction between the conditions and time on mindful attention awareness, $F(1,50) = .007$, $p = .931$, $\eta_p^2 = .000$ (see Table 5 for means). The main effect of time showed a statistically significant increase in mean mindful attention awareness at the different time points, $F(1, 50) = 8.986$, $p = .004$, $\eta_p^2 = .152$ (pre-test M=54.21, SD=1.79; post-test $M = 58.21$, $SD = 2.06$). The main effect of condition did not show a statistically significant difference in mean mindful attention awareness between conditions, $F(1,50) = .029$, $p = .866$, $\eta_p^2 = .001$ ($M_{\text{MindfulMe!}} = 56.52$, $SD = 2.56$; $M_{\text{HealthyMe!}} = 55.90$, $SD = 2.56$).

Children's Response Styles Questionnaire – Rumination Scale Revised

There were no outliers, as assessed by boxplot. There was a statistically significant interaction between conditions and time on rumination scores, $F(1,50) = 7.842$, $p = .007$, $\eta_p^2 = .136$ (see Table 5 for means). The main effect of time showed a statistically significant difference in mean rumination at the different time points, $F(1, 50) = 15.268$, $p < .001$, $\eta_p^2 = .234$ (pre-test $M = 22.67$, $SD = 1.01$; post-test $M = 20.37$, $SD = 1.03$). The main effect of condition did not show a statistically significant difference in mean rumination between conditions, $F(1,50) = .025$, $p = .875$, $\eta_p^2 = .000$ ($M_{\text{MindfulMe!}} = 21.37$, $SD = 1.38$; $M_{\text{HealthyMe!}} = 21.67$, $SD = 1.38$).

Separate t-tests were conducted to further investigate the significant interaction. There was a significant difference in the rumination scores from pre-test ($M = 23.35$, $SD = 5.73$) to post-test ($M = 19.38$, $SD = 7.45$) in the MindfulMe! condition; $t(25)=5.569$, p = 0.000, Cohen's $d = 0.598$). In contrast, no significant differences were found in the rumination scores from pre-test ($M = 22.0$, $SD = 8.58$) to post-test ($M = 21.35$, $SD = 7.36$) in the HealthyMe! condition; $t(25)=0.693$, p = .494, Cohen's $d = 0.081$. The significant interaction and subsequent t-tests would indicate that from pre- to post-test, students in the MindfulMe! condition decreased in rumination significantly and their peers in HealthyMe! did not. This would further suggest that

when students participate in a six-week health-based intervention, they do not experience any difference in self-reported rumination.

Resiliency Inventory (RI)

Five outliers between the two conditions were identified through the visual inspection of a boxplot[2]; they were not removed due to an already limited sample size (26). There was a statistically significant interaction between the conditions and time on optimism, $F(1,50) = 4.880$, $p = .032$, $\eta_p^2 = .089$. The main effect of time did not show a statistically significant difference in mean optimism at the different time points, $F(1, 50) = .076$, $p = .784$, $\eta_p^2 = .002$. The main effect of condition did not show a statistically significant difference in mean optimism between conditions, $F(1,50) = .593$, $p = .445$, $\eta_p^2 = .012$.

Separate t-tests were conducted to further investigate the significant interaction. No differences were found in the optimism scores from pre-test ($M = 44.0$, $SD = 7.18$) to post-test ($M = 45.62$, $SD = 7.05$) in the MindfulMe! condition; $t(25)=-1.598$, p = 0.123, Cohen's $d = 0.228$. These results suggest that participating in a six-week mindfulness-based program did not have a significant effect on self-reported optimism. Specifically, the results suggest that even though the means appear to increase from pre- to post-test, students who participated in MindfulMe! did not experience a statistically significant increase in optimism. Similarly, no significant differences were found in the optimism scores from pre-test ($M = 47.35$, $SD = 7.93$) to post-test ($M = 45.27$, $SD = 8.32$) in the HealthyMe! condition; $t(25)=1.560$, p = .131, Cohen's $d = 0.256$. While the means suggest a decrease in self-reported optimism, the t-test suggests these results are not statistically significant.

[2] After running analyses with and without the outlier we found that these outlier did not affect the results.

Mood and Anxiety Symptoms Questionnaire – Anxiety Arousal

There were no outliers, as assessed by boxplot. A statistically significant interaction was not found between the conditions and time on anxiety arousal, $F(1,50) = .237$, $p = .628$, $\eta_p^2 = .005$. The main effect of time showed a statistically significant decrease in mean anxiety arousal at the different time points, $F(1, 50) = 5.271$, $p < .026$, $\eta_p^2 = .095$. The main effect of condition did not show a statistically significant difference in mean rumination between conditions, $F(1,50) = .327$, $p = .570$, $\eta_p^2 = .007$.

Hypothesis 2

Outcome Measures

The second hypothesis proposed executive function scores would significantly predict change scores for all five outcome measures in the MindfulMe! condition. To examine whether change scores are predicted by student levels of executive function, linear regressions were run with composite executive function score as the continuous predictor, and change scores for students' mindful attention awareness, strengths and difficulties, mood and anxiety symptoms, rumination, and optimism as dependent variables. Executive function was measured by the Behavioral Rating Inventory of Executive Function 2 for parents, teachers, and students (self-report) and was amalgamated into a single composite score by summing and then averaging the BRIEF2-P, BRIEF2-T, and BRIEF2-SR raw scores.

Strengths and Difficulties

A linear regression was run to understand the effect of executive function on strength and difficulty change scores after a mindfulness-based intervention. Two participants were identified

as outliers with an SDQ change score of +7 and -30, respectively[3]. They were not removed from the analysis due to an already limited sample size (26).

A linear regression was used to predict the total difficulties change score = -10.997 + 0.303*composite executive function. The composite executive function score was a statistically significant predictor of the total difficulties change scores, $F(1, 24) = 7.102$, $p = .014$, accounting for 22.8% of the variation in total difficulties change scores with adjusted $R^2 = 19.6\%$, a small-medium size effect according to Cohen (1988). Notably, a single increase (+1) in an individual's composite executive function score leads to a 0.303, 95% CI [0.068, 0.538] increase in total difficulties change score. Predictions were made to determine mean total difficulties change score for those with a composite executive function score of 25, 50, and 75. For example, for a composite executive function score of 25, mean total difficulties change score was predicted as -3.422, 95% CI [-4.913, -1.930]; for a score of 50 it was predicted as +4.154, 95% CI [-2.292, 10.600]; and for a score of 75 it was predicted as +11.729, 95% CI [-.506, 23.965].

A linear regression was also conducted to determine the effect of executive function on total difficulties after a health-based intervention. The composite executive function score did not statistically significantly predict total difficulties change scores in the active control group, $F(1, 24) = .023$, $p = .882$.

Mindful Attention Awareness

To determine the effect of executive function on mindful attention awareness after a mindfulness-based intervention, a linear regression was computed. One participant was identified

[3] After running analyses with and without the outliers we found that these outliers did not affect the results.

as an outlier with a change score of +38. This participant was not removed from the analysis due to an already limited sample size (26). [4]

A linear regression was used to predict the mindful attention awareness change score = 15.636 – 0.496*composite executive function. The composite executive function score statistically significantly predicted mindful attention awareness change scores, $F(1, 24) = 5.473$, $p = .028$, accounting for 18.6% of the variation in mindfulness attention awareness change scores with adjusted $R^2 = 15.2\%$, a small-medium size effect according to Cohen (1988). Notably, a single increase (+1) in an individuals' composite executive function score leads to a 0.496, 95% CI [-0.934, -0.058] decrease in mindful attention awareness gain score. Predictions were made to determine mean mindful attention awareness change score for those with a composite executive function score of 25, 50, and 75. For example, for a composite executive function score of 25, mean mindful attention awareness change score was predicted as -3.231, 95% CI [.449, 6.013]; for a score of 50 it was predicted as -9.174, 95% CI [-21.199, 2.851]; and for a score of 75 it was predicted as -21.579, 95% CI [-44.404, 1.246].

A linear regression was also conducted to determine the effect of executive function on mindful attention awareness after a health-based intervention. The composite executive function score did not statistically significantly predict mindful attention awareness change scores in the active control group, $F(1, 24) = .187$, $p = .669$.

Children's Response Styles Questionnaire – Rumination Scale Revised

To determine the effect of executive function on rumination after a mindfulness-based intervention, a linear regression was computed. No outliers were reported.

[4] After running analyses with and without the outlier we found that these outlier did not affect the results.

A linear regression was used to predict the rumination change score = -13.589 + 0.415*composite executive function. The composite executive function score statistically significantly predicted rumination change scores, $F(1, 24) = 24.546$, $p < .001$, accounting for 50.6% of the variation in rumination change scores with adjusted $R^2 = 48.5\%$, a large size effect according to Cohen (1988). Notably, a single increase (+1) in an individuals' composite executive function score leads to a 0.415, 95% CI [.242, .587] increase in rumination change score. Predictions were made to determine mean rumination change score for those with a composite executive function score of 25, 50, and 75. For a composite executive function score of 25, mean rumination change score was predicted as -3.233, 95% CI [-4.320, -2.125]; for a score of 50 it was predicted as +7.144, 95% CI [2.399, 11.889]; and for a score of 75 it was predicted as +17.511, 95% CI [8.504, 26.518].

A linear regression was also conducted to determine the effect of executive function on rumination after a health-based intervention. The composite executive function score did not statistically significantly predict rumination change scores in the active control group, $F(1, 24) = 3.156$, $p = .088$.

Resiliency Inventory – Optimism Subscale

To determine the effect of executive function on optimism after a mindfulness-based intervention, a linear regression was computed. The composite executive function score did not statistically significantly predict optimism change scores, $F(1, 24) = .253$, $p = .620$.

A linear regression was also conducted to determine the effect of executive function on optimism after a health-based intervention. The composite executive function score did not statistically significantly predict optimism change scores in the active control group, $F(1, 24) = .008$, $p = .931$.

Mood and Anxiety Symptom Questionnaire – Anxiety Arousal

To determine the effect of executive function on anxiety arousal after a mindfulness-based intervention, a linear regression was computed. No outliers were reported.

A linear regression was used to predict the anxiety arousal change score = -7.350 + 0.217*composite executive function. The composite executive function score statistically significantly predicted anxiety arousal change scores, $F(1, 24) = 4.934$, p = .036, accounting for 17.1% of the variation in anxiety arousal change scores with adjusted R^2 = 13.6%, a small size effect according to Cohen (1988). Notably, a single increase (+1) in an individuals' composite executive function score leads to a 0.217, 95% CI [.015, .419] increase in anxiety arousal change score. Predictions were made to determine mean anxiety arousal change score for those with a composite executive function score of 25, 50, and 75. For a composite executive function score of 25, mean anxiety arousal change score was predicted as -1.921, 95% CI [-3.203, -.638]; for a score of 50 it was predicted as +3.509, 95% CI [-2.034, 9.051]; and for a score of 75 it was predicted as +8.938, 95% CI [-1.583, 19.459].

A linear regression was also conducted to determine the effect of executive function on anxious arousal after a health-based intervention. The composite executive function score did not statistically significantly predict anxious arousal change scores in the active control group, $F(1, 24) = .324$, $p = .574$.

Hypothesis 3

The third hypothesis proposes that weekly activity ratings provided by students in the MindfulMe! condition will correspond with their executive function. More specifically, we expect activities requiring more attention, concentration, stillness, or silence (i.e., the body scan, optimism, and gratitude) will be rated less favorably than activities allowing physical movement

or opportunity for discussion (i.e., mindful movements, mindful eating, and mindful seeing) for students with lower executive function. To evaluate this hypothesis, six separate linear regressions were completed with executive function score as the independent variable and feedback rating (1=I did not enjoy today's activity at all, 5=I enjoyed everything about today's activity) as the dependent variable.

A linear regression was used to predict the activity rating for the body scan (Body Scan) = 5.608 – .109*composite executive function. The composite executive function score significantly predicted the activity rating for the body scan, $F(1, 24) = 8.029$, $p = .009$, accounting for 25.1% of the variation in students' rating of the body scan with adjusted R^2 = 21.9%, a medium size effect according to Cohen (1988). This suggests that students with difficulties in executive function may not enjoy the body scan as much as students who do not have difficulties in executive function.

A linear regression was used to predict the activity rating for a gratitude-based activity (Gratitude) = 5.590 – .080*composite executive function. The composite executive function score significantly predicted the activity rating for the gratitude activity, $F(1, 24) = 4.818$, $p = .038$, accounting for 16.7% of the variation in students' rating of the body scan with adjusted R^2 = 13.2%, a small size effect according to Cohen (1988). This suggests that students with difficulties in executive function may not enjoy the gratitude activity as much as students who do not have difficulties in executive function.

A series of four linear regressions found that ratings from (1) mindful movements, (2) optimism, (3) mindful eating, and (4) mindful seeing, were not significantly predicted by executive function, $ps > 0.05$ as they were rated similarly by students across all levels of

executive function. Notably, the mindful movements activity, mindful eating activity, and mindful seeing activity were all rated relatively high by all students.

Students were given the opportunity to provide written feedback following each weekly activity. The second and third items on the "student activity feedback form" ask what students enjoyed and what they did not enjoy about the respective weekly activity. Table 1 outlines abundant weekly themes (positive and negative) that were found in student activity feedback forms.

In Week One, students were taught the importance of mindful breathing and the benefit of listening to your body. The majority of students deemed the body scan to be relaxing and calming. Meghan* particularly enjoyed how the feeling of relaxation "continued after the body scan was over". Many students were able to identify sore muscles or aches and pains they had not previously recognized, after completing the body scan. Students were encouraged to complete the body scan in a position most comfortable for them, for example, with open or closed eyes, and lying on the ground or standing against the wall. While many students appeared to benefit from having freedom of choice, feedback indicated numerous instances of physical discomfort due, in part, to location and equipment-related barriers. Shannon believed that she "would have been more comfortable on a beanbag chair, but Lisa took the last one".

In Week Two, students continued practicing their mindful breathing while engaging in mindful movements. Many students shared their previous experiences with yoga, gym class, and meditation. Natalie felt "best when doing a challenge", referring to the different levels of poses offered by the research facilitator. For example, a pose requiring closed eyes was followed by the option to challenge yourself by standing on one foot. An increase in concentration was frequently

* All names used are pseudonyms

cited by students as something they enjoyed from the activity. Tui made a connection with a previous activity, the body scan, by noting how it "helps keep focus on my body...kind of like during the body scan". Similar barriers to Week One were experienced in Week Two, such that students felt there was not adequate space to purposefully complete the activity.

In Week Three, students were taught how to be mindful in difficult situations, namely by choosing to be optimistic while remaining realistic. The difference between optimistic, pessimistic, and unrealistic response styles were explored across many situations. Students particularly enjoyed the *collaborative* nature of this activity. For instance, Vivienne appreciated the opportunity to "share answers with her friends and talk about other answers with the class". Upon reflecting on what they did not enjoy, a commonly noted theme was *unrealistic expectations.* More specifically, students felt as though this exercise would not come naturally to them, nor did they believe they would be willing, when encountering a real-life difficulty.

In Week Four, students were given the opportunity to reflect on common (e.g. friends, family, pets) and uncommon (e.g. an annoying fridge buzz because it represents fresh food in the home) items of gratitude. Simply noting instances of gratitude was familiar among students, however the ability to be grateful for life's difficulties, annoyances, or hardships was a brand-new activity for all. The class was keen to share their 'leaves of gratitude' with one another, with examples ranging from "fuzzy socks because they keep my feet warm" to "you people...I like all the stuff you guys do with us...and it helps me". Very few students opted to share negative feedback in Week Four, however, it is worth mentioning that all negative feedback was associated with difficulties coming up with new things to be grateful for.

In Week Five, students learned how to be mindful of the taste, texture, and feelings associated with different foods. Whereas research facilitators conducted visualization exercises

with lemons, pretzels, and ice cream, students were most fond of the opportunity to imagine their own favorite foods. Due to circumstances beyond the researcher's control, we were unable to practice mindful eating with real food. In previous research, mindful eating has been practiced with jellybeans. The current study adapted to limitations by completing the activity through a visualization exercise and asking the students to mindfully eat their snacks and lunch later in the day. As such, students' feedback on the mindful eating activity was consistent with these limitations, such that they focused on requests for real food, and to complete the activity during the lunch hour rather than before. Daniel felt the activity was “unrealistic because if he is hungry, he will just eat quickly”.

In Week Six, students were asked to look outside as if for the first time. As a group, the grass, trees, birds, and feeling of shining sun were discussed in detail. Wider applications and relevant connections were made by students, including Ella who wrote “mindful seeing could help kids see bullying or maybe why your friend is being not nice”, and Steven “I like that I feel like a hockey announcer because you have to follow the game you can’t just watch it”. When asked if there was anything that they did not enjoy about the mindful seeing activity, Juan asserted that “it was too short, and he would rather go for a walk outside to make it longer instead of looking out the window”.

Discussion

The study evaluated the impact of executive function on the psychological, behavioral, and physiological outcomes of elementary school students who were randomized to a mindfulness-based intervention or a health-based intervention. It was hypothesized that regardless of executive function, students in the mindfulness-based intervention would show greater improvements pre- to post-test in rumination, anxious arousal, total difficulties, mindful

attention awareness, and optimism, in comparison to an active control group. It was further hypothesized that executive function would significantly predict the extent that a student would benefit from the mindfulness-based intervention, according to outcome variable gain scores. Finally, it was hypothesized that students weekly activity ratings would correspond with their level of executive function, such that activities requiring more attention, concentration, and stillness would be rated lower by students with executive function difficulties, than those activities allowing movement, imagination, and free discussion.

After a six-week mindfulness-based intervention, decreased rumination was observed in comparison to an active control condition. Significant differences between conditions were not observed for total difficulties, mindful attention awareness, optimism, or anxious arousal. Significant improvements were not found for any outcome variable in the HealthyMe! active control condition.

Furthermore, our findings are important to consider when referencing past literature, such that there may be a latent factor influencing the non-significant differences found in this study and other studies (K A Schonert-Reichl & Lawlor, 2010). More specifically, and in line with the current study, it is possible that executive function may play a role in non-significant findings in mindfulness-based research, such that significant differences between intervention and controls may be diminished when there are participants with difficulties in executive function. For example, if half of an intervention group includes students with ADHD, ASD, learning disorders, or other difficulties, their results have potential to skew data collected within the classroom as a whole. In this instance, research tends to present non-significant findings without acknowledging the significant benefits that may be occurring for some students as well as the difficulties experienced by the students who did not benefit from the program at all or as much as their

peers. From this first hypothesis, we attempted to further our understanding of the role that executive function plays in mindfulness-based interventions and its potential benefits.

The second hypothesis establishes the predictive ability of executive function when looking at change scores (pre- to post-test) of students who participated in MindfulMe! and in HealthyMe!. More specifically, the second hypothesis addresses *why* significant differences may not have been found for the overwhelming majority of outcome variables. According to our results, we should not focus on why mindfulness does not appear to significantly target outcomes when compared to an active control, but rather we should focus on the underlying characteristics of participants and whether *they* are preventing the benefits of mindfulness-based interventions to take full effect. In the current study, executive function is the underlying participant characteristic of interest.

The results of a series of linear regressions suggest that a six-week classroom-based mindfulness intervention may not be beneficial or accessible to all students. The current study demonstrates that executive function may significantly predict the extent that a student will benefit from a mindfulness-based intervention in all areas (anxiety arousal, mindful attention awareness, optimism, total difficulties) except rumination. This finding is important to consider when evaluating the cognitive faculties required for children to benefit from mindfulness-based interventions, such that rumination appears to be accessible to all students regardless of their executive function in the current study. Further research with a larger sample size is clearly warranted to conclusively state that current mindfulness-interventions and their activities are well-equipped to decrease rumination in all students.

The association between mindfulness program outcomes and executive function may reflect the cognitive skills needed to sufficiently participate and benefit from a mindfulness-

based intervention. Students with greater executive function may demonstrate proficiencies in any or all of their working memory, inhibitory control, and cognitive flexibility, which in turn aligns well with the skills utilized during a mindfulness-based activity. Notably, research suggests that mindfulness may require components of executive function, such as inhibitory control, in an effort to maintain attention, prevent rumination, and control impulsive thoughts, behaviors, and emotions (Davidson, Amso, Anderson, & Diamond, 2006; Riggs et al., 2015).

Results from the current study suggest that mindfulness-based interventions facilitated in school settings appear to be optimally designed for typically developing students. Research has previously indicated that mindfulness requires the "recruitment of working memory skills and inhibitory control" to attend to the present moment and control intruding thoughts, behaviors, and emotions (Riggs et al., 2015). Our findings indicate that students who (according to their own, their parent, and their teachers BRIEF2 screening form) have relatively lower level of executive function, are unfortunately not experiencing the same positive benefits that mindfulness-based interventions have to offer as their typically developing peers. We previously indicated the need to create an accessible mindfulness-based intervention for students; our findings show that currently developed programs, while beneficial for some, must be revised. To address the need for revision, we collected weekly activity ratings and written feedback from students in the MindfulMe! condition. While our present data is limited in identifying the executive function of students who provided feedback, we believe that first-hand qualitative remarks and thematic analyses are an important first step in improving any program.

The third hypothesis proposed that students' executive function would predict whether they would enjoy the mindfulness-based activities. Specifically, the mindful movements were expected to receive high ratings from all students regardless of executive function level, such

that free movement and speaking are encouraged throughout the activity. In contrast, we anticipated that the body scan would receive lower ratings by those with difficulties in executive function for two distinct reasons. First, the body scan was the first activity introduced to MindfulMe! students by researchers with whom they did not have an established relationship with yet. As such, this drastic change in routine may have been unsettling for students with lower levels of executive function. Second, the body scan, gratitude, and optimism activities all require a strong focus on the present moment, stillness, and silence, all while concentrating on the voice of the facilitator directing you. An unexpected finding was that executive function did not significantly predict the enjoyment of the optimism activity. This may be an artefact of comfort felt by the participants as it preceded a highly rated activity (mindful movements). As expected, executive function did not predict enjoyment for mindful movements, mindful eating, or mindful seeing; all of which are activities that allow movement, do not restrict noise levels, and require much less attention than other activities.

A strong representativeness of feedback is demonstrated by the quotes from student participants. The researchers expected certain feedback points from students (i.e., physical comfort during the body scan/mindful movements), however, there were various instances, which surprised us. For example, students went above and beyond in making connections between distinct activities (see Tui's quote). While certain connections were unexpected, they were nevertheless impressive to our research team. Specifically, we were most impressed by comments in Week 6 where students were able to make connections with their everyday lives (i.e., bullying, a hockey announcer). Exploring student opinions and perceptions regarding the implementation of classroom-based mindfulness practices is invaluable to the dissemination and revision of these programs.

Limitations and Future Directions

There were various limitations to the study. First, the analyses were completed on an individual student level whereas randomization took place on a classroom-level. This methodology puts statistical significance into question due to the lack of independence in participant data. Despite this limitation, the choice to randomize at the classroom-level was consciously made, in an effort to optimize the study's external validity. When classroom-based mindfulness interventions are delivered in schools (outside of research) they typically are facilitated within classrooms as opposed to separating students into groups. Further, randomization by classroom rather than individual student appeared sufficient, as there were no significant differences between conditions (MindfulMe!, HealthyMe!) at pre-test for any variable. Future research with more participants may consider completing analysis at both a classroom and individual level. Another suggestion is to increase the amount of data collected from parents/caregivers and teachers, such as daily diaries, and some form of pre-post testing.

Second, it has been long asserted that there are limitations associated with self-report measures in behavioral research, notwithstanding the difficulties introduced when the self-reporter is a child participant (Goodman, Madni, & Semple, 2017). Bias in self-report measures is found to be an even larger issue in mindfulness research. Participants who have increased in their mindfulness may be more aware of their behavior, thoughts, and intentions, which then translates into rating themselves lower on self-report measures. This notable "reverse bias effect" would not take place in active control group participants, rendering any significant differences between the two groups difficult to interpret (Goodman et al., 2017). Further, participants in the mindful condition are exposed to familiar "context clues" in the questionnaire that they would have encountered during mindful activities (e.g. awareness, present moment, non-judgemental,

etc.) and may elicit a biased response. In addition to the self-report measures for outcome variables, research has asserted the limitations associated with measures of executive function in children. Further, a validated objective measure of dispositional mindfulness for children does not exist (Riggs et al., 2015). The difficulties associated with task-based measures of executive function include the inability to distinguish which component of EF is being used, whereas self-report measures of executive function are unable to capture the real-world responses that a task-based measure would. There is also concern for the lack of correlation between the two forms of measurement in past research (Ledochowski, Andrade, & Toplak, 2019). Future research would therefore benefit from using a combination of task-based and self-report measure of executive function, and to ensure they correlate prior to concluding any findings. Other suggestions might include using the full BRIEF2 rather than a screening form, as this would allow for a more componential analysis of executive function.

Third, our sample size and diversity were largely limited due to circumstances beyond the researcher's control, as the participating schools in the current study were specifically oriented toward two niche groups of students. The first school catered to students with learning difficulties and the second school catered to students in competitive hockey. Therefore, we are limited in our ability to generalize any significant findings beyond these populations as they may not fully represent a typical classroom in Ontario. The variety of schools in a research study have a potentially significant effect in mindfulness research, especially when considering the generalizability to a greater population. For example, socioeconomic background, teacher qualifications, and past mindfulness experience may have an effect on the acceptability of the current mindfulness-based intervention. Since our sample contains clinical populations, this precludes generalizability to classrooms with neurotypical-only students. Future research might

benefit extensively from a larger sample size, namely through the analysis of a wider variety of schools (i.e., private, public, Catholic, etc.). As a general rule of thumb, it is suggested that a study has at least 50 to conduct meaningful linear regressions. Our sample size does fit with these recommendations as we have 52 participants.

Fourth, the MindfulMe! program was facilitated by trained research assistants. This serves as a potential barrier to acceptability such that students may not be as receptive to learning about mindfulness from an external facilitator rather than their teacher with whom they are familiar. Therefore, the current study is only generalizable to programs that are facilitated by an external individual. However, it is important to note the barriers associated with teacher-delivered mindfulness including additional training for teachers, additional work to an already full teaching plan, and the unrealistic expectations for all teachers to become specialists in mindfulness.

The study was successful in establishing a predictive relationship between an individual's executive function and their subsequent benefit from a mindfulness-based intervention. Accordingly, past research has demonstrated a significant association between greater dispositional mindfulness and higher scores on a latent executive function variable (Riggs et al., 2015). Nevertheless, the association between dispositional mindfulness and executive function is limited in the scientific literature with adolescents. Researchers agree that next steps would involve the testing of individual executive function components (i.e., inhibitory control, working memory, cognitive flexibility) (Dahl, Lutz, & Davidson, 2015; Felver, Tipsord, Morris, Racer, & Dishion, 2017; Riggs et al., 2015). We would add that future research would benefit from neurologically testing individual components of mindfulness in an effort to establish which cognitive faculties are used/required to maximize its full potential. An example of required future

research is Valk and colleagues (2017), who found cortical thickening and plasticity differentially occurred, according to which mindfulness-based exercise was practiced. Advances in this area would further our understanding of how individuals experience mindfulness and how each activity is not one-size-fits-all.

Finally, while the inclusion of clinical populations in inevitable when researching a range of executive functioning, limitations are found within the lack of data available due to ethical reasons. For example, the current study would have benefitted from knowing more information about students who have been formally diagnosed with a disorder associated with executive dysfunction, such as their medication intake, treatment/therapy history, date of diagnosis, name of diagnosis, and any other relevant information that could be held constant during data analyses.

Conclusion

Student feedback in the current study may serve as a guide for future mindfulness-based interventions. When children attend physical education classes, they often take place in an appropriately sized gymnasium with some form of equipment (mats, balls, etc.). Similarly, when children are taught mathematics, they are typically placed in a standard classroom with a chalkboard, desks, chairs, pencils and paper. Unfortunately, we may not be meeting such basic standards when it comes to mindfulness-based interventions. For example, when the body scan was completed in the current study, many students experienced physical discomfort that could be avoided had mats been provided to those who wished to lie down. In many instances, students believed their space was not optimal for the activity, however, a larger space was not available since the intervention took place within a classroom and not during gym or outdoor time. Mental discomfort was noted as students shared a lack of focus most likely caused by noise from other classrooms or students, and sometimes a poor understanding of how mindfulness-based activities

were any different from going for a walk with friends. This feedback may very well elicit responses along the lines of "comfortable physical equipment and a quiet room are not needed for mindfulness". However, the current study may suggest that these options could be holding some children back from experiencing optimal benefits. Future studies would benefit from eliciting feedback from all students, and especially from students with lower levels of executive function. In doing so, revisions can be made to serve those who need them most so that mindfulness-based interventions can work toward inclusivity and students of all developmental trajectories may reap its benefits.

Table 1. *Age, Gender, Ethnic Background and Grade Distribution by Condition (MindfulMe!, Control)*

Demographic	MM (n = 26)		Control (n = 26)	
	%	n	%	n
Racial Background				
White (Anglo, Caucasian, European)	65.4	17	65.4	17
Latin (South American, Portuguese, etc.)	0	0	3.8	1
Asian (Chinese, Japanese, Korean, etc.)	3.8	1	0	0
Indian	0	0	3.8	1
Middle Eastern (Arabic, Iranian, Persian)	3.8	1	0	0
Not specified	26.9	7	26.9	7
Gender				
Female	23.1	6	11.5	3
Male	76.9	20	88.5	23
Age				
9	3.8	1	0	0
10	19.2	5	11.5	3
11	46.2	12	26.9	7
12	11.5	3	34.6	9

13	15.4	4	26.9	7
14	3.8	1	0	0
Grade				
Five	15.4	4	11.5	3
Six	57.7	15	19.2	5
Seven	11.5	3	34.6	9
Eight	15.4	4	34.6	9

Table 2. *Pearson Correlations between the Parent, Teacher, and Self-report BRIEF2*

Measure	BRIEF2-T		BRIEF2-P		BRIEF2-SR	
	r	*p*	r	*p*	r	*p*
BRIEF2-T			.644	<.001	.650	<.001
BRIEF2-P	.644	<.001			.634	<.001
BRIEF2-SR	.650	<.001	.634	<.001		

Table 3. *MindfulMe! Program with Weekly Activities*

Week	**Activity**	**Description**
1	Body Scan	Students learned about the importance of relaxation, breathing techniques and they completed a body scan. Students were then challenged to do the body scan at least once in the next week.
2	Mindful Movement	Students learned to measure their own heart rate. Mindful movements included "poses" such as the butterfly pose, rag doll pose, and warrior pose. Students were challenged to do a balancing action at least 1x daily over the next week.
3	Learning to Choose Optimism	Students learned the importance of a positive attitude by training the skill of optimism while remaining realistic. Students were challenged to make an "optimism framework" at least 1x over the next week.
4	Gratitude	Students wrote what they are thankful for on green cardboard "thankful leaves" that were later combined to create a "gratitude tree". Students were challenged to name something you are grateful for 2x daily.

5	Mindful Eating	Students took part in a visualization exercise where they mindfully imagined eating something sweet, salt, sour, and bitter. Students were challenged to mindfully eat their lunch that day (immediately following this activity).
6	Mindful Seeing	Students mindfully looked out their window and described stimuli as if it were the first time (e.g. what would a bird look like if you've never seen one, describe the shape, color, weight, texture, etc.).

Table 3. *HealthyMe! Program with Weekly Activities*

Week	**Activity**	**Description**
1	Food Labels	Students learned how to interpret food labels and nutrition facts. Students were challenged to choose healthier foods for one week.
2	Peer Pressure	Students learned the difference between positive and negative peer pressure by engaging in a role play. Students were challenged to identify words affiliated with positive peer pressure and negative peer pressure.
3	Breakfast	Students created a breakfast menu and incorporated healthy food options. Students were challenged to eat one more healthy breakfast than usual.
4	Germs	Students learned about ways to avoid germs such as washing hands. Students created a catchy song, joke, or dance to relay knowledge to their peers. Students were challenged to wash their hands properly and for the recommended amount of time.
5	Cold and Flu	Students discussed how individuals catch colds, what the symptoms are, and how to prevent catching a cold. Students created a factsheet differentiating the

		common cold and the flu. Students were challenged to teach one other person the difference between the cold and flu.
6	Online Safety	Students learned about fun, educational, and safe online games. Students learned the difference between a safe or potentially unsafe online website. Students were challenged to find a fun and safe website for children.

Table 4. *Means and Standard Deviations for Raw Score, Percentile, and Classification on the BRIEF according to Program (MindfulMe!, Control) and Respondent (Teacher, Parent, Student)*

	Teacher BRIEF2		Parent BRIEF2		Student BRIEF2	
	MM (n = 26) *M* (*SD*)	Control (n = 26) *M* (*SD*)	MM (n = 26) *M* (*SD*)	Control (n = 26) *M* (*SD*)	MM (n = 26) *M* (*SD*)	Control (n = 26) *M* (*SD*)
Raw Score	22.58(8.16)	20.88(6.36)	22.81(6.63)	22.31(5.98)	24.27 (5.54)	23.4(4.32)
Percentile	73.97(30.67)	74.35(23.14)	73.54(28.9)	73.62(24.73)	-*	-*
Classification	1.31(0.93)	1.42(0.76)	1.04(1)	1.04(1)	-*	-*

Note: Classification indicates whether the raw score and percentile corresponds to neurotypical (0), potentially clinically elevated (1), or clinically elevated (2).
**: As per the age restrictions on the BRIEF2-SR, percentile and classification was unable to be calculated due to the participants who were younger than the calculation was made for*

Table 5. *Means and Standard Deviations for Outcome Measures by Program (MindfulMe!, Control) and Time (Pre, Post)*

		MindfulMe!		HealthyMe!	
	n	Pre-test	Post-test	Pre-test	Post-test
SDQ					
Total Difficulties	26	21.08(6.65)	17.12(8.16)	19.31(6.89)	13.62(7.26)
Emotional Problems	26	4.46(2.61)	5.15(2.99)	3.23(2.30)	4.04(2.66)
Conduct Problems	26	3.69(1.55)	3.19(2.40)	3.81(1.94)	2.54(2.20)
Hyperactivity	26	6.69(1.85)	5.23(2.16)	6.27(2.39)	4.50(2.23)
Peer Problems	26	6.19(2)	3.38 (2.42)	6(1.94)	2.42(2.04)
Prosocial	26	7.58(1.81)	8.08(1.57)	7.38(2.53)	7.62(2.32)
Internalizing Score	26	10.65(4.17)	8.54(5.06)	9.23(3.31)	6.46(4.43)
Externalizing Score	26	10.38(3.14)	8.42 (4.12)	10.08(3.98)	7.04(3.95)
MAAS-C					
Total Mindfulness Score	26	54.46(12.22)	58.58(13.98)	53.96(13.53)	57.85(15.64)
CRSQ-RSR					
Total Rumination Score	26	23.35(5.73)	19.38(7.45)	22(8.58)	21.35(7.36)
RI-Optimism					
Total Optimism Score	26	44(7.18)	45.62(7.05)	47.35(7.93)	45.27(8.32)
MASQ-AA					
Total Anxiety Arousal Score	26	21.62(7.89)	19.31(9.22)	22.54(10.05)	21.04(8.20)

Table 6. *Means and Standard Deviations for Change Scores by Program (MindfulMe!, Control)*

		MindfulMe!	HealthyMe!
	n	Change Score	Change Score
SDQ			
Total Difficulties	26	-3.96(3.94)	-5.69(7.31)
Emotional Problems	26	+0.69(2)	+0.81(2.77)
Conduct Problems	26	-0.5(1.27)	-1.27(2.18)
Hyperactivity	26	-1.46(1.88)	-1.77(2.98)
Peer Problems	26	+2.81(2)	-3.58(2.35)
Prosocial	26	+0.50(2.35)	+0.23(2.08)
Internalizing Score	26	-2.12(2.90)	-2.77(4.04)
Externalizing Score	26	-1.96(2.54)	-3.04(4.64)
MAAS-C			
Total Mindfulness Score	26	+4.12(7.16)	+3.88(11.57)
CRSQ-RSR			
Total Rumination Score	26	-3.96(3.63)	-1.65(5.92)
RI-Optimism			
Total Optimism Score	26	+1.62(5.15)	-2.08(6.79)
MASQ-AA			
Total Anxiety Arousal Score	26	-2.31(7.89)	-1.5(7.8)

Table 7: Weekly Activities and Major Feedback Themes (Positive, Negative) for MindfulMe! participants

Activity	Common themes (+)	Common themes (-)
Week 1: Body Scan	Relaxation Calming	Physical barriers Physical discomfort
Week 2: Mindful Movements	Challenging poses Concentration	Physical location
Week 3: Learning to Choose Optimism	Sharing with the group	Mental discomfort Unrealistic
Week 4: Gratitude	Sharing with the group	Difficulty thinking of new ideas
Week 5: Mindful Eating	Choosing favorite foods	Unrealistic
Week 6: Mindful Seeing	Wider applications	Time restraints

Appendix A

Children's Response Styles Questionnaire – Rumination Scale Revised

We are interested in what you are like. The following items ask you questions about how you feel. When people feel sad, they do and think different things. What about you? What do you do and think when you are sad? For each question, **please indicate what you usually do**, not what you think you should do.

	Almost Never	Sometimes	Often	Almost Always
1. When I am sad, I think about a recent situation wishing it had gone better.	1	2	3	4
2. When I am sad, I think: "Why can't I handle things better?"	1	2	3	4
3. When I am sad, I think: "Why do I always react this way?"	1	2	3	4
4. When I am sad, I think: "Why do I have problems others don't have?"	1	2	3	4
5. When I am sad, I think: "What am I doing to deserve this?"	1	2	3	4
6. When I am sad, I go away by myself and think about why I feel this way.	1	2	3	4
7. When I am sad, I go someplace alone to think about my feelings.	1	2	3	4
8. When I am sad, I think about recent events to try to understand why I feel this way.	1	2	3	4
9. When I am sad, I write down what I am thinking and try to understand these thoughts.	1	2	3	4
10. When I am sad, I take time to reflect to try to understand why I am sad.	1	2	3	4

Appendix B
Mindful Attention Awareness Scale for Children

Please circle the number that best answers each statement. Please answer honestly and ask any questions if you do not understand any of the statements. Your responses will be kept confidential, and **only** the researchers, **not the teachers, parents, and principal** will see your completed answers.

		Almost Never	Not very often at all	Not very often	Somewhat often	Very often	Almost Always
1.	**I could be feelings a certain way and not realize it until later**	1	2	3	4	5	6
2.	**I break or spill things because of carelessness, not paying attention, or thinking of something else**	1	2	3	4	5	6
3.	**I find it hard to stay focused on what's happening in the present moment**	1	2	3	4	5	6
4.	**Usually, I walk quickly to get where I'm going without paying attention to what I experience along the way**	1	2	3	4	5	6
5.	**Usually, I do not notice if my body feels tense or uncomfortable until it gets really bad**	1	2	3	4	5	6
6.	**I forget a person's name almost as soon as I have been told it for the first time**	1	2	3	4	5	6
7.	**It seems that I am doing things automatically without really being aware of what I am doing**	1	2	3	4	5	6
8.	**I rush through activities without being really attentive to them**	1	2	3	4	5	6
9.	**I focus so much on a future goal that I want to achieve that I don't pay attention to what I am doing right now to reach it**	1	2	3	4	5	6
10.	**I do jobs, chores, or schoolwork automatically without being aware of what I am doing**	1	2	3	4	5	6
11.	**I find myself listening to someone with one ear, doing something else at the same time**	1	2	3	4	5	6
12.	**I walk into a room, and then wonder why I went there**	1	2	3	4	5	6
13.	**I can't stop thinking about the past or the future**	1	2	3	4	5	6
14.	**I find myself doing things without paying attention**	1	2	3	4	5	6
15.	**I snack without being aware that I am eating**	1	2	3	4	5	6

Appendix C
Mood and Anxiety Symptom Questionnaire – Anxiety Arousal

Below is a list of feelings, sensations, problems, and experiences that people sometimes have. Read each item and then fill in the blank with the number that best describes how much you have felt or experienced things this way during the past week, including today.

1	2	3	4	5
not at all	a little bit	moderately	quite a bit	extremely

_____ 1. I was short of breath

_____ 2. I felt dizzy or lightheaded

_____ 3. My hands were cold or sweaty

_____ 4. I was trembling or shaking

_____ 5. I had trouble swallowing

_____ 6. I felt like a failure

_____ 7. My muscles twitched or trembled

_____ 8. I had a very dry mouth

_____ 9. I felt distant or withdrawn from other people

_____ 10. I felt tense or “high strung”

Appendix D
Resiliency Inventory – Optimism Subscale

For each sentence, please indicate how well it describes you by circling the number that describes how true it is for you.

	Not at all like me	**A little bit like me**	**Kind of like me**	**A lot like me**	**Always like me**
1. I have more bad times than good times*	1	2	3	4	5
2. More good things than bad things will happen to me	1	2	3	4	5
3. I start most days thinking I will have a bad day*	1	2	3	4	5
4. Even if there are bad things, I am able to see the good things about me and my life	1	2	3	4	5
5. I am bored by most things in my life*	1	2	3	4	5
6. I think things will get worse in the future*	1	2	3	4	5
7. I am optimistic about school life	1	2	3	4	5
8. I think that I am a lucky one	1	2	3	4	5
9. When something bad happens to me, I think that it will last long*	1	2	3	4	5
10. Even little things make me upset*	1	2	3	4	5
11. I keep making the same mistakes over and over again	1	2	3	4	5
12. I get impatient when I have to wait for something*	1	2	3	4	5
13. I make decisions before I have a chance to think about the consequences	1	2	3	4	5
14. I stay calm even when there is an emergency	1	2	3	4	5

Appendix E
Strengths and Difficulties Questionnaire

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain. Please give your answers on the basis of how things have been for you over the last six months.

	Not True	Somewhat True	Certainly True
1. I try to be nice to other people. I care about their feelings	0	1	2
2. I am restless, I cannot stay still for long	0	1	2
3. I get a lot of headaches, stomach-aches or sickness	0	1	2
4. I usually share with others (e.g. games, food, etc.)	0	1	2
5. I get very angry and often lose my temper	0	1	2
1. I would rather be alone than with people my age	0	1	2
2. I usually do as I am told	0	1	2
3. I worry a lot	0	1	2
4. I am helpful if someone is hurt, upset, or feeling ill	0	1	2
5. I am constantly fidgeting or squirming	0	1	2
1. I have one good friend or more	0	1	2
2. I fight a lot. I can make other people do what I want	0	1	2
3. I am often unhappy, sad, or tearful	0	1	2
4. Other people my age generally like me	0	1	2
5. I am easily distracted, I find it difficult to concentrate	0	1	2
1. I am nervous in new situations. I easily lose confidence	0	1	2
2. I am kind to younger children	0	1	2
3. I am often accused of lying or cheating	0	1	2
4. Other children or young people pick on me or bully me	0	1	2
5. I often offer to help others (parents, teachers, children)	0	1	2
1. I think before I do things	0	1	2
2. I take things that are not mine from home, school or elsewhere	0	1	2
3. I get along better with adults than with people my age	0	1	2
4. I have many fears, I am easily scared	0	1	2
5. I finish the work I am doing. My attention is good	0	1	2

Appendix F

Assent Form for Student Participants

Why are we doing this study?
We want to tell you about a research study we are doing. A research study is a special way to find out about new things that may benefit people. We are doing a research study about how certain activities make people feel.

Why am I being asked to be in the study?
We are inviting you to be in the study because your parents and teachers believe that you could benefit from the activities we will learn and practice together.

What if I have questions?
You can ask questions if do not understand any part of the study. If you have questions later that you don't think of now, you can talk to me again or ask Kaitlyn Butterfield.

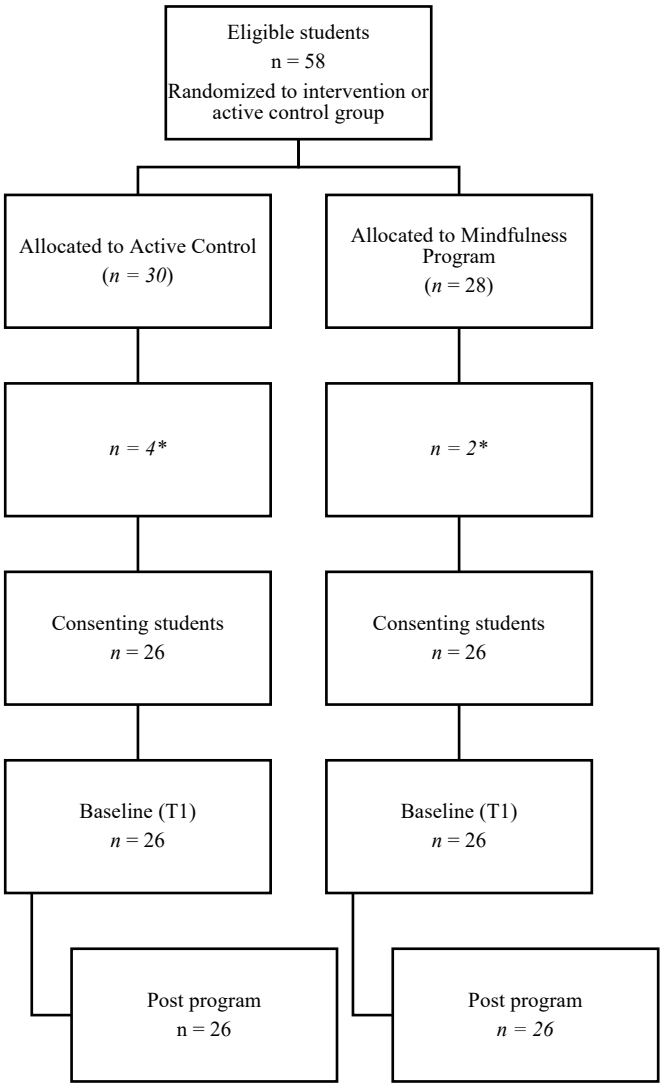
If I am in the study what will happen to me?
If you decide that you want to be part of this study, you will be asked to participate in activities that will take about half an hour of class time. You will also be asked to fill out some questionnaires.

Will the study help me in anyway?
Other students have found the activities we will be doing to be helpful for them. We do not know if being in this study will help you in the same way, but we hope to learn something that will help other people someday.

Do I have to be in this study?
You can choose to be or not to be in this study. It is entirely up to you. If you say yes now, but change your mind later, that is okay too. All you have to do is tell us. Nobody will be angry or upset. If you decide not to be in the study, we will bring you to a quiet room where you can read or color while the class does the activity. We are discussing the study with your parents/guardians and you should talk to them about it too. Whatever you decide, we will support you.

What happens after the study?
When we are finished this study we will write a report about what was learned. This report will not include your name or that you were ever in the study.

Figure 1. Flow of participants through study



*Of the fifty-eight students given a consent form, fifty-two took part in the study; six students did not provide adequate written consent and/or verbal assent and their data was therefore not collected

Figure 2: Activity Feedback for Week One by Program

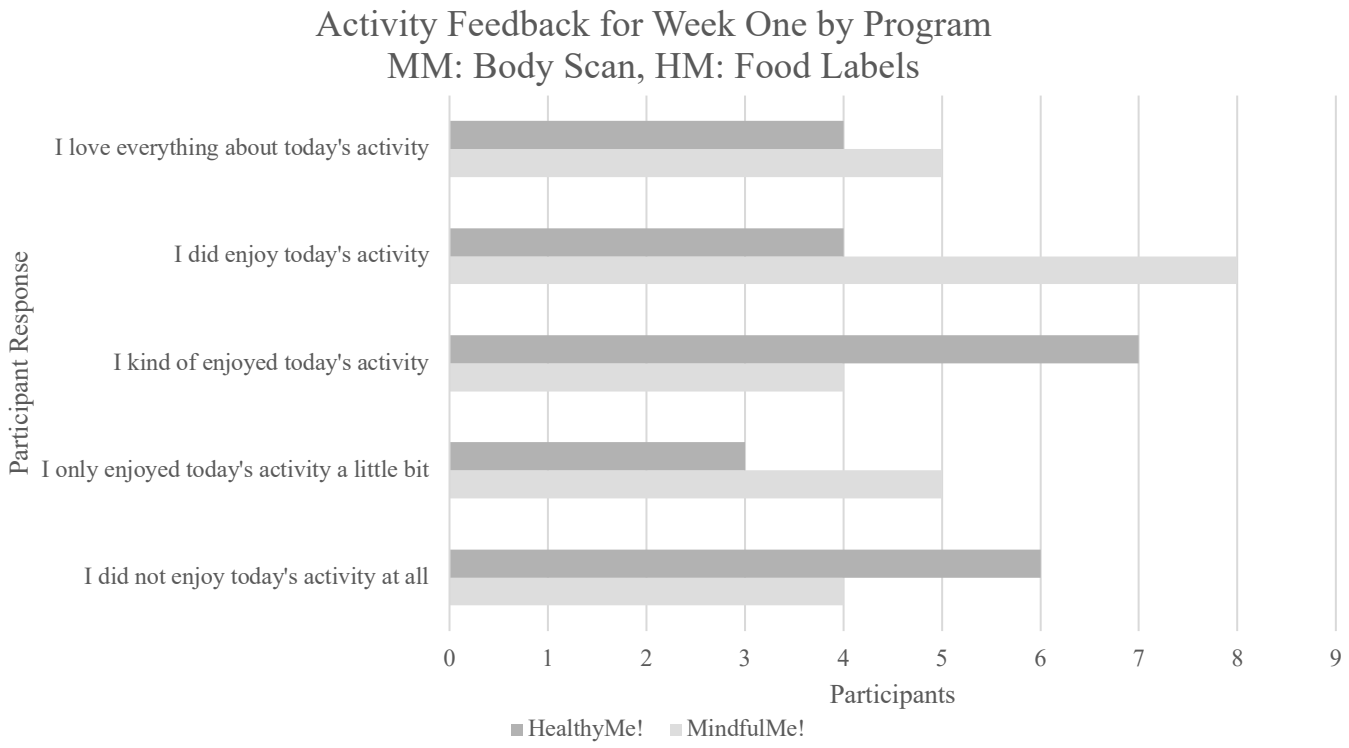


Figure 3: Activity Feedback for Week Two by Program

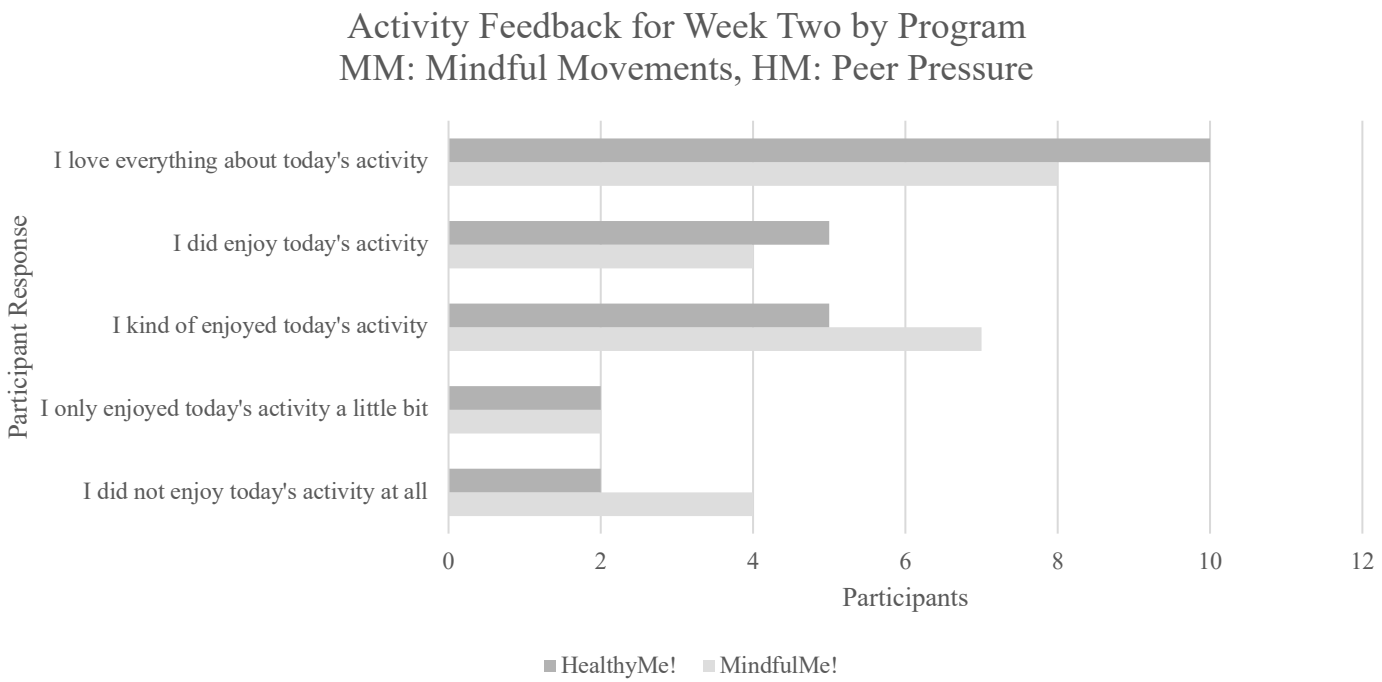


Figure 4: Activity Feedback for Week Three by Program

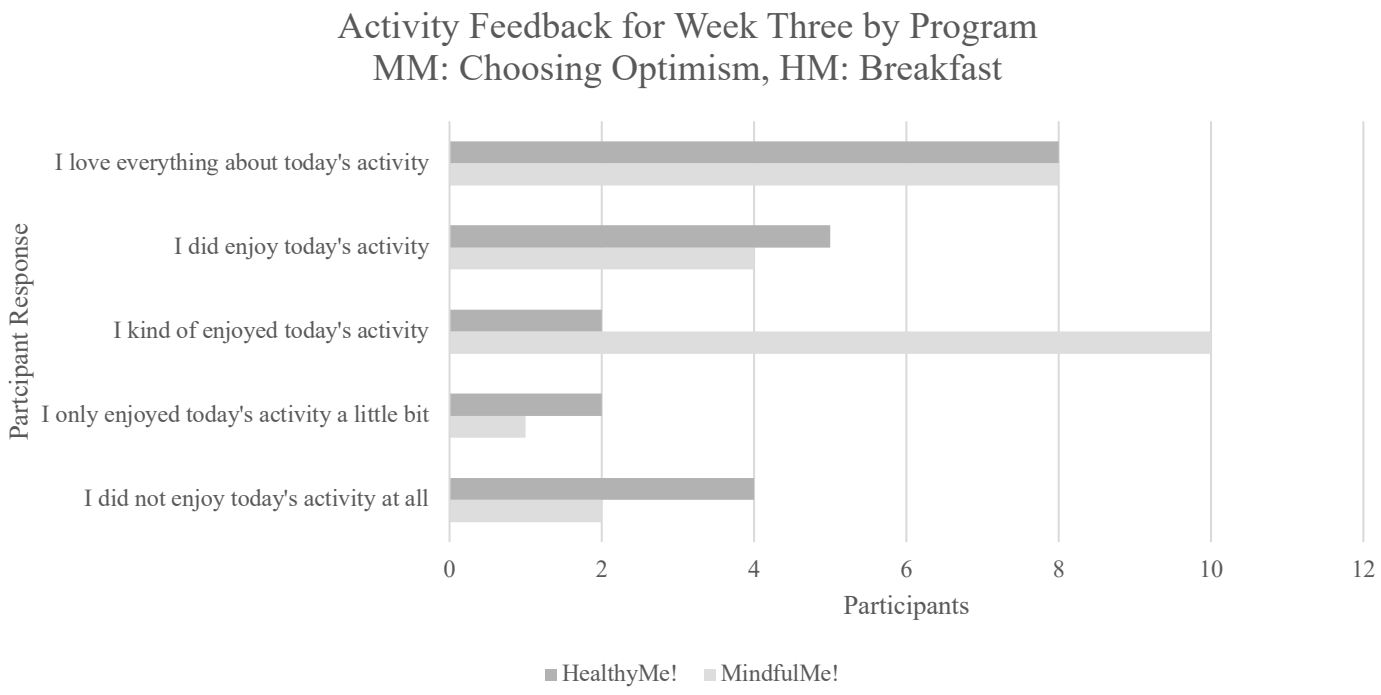


Figure 5: Activity Feedback for Week Four by Program

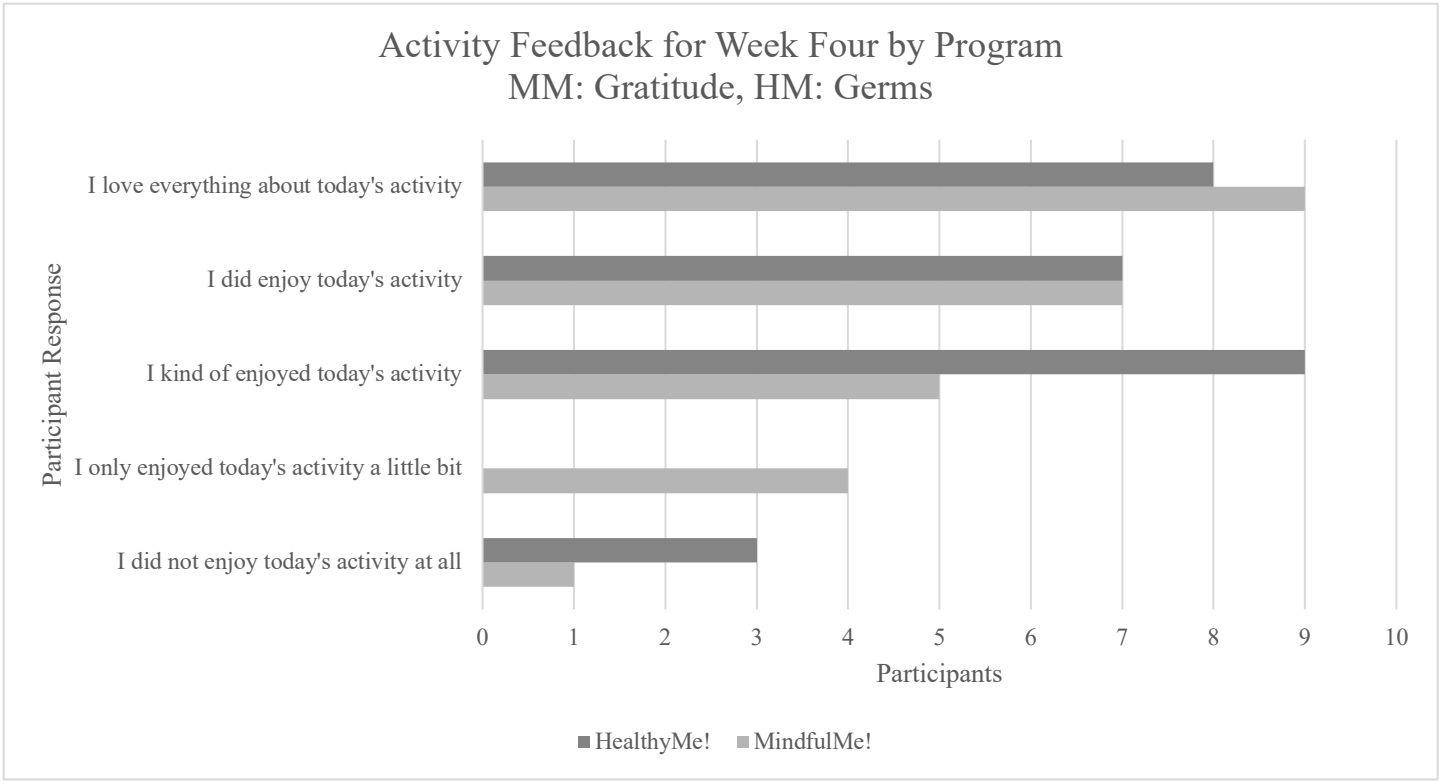


Figure 6: Activity Feedback for Week Five by Program

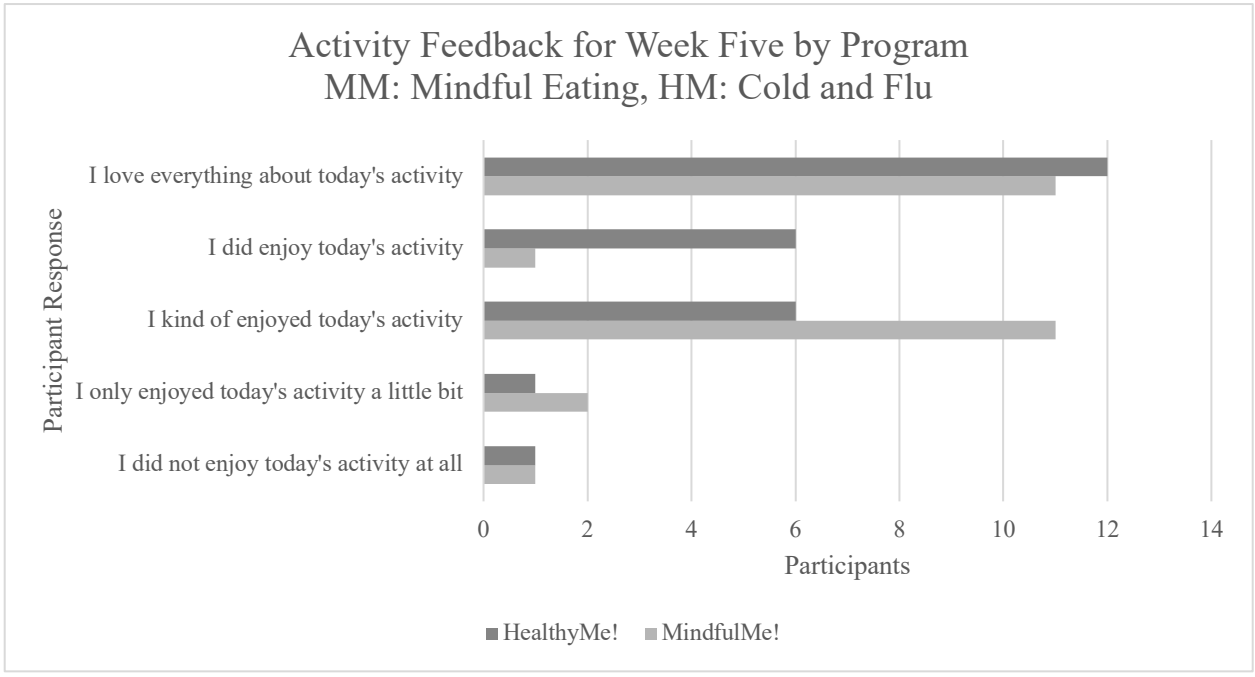
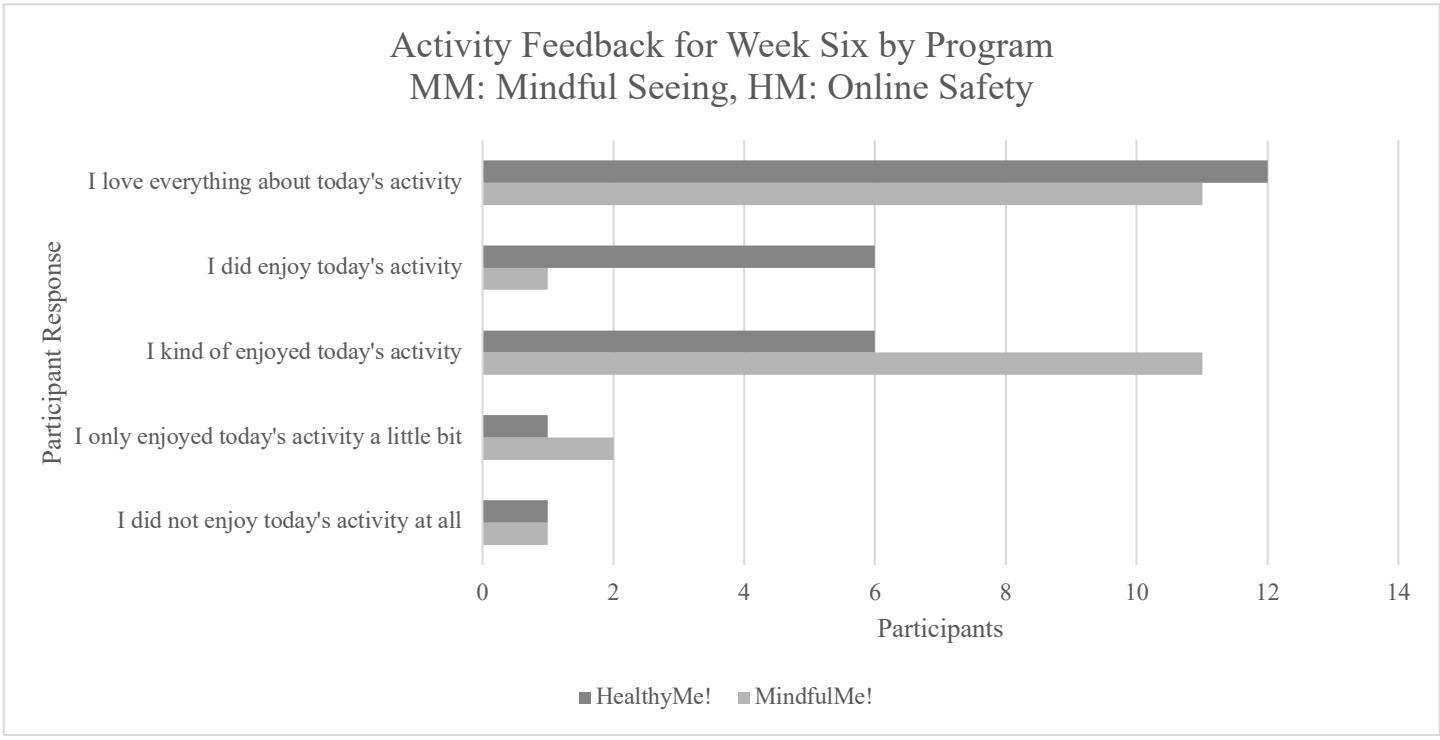


Figure 7: Activity Feedback for Week Six by Program



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