Stop. Breathe. Be.

A Pilot Study Examining Mindfulness Training to Improve

the Socioemotional Wellbeing of Youth with Autism Spectrum Disorder

By

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Abstract

Adolescence is challenging time for youth with autism spectrum disorder (ASD), who generally exhibit a myriad of psychosocial difficulties. While this developmental period represents an important window for intervention, few evidence-based programs exist. Recent research suggests that interventions targeting emotion regulation (ER) skill deficits in ASD may represent a promising approach to promoting more favourable outcomes for these youth (Mazefsky et al., 2014). Nurturing mindfulness has been shown to be an effective means of improving ER and wellbeing in diverse child and adult populations, although research in ASD is limited. This pilot study evaluated the impact of a 9-week mindfulness intervention on the ER and socioemotional functioning of 14 adolescents (13-17 years) with high functioning ASD using a pre-test post-test design. Parents reported statistically significant changes of small to medium effect size in adolescents' overall problem behaviours and social skills, ER, adaptability, hyperactivity, and withdrawal behaviours. Additionally, parents reported changes of small effect size that approached significance for adolescents' anxiety symptoms and atypicality. Adolescents reported changes of small effect size that were statistically significant for anxiety symptoms and interpersonal functioning, and non-significant for depression and social stress symptoms. Changes in many parent-reported outcome variables showed moderate to strong correlations with home practice adherence and parent-reported changes in ER. Qualitative observations of program impact and social acceptability were positive and supported the quantitative findings. The results provide promising evidence for mindfulness training with youth with ASD. Implications for assessment, intervention, and future research are discussed.

Keywords: Autism Spectrum Disorder, Mindfulness, Emotion Regulation, socioemotional wellbeing, social skills, adolescents.

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Dedication

       This M.A. thesis is dedicated to young people living with Autism Spectrum Disorder and their families. It is my hope that our communities will continue to identify and develop opportunities to support your growth and wellbeing. I also hope that the research field will continue to examine issues and interventions pertaining to youth with ASD and their families so that we can better understand their strengths and needs, and build accessible and feasible evidence-based programming that helps improve outcomes for important members of our society.

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Improve the Socioemotional Wellbeing of Youth with Autism Spectrum Disorder

Adolescence has been traditionally characterized as a period of "storm and stress" (Arnett, 1999). This developmental period can be especially challenging for adolescents with autism spectrum disorder (ASD) who often experience elevated levels of social exclusion, peer victimization, loneliness, and mental health problems (Shtayermann, 2007; Tantam, 2003; White & Roberson-Nay, 2009). Emotional and self-regulatory skills have been increasingly recognized as key predictors of social and emotional outcomes (Blair & Diamond, 2008; CASEL, 2012; Eisenberg et al., 2001; Eisenberg, Spinrad, & Eggum, 2010; Montgomery et al., 2008; Montgomery, McCrimmon, Schwean, & Saklofske, 2010), and skill deficits in these areas are particularly common in ASD (Jahromi, Mekk, & Ober-Reynolds, 2012; Jahromi, Bryce, & Swanson, 2013; Konstantareas & Stewart, 2006; Lopez, Lincoln, Ozonoff, & Lai, 2005; Mazefsky et al., 2013; Mazefksy, Borue, Day, & Minshew, 2014; Samson, Huber, & Gross, 2012; Samson et al., 2013). Meditation and mindfulness training have been supported by a rapidly growing body of research as innovative and effective avenues to improving self-regulatory and socioemotional competencies and outcomes in child and adult populations, however, research in ASD remains limited (Keng, Smoski, & Robins, 2011; Weare, 2013; Wisner, Jones, & Gwin, 2010).

Literature Review

Overview of Autism Symptomatology and Socioemotional Outcomes

ASD is a neurodevelopmental disorder that emerges early in life and is characterized by persistent impairments in social communication and interaction, and restricted, repetitive patterns of behaviour, interests, or activities (American Psychiatric Association, 2013). Social interaction

and communication challenges in ASD typically include difficulties with initiating interactions,

perspective taking, understanding and following the norms of social behaviour and nonverbal

communication, using pragmatic language, and maintaining reciprocity (Bellini, Peters, Benner,

& Hopf, 2007; Williams, Keonig, & Scahill, 2007). The symptoms of ASD are lifelong, and

often lead to significantly impaired social, emotional, occupational, and adaptive functioning

(Gutstein & Whitney, 2002; Klin et al., 2007; Lake, Perry, & Lunsky, 2014; Matson, Mayville,

Lott, Bielecki, & Logan, 2003). Notably, for a subgroup of individuals with ASD these

difficulties occur despite typically developing cognition and age-appropriate language skills

(America Psychiatric Association, 2013).

Adolescents with High Functioning ASDs: A Population At-Risk

Individuals with ASD represent a heterogeneous population with significant variability in

symptom severity, co-occurring conditions and psychopathology, and functional impairment

(American Psychiatric Association, 2013). The unofficial, yet commonly used term 'high

functioning autism spectrum disorders' (HFASDs) has been used to describe a heterogeneous

group of individuals with impairments in social communication and adaptive skills who exhibit

relatively intact cognitive and language abilities (Volker et al., 2010). This umbrella term is

often used to refer to individuals with Asperger's disorder, Pervasive Developmental Disorder,

not otherwise specified (PDD-NOS), and other forms of ASD where no intellectual disability is

present. While separate diagnostic subgroup categories are used in the current diagnostic

guidelines of the International Classification of Diseases and Related Health Problems

Classification of Mental and Behavioural Disorders (ICD-10; World Health Organization,

1992), the newest edition of the Diagnostic and Statistical Manual of Mental Disorders – Fifth

Edition (DSM-V; American Psychiatric Association, 2013) has grouped the previous diagnoses

(Asperger's disorder, PDD-NOS, Autistic disorder) into one general category (ASD). However,

researchers commonly designate subgroups to create more homogeneous groupings required for statistical methods and to facilitate better understanding of a particular group.

Conceptualizing the clinical profile of individuals with HFASDs as 'mild' cases of autism can be misleading, as individuals with HFASDs are at high risk of poor outcomes that may be severe in impact (Balfe & Tantam, 2010; Howlin, 2003; Lake et al., 2014; Tantam, 2003). For example, a growing body of research reports that youth and adults with HFASDs exhibit significant difficulties with independent living and high rates of underemployment (i.e., unskilled jobs with few hours and/or poor compensation) or lack employment altogether (Baldwin, Costley, & Warren, 2014; Chen, Leader, Sung, & Leahy, 2014). Mental health problems are frequently reported in this population, including elevated symptoms of stress, depression, anxiety, and suicidality (Mayes, Calhoun, Murray, Ahuja, & Smith, 2011; Shtayermman, 2009; Storch et al., 2013; Tantam, 2003; White et al., 2009). Suicidality, in particular, has been highlighted as a significant issue for individuals with ASD, with reported incidences of suicidal ideation and behaviours in this population ranging from 10.7 to 50% (Hannon & Taylor, 2013; Richa, Fahed, Khoury, & Mishara, 2014; Segers & Rawana, 2014). Increased prevalence rates of suicidality are observed in higher functioning individuals, and researchers speculate that intact reasoning skills and greater exposure to a broad range of risk factors, particularly those of a social nature (e.g., bullying) may increase their vulnerability to self-harm related thinking (Hannon & Taylor, 2013; Lake et al., 2014; Richa, Fahed, Khoury, & Mishara, 2014; Segers & Rawana, 2014; Tantam, 1991, 2003).

Further contributing to their risk of poor outcomes, the needs and social interests of individuals with HFASDs can easily be overlooked by professionals, caregivers, and/or peers, resulting in limited support and opportunities for meaningful relationships to form. Specifically,

the comparatively stronger intellectual and language skills in individuals with HFASDs often

cause others to misjudge behaviour and/or need for specialized services, as these abilities may

mask the full range of difficulties individuals experience across everyday settings and social

situations (Lake et al., 2014; Tsatsanis, Foley, & Donehower, 2004). The unusual social

behaviors and deficits may lead others to believe that individuals on the autism spectrum have

little to no interest in friendships and are content, or even prefer to be alone (Kanner, 1943). In

contrast to these assumptions, many individuals with HFASDs do report a desire for meaningful

interpersonal relationships (Barnard, Prior, & Potter, 2000; Bauminger & Kasari, 2000;

Lasgaard, Nielsen, Eriksen, & Goossens, 2010; Strunz et al., 2016), but the core impairments in

social interaction and communication that characterize ASD, paired with limited support

provided over the lifespan, present significant barriers to successful relationships. Consequently,

the social relationships and experiences of individuals with HFASDs tend to be much less than

optimal.

        Research has documented a broad range of poor social outcomes in individuals with

HFASDs. Children and youth with HFASDs experience high rates of social exclusion,

loneliness, peer victimization, bullying, poorer quality friendships, low satisfaction with

friendships, and low social network status and peer acceptance (Barnard, et al., 2000; Bauminger

& Kasari, 2000; Cappadocia, Weiss, & Pepler, 2012; Chamberlain, Kasari, & Rotheram-Fuller,

2007; Lasgaard et al., 2010; Locke, Ishijima, Kasari, & London, 2010; Portway & Johnson,

2003; Shtayermman, 2007; Sofronoff, Dark, & Stone, 2011; Wainscot, Naylor, Sutcliffe,

Tantam, & Williams, 2008; Whitehouse, Durkin, Jaquet, & Ziatas, 2009). Critically, pervasive

and frequent stress from such negative social experiences may contribute to the risk, onset,

and/or severity of behavioral and mental health problems commonly observed in this population

(White, Oswald, Ollendick, & Scahill, 2009; Tantam, 2000; Whitehouse et al., 2009). For example, such negative social experiences have been linked to the negative self-perceptions and elevated symptoms of depression and anxiety of youth with HFASDs (Humphrey & Lewis, 2008; Shtayermman, 2007, 2009; Whitehouse et al., 2009).

The impact of negative social experiences becomes particularly prominent during adolescence. Specifically, the increasing importance and complexity of social relationships and emerging vocational opportunities, coupled with rising self-awareness of social differences, fewer psychological resources, and limited access to professional supports make persisting impairments in social communication and interaction especially salient (Lake et al., 2014; Reaven, Blakeley-Smith, Leuthe, Moody, & Hepburn, 2012; Tantam, 2003; White et al., 2009; Williams et al., 2007). Further, these challenges must be faced in conjunction with the arduous developmental tasks and physiological changes that arise in adolescence (Revean et al., 2012). The burden of this confluence of developmental, physiological and psychosocial stressors makes adolescents with HFASDs increasingly vulnerable to mental health problems. Consequently, compared to their younger counterparts, adolescents with HFASDs report increased symptoms of stress, depression, and anxiety (Mayes et al., 2011; van Steensel, Bögels, & Perrin, 2011). These mental health problems may, in turn, further increase social impairment by worsening social skill performance and ASD symptoms (e.g., ritualizing, rocking; Tantam, 2003). Moreover, these mental health problems are also likely to persist or become exacerbated as individuals transition to adulthood, given social impairments and stress levels of individuals with ASD typically remain high (Seltzer et al., 2004; Senland & Higgins-D'Allesandro, 2016; Hirvikoski & Blomqvist, 2015), contributing to ongoing functional impairment in occupational, academic, home, and community contexts (Trembath, Germano, Johanson, & Dissanayake, 2012).

Adolescence, thus, represents an important period for setting the stage for the transition into adulthood, such that how adolescents respond to stress within this period impacts very important future outcomes (Montgomery et al., 2008; Eiland & Romeo, 2013).

Despite identified needs, adolescents with HFASDs represent an under-studied and under-serviced population when compared to younger individuals and/or populations with ASD and concurrent intellectual disability (Lake et al., 2014; Schwean & Saklofske, 2008; Tantam, 2003; Tsatsanis et al., 2004). Few evidence-based programs have been developed for adolescents with ASD specifically, despite the widely acknowledged need (Lake et al., 2014; Schall and McDonough, 2010; Tantam, 2003; Tsatsanis et al., 2004). Characterizing the risk that this poses, Reaven et al. (2012) describe adolescents with HFASDs as vulnerable to a "perfect storm – high intellect and vulnerability to psychiatric symptoms, coupled with few psychological resources and limited access to state/federal support" (p. 2). Importantly, despite being opportune for a "perfect storm", adolescence can also be ripe for positive change when appropriate supports are provided to at-risk individuals (Masten, et al., 2004). As well, intervention effects may be more durable and widespread during adolescence. For example, a meta-analysis of school-based interventions for children with ASD found that secondary students exhibited the highest levels of treatment maintenance and generalization, as compared to preschool and elementary school aged students (Bellini et al., 2007), suggesting that adolescence is an excellent time to successfully intervene.

Traditional and Current Approaches to Improving Socioemotional Outcomes in ASD

Efforts to improve socioemotional outcomes in individuals with ASD have commonly focused on social skill development (Tsatsanis et al., 2004). Social skills interventions generally employ psychoeducational, behavioural and/or social learning techniques to teach the skills necessary to build and maintain interpersonal relationships (Cappadocia & Weiss, 2011;

Williams et al., 2007). There have been a variety of approaches and strategies developed to teach social skills to individuals with ASD, such as Social Stories[TM] (Gray, 2004; Kokina & Kern, 2010), video modeling (Bellini & Akullian, 2007), and peer mediated strategies (Chan et al., 2009). Aside from obvious differences in primary teaching formats used, these interventions can differ greatly in intensity, duration, and effectiveness (Cappadocia & Weiss, 2011; Williams et al., 2007) making it difficult to compare results across studies. While qualitative reviews of social skill interventions in children and adolescents with ASD indicate some positive personal impact on social skill development and outcomes (Cappadocia & Weiss, 2011; Chan et al., 2009; Williams et al., 2007), meta-analyses evaluating social skills interventions in ASD have concluded that they are generally minimally effective and that there is limited generalization across a diversity of children and settings (Bellini et al., 2007; Bellini & Akullian, 2007; Kokina & Kern, 2010; Schneider, Goldstein, & Parker, 2008; Wang & Spillane, 2009).

A potential explanation for why social skills interventions show mixed or low treatment effects and limited generalizability is that many of these interventions target social awareness and relationship skills, but generally lack explicit and/or intensive instruction and training in pre-cursor skill areas that are critical to social competence and success (Cappadocia & Weiss, 2011; Williams et al., 2007). Emotional and self-regulatory skills represent such pre-cursor skills and have been garnering increasing attention from scholars and professionals for their role in social outcomes in ASD and non-ASD populations (Augustyniak, Brooks, Rinaldo, Bogner, & Hodges, 2009; Berard, 2014; Blair & Diamond, 2008; Brocki & Bohlin, 2004; CASEL, 2012; Eisenberg, et al., 2010; Mazefsky & White, 2014; Montgomery et al., 2008; Montgomery, Stoesz, & McCrimmon, 2013; Schwean & Saklofske, 2008). For example, emotional and self-regulatory skills may provide a scaffold for the application of knowledge and skill in everyday social

interactions, as improvements in emotional and self-regulatory skills may allow an individual to manage their thoughts, emotions, and behaviours more adaptively in naturalistic situations, facilitating the use of previously obtained knowledge and skills. Improving these skills would, therefore, likely enhance everyday social interactions, and may provide the bridge between traditional approaches to social skills training and real life applications (Montgomery, McCrimmon, Climmie, & Ward, in press).

The Relationship between Emotion Regulation and Social Skills

Emotion regulation (ER) refers to both the involuntary and voluntary processes that people use to manage their own emotional state to achieve personal and social goals (Mazefsky et al., 2013, 2014). Voluntary ER occurs at a conscious level and involves volitional cognitive processes and/or behaviors that an individual employs to alter the stressor or their emotional response to it (Mazefsky et al., 2014). Examples of voluntary ER include problem-solving, positive thinking, reappraisal, acceptance, and distraction. Involuntary ER processes, in contrast, are unconscious and automatic, and include such processes as emotional numbing, inaction, and involuntary action (Mazefsky et al., 2014). ER processes increase, decrease or maintain an emotional state, and may alter the intensity and/or duration of an emotion (Mazefsky et al., 2014). Hence, ineffective ER is implicated in the development of a broad range of psychopathology, including internalizing and externalizing disorders, as it may cause individuals to experience more pronounced and lengthier periods of distress (Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006). Effective ER, in contrast, enables an individual to respond to the physical and social demands of the environment in a flexible and socially appropriate manner (Laurent, Otr, & Rubin, 2004; Mazefsky et al., 2014). Consequently, effective ER is considered a core aspect of good social skills and protective against the development of psychopathology

(Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000; Graziano, Reavis, Keane, & Calkins, 2010).

In line with the above description, research with typically developing populations has documented a significant relationship between ER and social outcomes (Dunn & Brown, 1994; Graziano et al., 2010; Laurent et al., 2004). Specifically, children who have stronger (versus weaker) ER skills have been found to exhibit greater social competence, peer popularity and social skills (Dunn & Brown, 1994; Eisenberg et al., 1993, 1996, 1997; Fabes et al., 1999). Children with weaker ER abilities, conversely, are more likely to have poor social skills, and elevated externalizing problems, such as defiant, hyperactive, and/or aggressive behaviours, and rates of being victimized (Dunn & Brown, 1994; Rydell, Berlin, & Bohlin, 2003). These children also tend to elicit more negative responses from their peers and social environment in comparison to peers with better ER abilities (Laurent et al., 2004).

Emotional Regulation in ASD

ER abilities develop from early childhood into young adulthood in typically developing individuals, in concert with development in prefrontal and limbic areas of the brain (Eisenberg et al., 2010; Hooper, Luciana, Conklin, & Yarger, 2004; Prencipe et al., 2011). In persons with ASD, however, many of the core and secondary characteristics of ASD likely impede the development of age-appropriate, adaptive ER skills. This includes a high occurrence of alexithymia (i.e., limited ability to identify and describe emotions); sensitivity to change; hyperarousal; cognitive rigidity/inflexibility; impaired perspective-taking and interpretation of social/emotional cues; and poor problem-solving and abstract reasoning (Laurent et al., 2004; Mazefsky & White, 2014).

Emergent research indicates that ER impairments are indeed prominent in ASD across the lifespan, pointing to a need for support in this area. For example, research using

observational behavioral paradigms has showed that, compared to their typically developing

peers, young children with ASD tend to exhibit increased use of ineffective ER strategies (e.g.,

defensive behaviours, resignation), and decreased use of effective strategies (e.g., problem

solving) when exposed to a mildly frustrating situation (e.g., removal of a desired toy; Jahromi,

et al., 2012; Konstantareas & Stewart, 2006). Similarly, studies utilizing parent- and self-report

measures have observed that children, adolescents and adults with ASD employ more ineffective

ER strategies (e.g., rumination, suppression) and fewer effective ER strategies (e.g., reappraisal,

acceptance), in comparison to their typically developing peers (Jahromi et al., 2013; Mazefsky et

al., 2014; Samson, Gross, & Huber, 2012).   Further, ER deficits are implicated in the persisting

high levels of emotional reactivity, irritability, and negative affect individuals with ASD

commonly exhibit (Mazefsky, Pelphrey, & Dahl, 2012; Volker et al., 2010), and are positively

correlated with maladaptive autism-related behaviours, such as ritualistic, self-injurious,

stereotyped, and sensory seeking/avoidance behaviors, and impairments in social communication

and cognition, and increased ratings of psychopathology (Mazefsky et al., 2014; Samson et al.,

2013).

Despite the observed ER deficits in ASD, and recognition of the contribution ER makes

to socioemotional outcomes over development, limited research has examined ER-focused

interventions in individuals with ASD (Mazefsky & White, 2014).   Some empirical support for

the use of Cognitive Behaviour Therapy (CBT; Beck, Rush, Shaw, & Emery, 1979), an approach

that includes some elements of ER-focused training, has been documented for individuals with

HFASDs. This research has suggested that CBT improves ER and reduces emotional lability,

anxiety symptoms and/or mood disturbance in individuals with HFASDs (Lang, Regester,

Lauderdale, Ashbaugh, & Haring, 2010; Reaven et al., 2012; Scarpa & Reyes, 2011; Woods,

Mahdavi, & Ryan, 2013; Sukhodolsky, Bloch, Panza, & Reichow, 2013). Alternatively, emergent research indicates that mindfulness training may hold promise for persons with HFASDs. Research with non-ASD clinical and nonclinical populations suggests that mindfulness training facilitates the development of ER skills (Chiesa, Serretti, & Jakobsen, 2013; Farb, Anderson, & Segal, 2012; Zelazo & Lyons, 2012), and is associated with a wide variety of intra- and interpersonal benefits. A small number of studies have suggested that the benefits of mindfulness training may generalize to individuals with HFASDs, although to date no known studies have specifically investigated ER in this context.

Mindfulness

Mindfulness can be defined as "paying attention, on purpose, in the present moment with curiosity and kindness to things as they are" (MiSP, 2015). The practice of mindfulness is founded upon seven attitudinal pillars that promote flexible and compassionate responding, and include: non-judging; non-striving; patience; acceptance; trust; letting go; and beginners mind (Kabat-Zinn, 1990). Conceptions and practices of mindfulness originate from Buddhist tradition, but have been adapted by Western practitioners as a secular approach to wellness promotion (Meiklejohn et al., 2012). Standard mindfulness exercises include formal activities, such as body-breath awareness exercises, and more informal activities, such as mindful eating. These contemplative exercises involve sustained attention, attention switching, and inhibition of elaborative processing of thoughts, feelings, and sensations as they arise (Bishop et al., 2004). As well, mindfulness exercises and programs integrate cognitive control and reflective strategies that help to further increase self-awareness and the ability to manage attention, emotions, and behaviour (Burke, 2010; Greenberg & Harris, 2012; Thompson & Gauntlett-Gilbert, 2008). Hence, mindfulness is often described as a skill that directly supports processes of self-regulation, and particularly ER (Chiesa et al., 2013; Oberle, Schonert-Reichl, Lawlor, &

Thomson, 2011; Zelazo & Lyons, 2012). Given the documented associations between ER and

social outcomes (e.g., Eisenberg et al., 1996, 1997), examining interventions based in the

previously documented approaches may be particularly of interest for individuals with HFASDs.

A rapidly growing body of research documents that mindfulness is associated with a wide

variety of physiological (e.g., pain management; immune function), psychological (e.g., stress,

depression), and cognitive benefits (e.g., executive function) in children and adults from clinical

and non-clinical populations (Harnett & Dawe, 2012; Keng et al., 2011; Oberle et al., 2011;

Wisner et al., 2010; Zenner, Herrnleben-Kurz, & Walach, 2014; Zoogman, Goldberg, Hoyt, &

Miller, 2014; Weare, 2013). Further, the magnitude of improvement in these areas is linked to

more extensive and long-term practice (Baer, Lykins, & Peters, 2012; Carmody & Baer, 2008;

Huppert & Johnson, 2010). Specific to child and youth populations, recent meta-analyses

(Zenner et al., 2014; Zoogman et al., 2014) reported that mindfulness interventions with youth

have a small to moderate sized impact on cognitive performance and psychological symptoms

and that these effects are generally stronger in clinical versus non-clinical samples (*Cohen's d =*

0.50 vs. 0.20). This suggests that youth from clinical populations might particularly benefit from

this type of intervention, however, literature for this specific purpose is currently limited.

Mindfulness and ASD

Mindfulness may be particularly suited to the needs and abilities of youth with HFASDs

for a number of reasons. Firstly, meditation and mindfulness practices can increase an

individual's self-awareness, empathy, cognitive flexibility, and self-compassion making these

exercises particularly relevant to the cognitive and social difficulties experienced by this group

(Block-Lerner et al., 2007; Moore & Malinowski, 2009). Secondly, the simple experiential

exercises used in mindfulness training do not require clients to analyze or challenge thought

content, but instead teach individuals to relate to internal processes in a different, nonreactive

way (i.e., with nonjudgment and nonattachment; Coffey, Hartman, & Fredrickson, 2010; Metz et al., 2013). This approach may be highly suitable for individuals with ASD who tend to find abstract concepts and learning challenging and do best with direct instruction and concrete exercises (Iovannone, Dunlap, Huber, & Kincaid, 2003; Spek, van Ham, & Nyklicek, 2013). Given this information, introducing mindfulness through concrete experiences of noticing sensations of body and breath (e.g., paying attention to temperature, tension, and location of feeling, etc.) may provide a concrete anchor for experiencing more abstract aspects of mindfulness practice (e.g., paying attention to emotions or thoughts as they arise, linger and pass) as individual practice develops.

While not specific to mindfulness per-say, a third benefit is that mindfulness training can be delivered in a group-format. A group-based approach can be advantageous because it can offer youth with HFASDs naturalistic opportunities to practice newly learned skills and promote positive peer interactions and friendships among children (Williams et al., 2007). Group-based approaches can also be more practical and cost-effective than individualized instruction. In light of the potential advantages for individuals with HFASDs, however, mindfulness training may also require some special considerations for use with this population. For example, the use of abstract language in mindfulness interventions may pose a particular challenge for individuals with HFASDs, which has led some researchers to make adaptations (e.g., removal of metaphors) in their programs (Singh et al., 2011a; Spek et al., 2013).

Overall, a small number of studies have examined mindfulness interventions in adults and adolescents with HFASDs. Outcome measures in this line of research have included self- and parent-report measures, and behavioural frequency tracking measures. Preliminary evidence is promising, with observed improvements in emotional health and reductions in behavioural

problems that mirror benefits observed in other populations. Specifically, researchers have observed that, following mindfulness training adolescents with HFASDs exhibit reductions in rumination symptoms, physical aggression and other externalizing behaviours, and improvements in quality of life, social responsiveness, social communication, social cognition, and social motivation (Bögels, Hoogstad, van Dun, de Schutter, & Restifo, 2008; de Bruin, Blom, Smit, van Steensel, & Bögels, 2014; Singh et al., 2011a, 2011b). A study conducted by Spek et al. (2013) with adults with HFASDs noted improvements in positive affect and reductions in anxiety and depression symptoms following mindfulness training. Importantly, benefits to emotional functioning may have some durability in this population, as reductions in depression and anxiety symptoms (as compared to baseline) reported by adult participants persisted nine weeks after intervention completion (Kiep, Spek, & Hoben, 2015).

Consistent with research in neurotypical populations, research with adolescents with HFASDs has also suggested that observed benefits may strengthen or only appear after more extensive practice. For example, in a study by de Bruin et al. (2014), improvements in adolescents' social skills, rumination symptoms, and behaviours were only observed at the nine-week follow-up assessment, while improvements in quality of life and social cognition increased in effect size from post-test administered immediately after intervention to follow-up assessment. This suggests that some benefits of mindfulness training may be slow to emerge in this population and/or associated with more extensive practice. The work of Singh et al. (2011a, 2011b) also suggests that the benefits of mindfulness may be slow to emerge in this population, requiring several weeks to months with regular practice.

Collectively, the aforementioned studies suggest that mindfulness may hold promise for improving the socioemotional outcomes of individuals with HFASDs, although sample and

methodological differences and limitations make it difficult to draw strong conclusions. That is, studies on mindfulness training with individuals with HFASDs (as described above) have differed greatly in their instructional format, content, duration, concurrent parent training, target outcomes, participant characteristics (e.g., age, concurrent diagnoses), sample size, and study design (e.g., multiple baseline design, pre-test post-test post single sample design), with only one known study employing a randomized control trial design (Spek et al., 2013). Further, methodological differences make it difficult to tease apart whether there are specific components of the intervention that make be particularly effective for a specific outcome. Given the limitations documented, more research in this area is needed.

The Current Study

The preceding literature review illustrates the significant social and emotional difficulties faced by adolescents with HFASDs and demonstrates a critical need for research investigating acceptable and feasible approaches to promoting promote positive socioemotional outcomes in this population. Mindfulness appears to be a promising approach, as it may facilitate development in ER, although research in ASD is limited. Therefore, the purpose of the current study was to examine the impact of a nine-week mindfulness training program on the socioemotional functioning of adolescents with HFASDs.

Based on a review of previous research, four main hypotheses were generated, including that: 1) Mindfulness training would lead to changes in ER in adolescents with HFASDs, as measured by parent and adolescent self-report[1]; 2) Mindfulness training would lead to changes in socioemotional behaviours as measured by parent and adolescent self-report[2]; 3) Time spent in

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[1]Including parent-report measure: BASC-2: PRS - Emotional Self-Control. Adolescent self-report measure: DERS Total Score.

[2] Including parent-report measure: BASC-2: PRS, Behavioral Symptoms, Anxiety, Depression, Withdrawal, , Hyperactivity, Attention Problems, Atypicality, Adaptability; SSIS: PRS, Social Skills and Problem Behaviors

practising mindfulness outside of class would be associated with changes in ER and

socioemotional behaviours as measured by parent and adolescent self-report[3]; and 4) Changes in

ER would be associated with changes in socioemotional behaviours as measured by parent and

adolescent self-report.[4] Further, many mindfulness-based intervention studies have not included

a measure of mindfulness, which is important for ascertaining that an intervention teaches the

core skills it intends to, as well as for documenting how increases in said skills may be related to

improvements in target outcomes. Thus, we hypothesized that 5) mindfulness training would

lead to changes in adolescents' trait mindfulness[5], and that 6) this would be related to changes in

adolescents' ER[6]. Finally, in light of the small pool of research on mindfulness and ASD to date,

we also sought to examine parent and adolescent perceptions of the utility and acceptability of

the program[7] to inform programming development and future modifications.

Method

The procedures outlined below were approved by the Psychology/Sociology Research

Ethics Board of the University of Manitoba.

Participants

Twenty-two participants were recruited from Winnipeg, Manitoba and the surrounding

area through word of mouth, social media, posters, and community organizations. Eligible

participants were 1) between the ages of 13 and 17 years, 2) had a formal diagnosis of ASD,

Asperger disorder, or Pervasive Developmental Disorder Not Otherwise Specified based on

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composite. Associated adolescent self-report subscales: BASC-2: SRP, Emotional Symptoms, Anxiety, Depression, Hyperactivity, Attention Problems, Social Stress; and EQi –YV, Intrapersonal, Interpersonal, Mood subscales.
[3] Including adolescents' self-reported Home Practice Adherence rating, and difference scores computed from aforementioned scales on the BASC-2: PRS, SSIS: PRS, DERS, EQi –YV, and BASC-2: SRP.
[4] Including difference scores computed from aforementioned scales on the BASC-2: PRS, SSIS: PRS, DERS, EQi – YV, and BASC-2: SRP.
[5] Including adolescents' self-report CAMS-R Total Score.
[6] Including the CAMS-R, DERS Total Score, and BASC-2: PRS Emotional Self Control subscale.
[7] Including a parent and adolescent Post Program Feedback Survey created by the researcher.

DSM-IV-TR or DSM-V criteria (made by a appropriately credentialed medical doctor, psychologist, or psychiatrist), 3) obtained a Verbal Intelligence Quotient (VIQ) of 80 ± 5 on the *Wechsler Abbreviated Scale of Intelligence* (Wechsler, 1999), and 4) were not receiving social skills training and/or psychotherapy during the course of the study. Of the 22 adolescents recruited for the study, five participants were ineligible because they obtained a VIQ < 80 ± 5. Of the 17 who met eligibility criteria and were invited to participate in this study, two participants withdrew before or after the second class due to disinterest or acute illness, and another participant had to be excluded from the data analysis due to failure to complete all of the post intervention measures. This resulted in a final sample of 14 participants (aged 13.50 to 17.08 years, *M* = 14.99, *SD* = 1.03, 9 males, 5 females). Figure 1 provides a summary of participant enrolment and attrition.
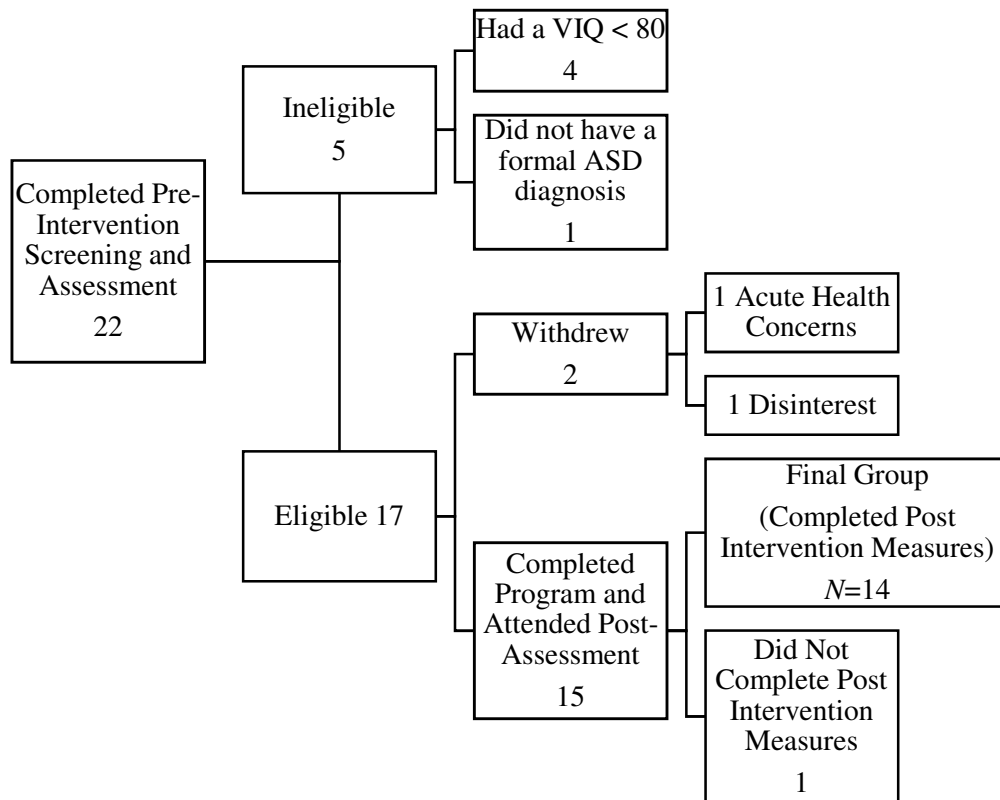
Figure 1. *Flow diagram of participant enrolment and attrition.*

A summary of participant characteristics, including age, estimated ASD symptom severity (AQ)

based on the Autism Quotient: Adolescent Version (AQ-A; Baron-Cohen, Hoekstra,

Knickmeyer, & Wheelwright, 2006), and participants' VIQ is provided in Table 1.

Table 1

Participant Characteristics (N = 14)

Variable	*Mean*	*St. Dev.*	Minimum	Maximum
Age	14.99	1.05	13.50	17.08
AQ	34.86	5.50	25.00	45.00
VIQ	103.29	14.20	80.00	137.00

AQ: Autism Quotient

VIQ: Verbal Intelligence Quotient

Participants with co-existing medical or mental health conditions were not excluded from

the study unless the condition interfered with their ability to complete tasks (e.g., selective

mutism). This allowed for a more naturalistic sample of adolescents with ASD as comorbidities

are common is this population (Lake et al., 2014; Montgomery et al., 2010; Simonoff et al.,

2008; van Steensel et al., 2011; van Steensel, Bögels, & de Bruin, 2013). Table 2 summarizes

the parent-reported concurrent mental health and physical conditions for the adolescents who met

the inclusion criteria and completed the study.

Table 2

Parent-Reported Co-Existing Mental and Physical Health Conditions

Condition	*f*	%age of Sample
No Medical Condition	12	85.71
No Mental Health Condition	2	14.29
ADHD	11	78.57
Anxiety	8	57.14
Depression	3	21.42
Obsessive Compulsive Disorder	3	21.42
Sensory Processing Disorder	2	14.29

Detrusor Instability	1	7.14
Epilepsy	1	7.14

ADHD: Attention Deficit Hyperactivity Disorder

Of the 12 participants who had concurrent mental health diagnoses, a majority had two or more

diagnoses. The two most commonly reported together included ADHD and anxiety disorders

(e.g., Generalized Anxiety Disorder, Social Anxiety Disorder). Table 3 summarizes the number

of concurrent mental health diagnoses reported for participants.

Table 3

Number of Concurrent Mental Health Diagnoses

Amount	*f*	%age of Sample
0	2	14.29
1	4	28.57
2	5	35.71
3	1	7.14
4	2	14.29

Notably, all participants who had diagnosed concurrent mental health conditions were

taking prescription medication(s) during the course of the study.   Medications that adolescents

were reportedly prescribed included stimulant, non-stimulant, mood stabilizing, and/or anti-

psychotic types. Table 4 summarizes the medication status of participants across the types of

prescriptions reported. To control for the potential influence of change in medication dosage or

status on adolescents' behaviour, participants were asked to maintain a consistent dosage

throughout the course of the study and to notify the researcher of any changes in their medication

status and/or use. No families reported changes in their adolescents' prescription medication

status or use during the course of the study.

Table 4

Parent-Reported Medication Status and Type

Medication	f	%age of Sample
Stimulant (ADHD)	10	71.43
Non-Stimulant (ADHD)	1	7.14
Mood Stabilizer	8	57.14
Antipsychotic	4	28.57
Medical (e.g. Anti-Convulsant)	1	7.14

Procedures

Stage 1. Adolescents and their parents or legal guardian(s) were invited to complete a battery of pre-intervention and screening measures at the Social Cognition Laboratory of the University of Manitoba or in the participant's home.[8] Adolescents who provided verbal assent and whose parents or legal guardians provided informed consent for their child's participation first completed two verbal subtests of the *Wechsler Abbreviated Scale of Intelligence* (Wechsler, 1999), followed by a battery of measures evaluating ER and socioemotional adjustment that were presented in a randomized order and required approximately 75 minutes to complete. These measures included the *Difficulties in Emotion Regulation Scale* (DERS, Gratz & Roemer, 2004), *Cognitive Affective Mindfulness Scale Revised* (Feldman, Kumar, Greeson, & Laurenceau, 2007), *BarOn Emotional Quotient Inventory – Youth Version* (BarOn EQ-i:YV, BarOn and Parker, 2000), and the self-report version of the *Behavioural Assessment System for Children, Second Edition* (BASC-2: SRP, Reynolds & Kamphaus, 2004). Participants were offered breaks throughout the session and given a draw ballot for one of three $50 gift cards as an honorarium for their time. Parents or legal guardians simultaneously provided information to assist in evaluating initial participant eligibility (individually, in a quiet room) while adolescents were

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[8] To reduce the potential for social desirability effects to confound results at either assessment times and to protect the confidentiality of participants' responses, all measures were administered and scored at pre- and post-intervention times by two trained undergraduate research volunteers who had no involvement in the group program.

with the research volunteers completing the measures mentioned above. This included

completing a Participant Information Questionnaire, the Autism-Spectrum Quotient: Adolescent

Version (Baron-Cohen, Hoekstra, Knickmeyer, & Wheelwright., 2006) and parent-report

versions of the BASC-2 (BASC-2: PRS) and *Social Skills Improvement System* (SSIS; Gresham

& Elliot, 2008), which required approximately fifty minutes to complete in total.

Stage 2. Participants who met eligibility criteria were invited to participate in a 9-week

mindfulness-based group intervention that commenced within two weeks of the pre-intervention

assessment and was offered at no cost to families. To accommodate participants' availability,

three intervention groups were conducted on Saturdays across October-December, and January-

March. Groups were run by two trained facilitators with experience working with this

population. Classes were sixty minutes in length and held at the St. Amant Centre (two

afternoon groups) or at a downtown location (one morning group). Participants were asked to

submit weekly records of their out-of-class mindfulness practices (see Appendix E) over the

course of the intervention. Participants earned gift-card draw ballots for each sheet returned,

regardless of what home exercises were or were not completed.

Stage 3. Adolescents and their parents or legal guardians completed post-intervention

measures within two weeks of the last class. This took place either at the participant's home or

the Social Cognition Laboratory at the University of Manitoba. Adolescents first completed a

Program Feedback Survey to assess their perceptions and satisfaction with the program, and then

the DERS, EQ-i: YV, CAMS, and BASC-2: SRP, presented in a randomized order. This

required approximately 60 minutes to complete in total. While adolescents were with the

research volunteer, parents or legal guardians completed a Program Feedback Survey, the

BASC-2: PRS and the SSIS: PRS, all of which required approximately 40 minutes to complete in total.

      Additional considerations. This study used a mixture of self- and parent-report rating scales to provide information from multiple perspectives. While using self-reports can be controversial in ASD and caution may be required (Johnson, Filliter, & Murphy, 2009; Mazefsky, Kao, & Oswald, 2011), there is evidence to suggest that individuals with HFASDs can reliably self-report on certain measures of socioemotional functioning (Mazefsky et al., 2014; Montgomery, 2007; Ozsivadjian, Hibberd, & Hallocks, 2013; Samson et al., 2013). Discrepancies may appear between parent- and self-report in HFASDs, but it is important to clarify that these reports represent different perspectives, with parent ratings representing perceptions of overt behavioural observations and adolescent ratings representing attitudes and perceptions of internal experiences, which can be useful in assessing intervention effects.

      Additionally, parent perspectives may be important because although individuals with HFASDs have been found to report reliably, there may be some tendency for individuals with HFASDs to under-report clinical symptoms (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001; Johnson et al., 2009). Including measures from the adolescent's perspective enables comparison across raters and provides a richer understanding of participant perspectives, while also honouring their own role in the intervention. In addition, response trends can be useful to compare to verify the direction of change. However, self-report ratings should be understood in light of potential limitations of social and self-awareness in HFASDs. More specifically, some studies that have utilized self-report measures to examine intervention changes have noted that when self-awareness is limited, decreases in scores (when increases are anticipated) may occur, but likely reflect increasing insight, and, thus, more realistic reporting,

rather than the direct impact of an intervention on skills or characteristic (Montgomery et al., 2010). Similar concerns have been cited in mindfulness-based studies with typically developing youth, whereby an increase in self-awareness may contribute to a lack of change observed on self-report measures (e.g., Huppert & Johnson, 2010). Consequently, this may be a relevant concern for this particular age group in general, as well as for those with HFASDs.

Intervention Materials

The *.b* program. This study utilized the *.b* program (pronounced "dot b" and stands for "Stop. Breathe. Be."), which is a manualized mindfulness training curriculum for adolescents 11-18 years of age. The overall objective of the *.b* program is to provide students with mindfulness-based tools and coping strategies that support their wellbeing and help them fulfill their potential (MiSP, 2014). The *.b* program is grounded in Mindfulness Based Stress Reduction (MBSR; Kabat-Zinn, 1990) and Mindfulness Based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2002), and emerging research highlights its potential to support the mental health, wellbeing, and socioemotional functioning of typically developing adolescents (Hennelly, 2011; Huppert & Johnson, 2010; Kuyken et al., 2013).

The *.b* curriculum was developed by experienced classroom teachers and mindfulness practitioners through the Mindfulness in Schools Project (MiSP, www.mindfulnessinschools.org), an organization affiliated with the University of Oxford, University of Cambridge, University of Exeter, and United Kingdom National Children's Bureau. It was carefully crafted to be engaging for youth and meet the principles of effective practice for school-based social-emotional learning and preventative mental health programs (Durlak & DuPre, 2008; Kuyken et al., 2013; Weare & Nind, 2011). These principles include: explicit instruction of skills and attitudes; modifying traditional adult mindfulness program components (e.g., shortening activities); employing a variety of age-appropriate, interactive, and

experiential teaching methods; providing age-appropriate resources to help students learn

mindfulness (e.g., a course work booklet and audio files); intensive teacher education; and

program implementation that emphasizes fidelity (Durlak & DuPre, 2008; Kuyken et al., 2013;

Weare & Nind, 2011).

There are 10 lessons in the *.b* curriculum, each of which begins with a short presentation

that includes lively and engaging visuals, film and sound clips, and is followed by discussion,

practical exercises, and demonstrations that seek to make mindfulness concepts real and relevant

to students. Participants learn a distinct mindfulness skill each class, such that by the end of the

course participants have received a comprehensive introduction to the core foundations and

applications of mindfulness, including fifteen different formal and informal mindfulness

practices (for a summary of each lesson, see Appendix A). The 10 lessons are intended to be

taught over the course of 10 weekly sessions and within a school setting or youth-related

organization. Due to time restrictions, the introductory and first lesson were combined into one

90-minute class for this study. Other program modifications are described below.

Program modifications. The *.b* curriculum was developed for use with typically

developing youth, and, to the researcher's knowledge, this was one of the first studies to explore

its use with an atypical population, such as ASD. Prior to course implementation, the *.b* program

content and exercises were carefully reviewed by the group facilitators, Katie Thom (M.A.

School Psychology candidate) and Karen Penner (Registered Occupational Therapist, Ph.D.

Psychology candidate), and Dr. Janine Montgomery (Ph.D. School Psychology, Psychology

Professor at the University of Manitoba) to evaluate its suitability for adolescents with HFASDs.

The reviewers had extensive combined clinical and research background in ASD and

mindfulness, and determined that only a few minor changes needed to be made to the

presentation of lesson content and specific exercises in order to support participant

comprehension and engagement. These included: conducting an alternative exercise to explore

stress reactions (lesson four); occasional simplification and/or repetition of the instructor script;

use of additional visual supports (e.g., small, adjustable flashlights to support a body scan

exercise; writing thoughts down on images to support mental imagery in a thought-observing

exercise; .b cue cards); strategies and tools for alternative group participation[9] (e.g., a "go/stop"

card to signal that you were ready to respond or move on to the next PowerPoint slide); and

altering the instructions of one home exercise to facilitate compliance (e.g., youth were provided

with adapted instructions to try out a long unguided exercise at increasing increments, starting

with 5 minutes). Further, because most participants did not have pre-existing relationships with

each other, each class began with a check-in and simple, routine group building activity.[10]

Weekly communication with parents about lesson themes and assigned home practices was

provided in response to parent requests and the importance of providing caregivers with a shared

understanding of their adolescents' learning. All adaptations that were implemented received

pre-approval from the Mindfulness in Schools Project staff.

       Treatment integrity. Details of instructor qualifications are provided here as part of an

extended description of the .b program, and to outline how program implementation fidelity was

surveyed and addressed for the purposes of this study. To teach the .b program, instructors must

meet several requirements. Facilitators are required to: 1) attend a 4-day *teach .b* certification

training, 2) complete a selection of required readings provided by the training instructors, 3)

attend an 8-week secular mindfulness course a minimum of six months prior to the *teach .b*

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[9] Several participants exhibited significant anxiety and/or discomfort with sharing their responses orally within a group setting and, thus, required additional supports to participate in group discussions and activities.
[10] The activity involved discussing the preferences and activities of the group mascot - a toy rooster, inspired by a former .b participant, who once humorously reported daydreaming about chickens during a .b practice.

course start date, and 4) maintain a daily personal mindfulness practice for at least six months

prior to participating in the *teach .b* training. The groups in this project were jointly facilitated

by two Psychology graduate students – Katie Thom and Karen Penner, both of whom had

received training to deliver this program, had an established personal mindfulness practice, and

had extensive experience working with the target population.

An assessment of treatment fidelity was conducted to evaluate internal validity. This was

seen as important as few studies examining the effects of socioemotional interventions in

children report on implementation fidelity (Bellini et al., 2007; Zenner et al., 2014), and

'program drift' is reportedly common in community settings (Mowbray, Holter, Teague, &

Bybee, 2003).   Further, it was important to ascertain whether the modifications that were made

to increase its suitability for adolescents with HFASDs still closely aligned with the *.b* program

manual. To complete an assessment of program fidelity, lessons four and eight from two of the

groups were video recorded and submitted to an independent and experienced *.b* instructor with

no affiliation or involvement in the current study.[11] This instructor then completed a program

implementation survey constructed by the researcher for each recording. Ratings were averaged

across the four completed surveys.

Measures

This project used standardized questionnaires to evaluate change from pre- to post-

intervention, and researcher-created measures to collect participant information, and general

feedback and evaluate home practice adherence. The respective measures are described below:

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[11] Recordings from the third group were not available due to unforeseen technical difficulties.

Researcher Created Measures.

Participant information questionnaire (PIQ). A general information questionnaire was administered to parents to gather information about the adolescents' age, gender, official diagnoses, and medication status (see Appendix D). Questions were derived and modified from the questionnaire used by Montgomery et al. (2007).

Mindfulness home practice adherence. Participants were asked to record the frequency and length of their mindfulness practice outside of class each week on a record form that was provided by the researcher (see Appendix E). Due to a poor return rate it was not possible to analyze this information, and, as such, this measure was later dropped from the data analysis. A modified general rating item was, however, included on the Adolescent Program Feedback Survey to serve as a general proxy of home practice adherence. This item asked participants to choose from one of four categories, the description that best matched their average weekly home practice adherence over the course of the program, from "everyday – 7 days/week" to "infrequently – 0/1 days/week" (see Appendix F).

Program feedback survey. A Program Feedback Survey (see Appendix F, G) was developed by the researcher and administered to parents and adolescents at the post-training appointment to gauge their experiences with and perceptions of the course. Both parent and adolescent surveys consisted of a variety of question types, including open-ended and rating scale questions. The survey items differed in format and wording between parent and adolescent forms, although generally focused on perceived benefit from course participation, course feasibility, home practices, continued practice, and satisfaction with the program. The differences in format and wording limited comparison of parent and adolescent responses.

Program fidelity survey. A survey assessing treatment adherence and instructor quality was constructed by the researcher and independently completed by an experienced .b instructor

not affiliated with the current study. The six survey questions included were based on the

Mowbray et al.'s (2013) definition of fidelity as "the extent to which delivery of an intervention

adheres to the protocol and program model originally developed" (p. 315). This included

evaluating whether the intervention facilitator generally met lesson objectives, followed the

lesson plan, and adhered to instructor guidelines, as outlined in the *.b* manual. Questions

included statements that the reviewer indicated their level of agreement with on a 5-point rating

scale, from 1= strongly disagree to 5 = strongly agree. The program fidelity survey allowed for

an evaluation of the quality and consistency of instruction across sessions, and a review of how

closely the intervention aligned with the program manual, which was especially important in

light of some adaptations that were made to the program for this study. For a detailed summary

of the questions and results see Appendix H.

Standardized measures. A broad overview of the measures used in this study is

provided below. For specific subscale descriptions, see Appendix B. For a summary of

interpretive guidelines provided by test authors (e.g., "At-Risk" vs. "Clinically Significant"), see

Appendix C.

Wechsler Abbreviated Scale of Intelligence (WASI). The WASI (Wechsler, 1999)

provides a brief and reliable measure of intellectual functioning in individuals aged 6 through 89

years of age. The WASI produces *T*-Scores that have a mean of 50 and standard deviation of 10

for each subtest, which are then transformed to standard scores (Mean = 100; SD + 15) for the

composite scales. The WASI can be used to generate a Full Scale IQ score and/or verbal and

performance based intelligence scores. For the purposes of this study, only the Verbal

Intelligence Quotient (VIQ score; consisting of Vocabulary and Similarities subtests) was used to

ascertain ability to benefit from verbally delivered instruction. In the Vocabulary subtest

participants orally define words presented orally and visually. In the Similarities subtest

participants explain how two words are alike. The WASI has been reported to correlate with

other IQ scores produced by comprehensive batteries and have excellent psychometric properties

(Saklofske, Caravan, & Schwartz, 2000), making it an appropriate IQ proxy for the purposes of

this study.

   The Autism-Spectrum Quotient – Adolescent Version (AQ-A). The AQ-A (Baron-

Cohen et al., 2006) is a 50 item parent-report questionnaire assessing the severity of autistic traits

in adolescents with normal intelligence. AQ items were developed from a review of the

traditional "triad" autism symptoms and other cognitive symptoms common to autism (Baron-

Cohen et al., 2006, 2001). Item are scored on a 4-point scale (from definitely agree to definitely

disagree), and are summed to create a single total score that can range from 0 to 50. The AQ-A is

intended as a brief descriptive measure of autistic traits (Baron-Cohen et al., 2006; Ruzich et al.,

2015)[12], and is modelled after the adult Autism-Spectrum Quotient (Baron-Cohen et al., 2001).

Similar to its adult counterpart, the AQ-A has been found to have reasonable evidence of face

and construct validity, and strong test-retest reliability (Baron-Cohen et. al, 2006).

   Cognitive Affective Mindfulness Scale – Revised (CAMS-R). The CAMS-R (Feldman

et al., 2007) is a brief self-report measure of trait mindfulness. The questionnaire consists of 12

items, including one reversal item, which are scored on a 4-point scale (from 1= rarely/not at all

to 4 = almost always). The CAMS-R yields a single total score that can range from 12 to 48,

with higher scores reflecting higher ratings of mindful qualities. Despite its abbreviated form,

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[12] Although the Baron-Cohen et al. (2006) recommend using an AQ cut-off score $\geq$ 30 to distinguish ASD from non-ASD cases, previous research has found that 90% of adolescents with ASD obtain an AQ-A score $\geq$ 30, while approximately 10% of adolescents with ASD obtain a score between 20 and 30 (Baron-Cohen et al., 2006). In the current study, 11 of the participants who completed the study met the recommended threshold score of $\geq$ 30, and the remaining three obtained a score within five points of this value.

the CAMS-R incorporates a comprehensive conceptual coverage of mindfulness, with items designed to reflect the attentional and attitudinal aspects of mindfulness. Particularly relevant to the target population, CAMS-R items are constructed to be free of specialized, metaphorical, and idiomatic language, which is helpful for populations with pragmatic difficulties who do better with concrete wording. In terms of its psychometric properties and clinical utility, previous research has found the CAMS-R to be sensitive to change, have acceptable levels of internal consistency, and demonstrate evidence of convergent and discriminant validity with concurrent measures of mindfulness and emotional and cognitive wellbeing (Feldman et al., 2007).

       Difficulties in Emotion Regulation Scale (DERS). The DERS (Gratz & Roemer, 2004) is a 36 item self-report questionnaire that assesses problems with emotion regulation (ER) and was designed for clinical research purposes. It can be used to quantify characteristics and/or evaluate intervention effectiveness (van Dam, Hobkrik, Sheppard, Aviles-Andrews, & Earleywine, 2013; Gratz & Roemer, 2004; Neumann, van Lier, Gratz, & Koot, 2010). Items are scored on a 5-point scale ranging from 1 (almost never) to 5 (almost always). The measure yields a total raw score and six subscales scores, with higher scores indicating greater dysfunction. For the purposes of this analysis, only the total score was examined as a broad-level estimate of self-reported ER problems. The DERS requires a 5th grade reading level, and takes approximately 10 minutes to complete. It was originally designed for use with individuals 18-60 years of age, but has been demonstrated to be a reliable and valid measure of ER in adolescents 13-17 years of age (Neumann et al., 2010; Weinberg & Klonsky, 2009). Previous research has found the DERS to have acceptable levels of internal consistency, test-retest reliability, and evidence for construct and predictive validity (Gratz & Roemer, 2004; Neumann et al., 2010; Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006; Weinberg & Klonsky,

2009). Further, of particular relevance to the current study, previous research has found the

DERS subscale scores to be correlated with measures of trait mindfulness (Coffey et al., 2010;

Goodall, Trejnowska, & Darling, 2012) and to be sensitive to change in mindfulness-based

interventions with youth (Metz et al., 2013).

  The BarOn Emotional Quotient Inventory: Youth Version (BarOn EQ-i: YV). The

BarOn EQ-i: YV (Bar-On & Parker, 2000) is a 60-item standardized self-report questionnaire

that uses a 4-point format (1 = very seldom true to 4 = very often true of me) to assess emotional

and social functioning in children and adolescents 7 to 18 years of age. It can be used to quantify

characteristics and/or monitor an individual's progress in treatment. The measure yields an

estimate of overall emotional and social intelligence, and subscale scores across five specific

areas. Results are reported as standard scores with a mean of 100 and standard deviation of 15.

Standard scores falling above the mean are considered indicative of better-developed emotional

and social capacity, while scores falling below are considered indicative of poorer-developed

emotional and social capacity.   For the purposes of this study, three subscale areas were

examined, including the Intrapersonal, Interpersonal and Mood subscales. These scales were

chosen as they represent important outcomes that may be reflect an individual's socioemotional

wellbeing. The BarOn EQ-i: YV takes approximately 25 minutes to complete, and requires a

fourth grade reading level. It has demonstrated satisfactory internal consistency and test-retest

reliability, and evidence of construct validity (Bar-On & Parker, 2000).

  Behavioural Assessment System for Children, Second Edition (BASC-2). The BASC-2

(Reynolds & Kamphaus, 2004) is a multidimensional standardized rating scale that assesses

behaviour and emotional functioning in individuals 2 to 25 years of age. It can be used to

quantify characteristics and/or evaluate intervention effectiveness. The BASC-2 includes three

rating forms (the Self-Report of Personality, SRP; Parent Rating Scale, PRS; and Teacher Rating

Scale, TRS) that can be administered to derive more accurate and complete information about

individuals. In this study, the parent- and self-report rating forms for adolescents between the

ages of 12-21 years were used, which include 150 and 176 questions, respectively. Required

completion times for the BASC-2: PRS and SRP are approximately 20 and 30 minutes,

respectively. Scores from the BASC-2 are reported as *T*-Scores with a mean of 50 and a

standard deviation of 10. Clinical and adaptive scales are interpreted differently, with scores one

or more standard deviations above the mean (50) reflecting better functioning for adaptive scales,

and poorer functioning for clinical scales (see Appendix C). The BASC-2 has been reported to

have acceptable levels of reliability, including internal consistency and test-retest reliability, and

exhibits evidence of convergent, discriminant, and construct validity (Kamphaus & Reynolds,

2004).

For the purposes of this study, specific scales reflecting relevant aspects of social and

emotional functioning were used. These included: two composite scores (Behavioral Symptoms

Index on the BASC-2: PRS; Emotional Symptoms on the BASC-2: SRP), one content scale

(Emotional Self-Control on the BASC-2: PRS), and twelve clinical/adaptive scales (Depression,

Anxiety, Social Stress, Attention Problems, and Hyperactivity from the BASC-2: SRP;

Hyperactivity, Attention Problems, Atypicality, Withdrawal, Adaptability, Depression, and

Anxiety on the BASC-2: PRS).

Social Skills Improvement System (SSIS). The SSIS (Gresham & Elliott, 2008) is a

standardized questionnaire that facilitates targeted assessment of social skills and problem

behaviours in children 3-18 years of age. It can be used to quantify characteristics and/or

evaluate intervention effectiveness. Like the BASC-2, it includes teacher, parent, and student

rating forms. For the purposes of this study, only the parent questionnaire was administered. The parent-report questionnaire consists of 78-items, and requires approximately 20 minutes to complete. Results from the SSIS are reported as standard scores, with a mean of 100 and standard deviation of 15, for two global composite scores (Social Skills and Problem Behaviours), and as raw scores for the subscales. Pre-post comparisons were planned for the Social Skills and Problem Behaviours composite scores in this study. Pre-post post-hoc comparisons explored change across seven Social Skills subscale areas, including: Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-Control. Scores for these composites are interpreted differently, with scores one or more standard deviations above the mean reflecting better functioning for Social Skills, and poorer functioning for Problem Behaviours (see Appendix C). The SSIS has been reported to have adequate internal consistency and test-retest reliability, and show evidence of convergent and predictive validity (Gresham & Elliott, 2008).

Analysis Procedures and Considerations

The data for this project was entered and verified by trained undergraduate research volunteers. Both qualitative and quantitative information was gathered from parents and participants to evaluate program impact and provide feedback on programming.

Qualitative methods. Participant ratings of overall satisfaction and perceived difficulty were analyzed using descriptive statistics. Additionally, to identify common themes in participants' and parents' experiences with the program, a thematic analysis of written responses to open-ended questions was conducted by the researcher in consultation with an independent reviewer using guidelines set forth by Braun and Clarke (2006). This included six interconnected stages: familiarization with the data; generating initial codes; searching for themes; reviewing and refining themes; defining and naming themes; and reporting themes

(Braun & Clarke, 2006). No specific theoretical framework was used to select themes to allow the data to form its own themes without preconceptions. The researcher and a reviewer independently read all participant responses for a given question multiple times and independently generated potential codes reflected in the responses. Ideas were then compared and discussed together. Potential themes were next generated independently, and then modified through consensus. The researcher and the reviewer then independently assigned each individual response to one or more of the themes, and later discussed these for consensus. Some themes were subsequently re-evaluated to ensure they reflected individual responses and themes were modified accordingly.

Quantitative methods. Data analysis was conducted using SPSS Version 22.0 (IBM, 2013).

Data screening. All data from the parent and adolescent questionnaires was scored, entered and/or checked separately by two undergraduate research volunteers to ensure all values were entered correctly. Any data that was missing at this point and was available was subsequently reviewed and entered by the researcher if available.

Missing scores. Some data were missing because they had not been completed by participants or parents. Where an acceptable number of missing items was found, corrections were applied as outlined by specific protocol guidelines. This typically involved substituting an individual's mean score on the corresponding subscale for the missing item value.

Verification of validity indices. Ratings scales depend on subjective ratings of an individual's behaviour and may be influenced by various factors, such as attention to and comprehension of item content, and motivation to respond truthfully (Gresham & Elliot, 2008; Reynolds & Kamphaus, 2004). Methods for detecting potentially invalid results and evaluating

response styles are, hence, important in behavioural research. This information provides context for rating scale results, and scrutiny is essential prior to interpreting results. The BarOn EQ-i: YV, BASC-2, and SSIS include scales to evaluate the validity of rater responses, including measures of random responding (Consistency Index on the BASC-2: PRS, SRP and SSIS: PRS; BarOn EQ-i: YV Inconsistency Index), patterned responding (Response Pattern on the BASC-2: PRS and SSIS: PRS), overly-negative behavioural ratings (*F* Index on the BASC-2: PRS, SRP and SSIS: PRS), overly positive self-ratings (The BarOn EQ-i: YV Positive Impression Scale, BASC-2: SRP L Index), and poor attention to/comprehension of test items (BASC-2: SRP V Index). Raw scores contributing to each validity index on the BASC-2 and SSIS are summed and reported as falling in one of the following categories: Acceptable, Caution, or Extreme Caution. Results of the BarOn EQ-i: YV Positive Impression Scale are reported as standard scores with a mean of 100 and standard deviation of 15, and results falling significantly above the mean are interpreted as representing overly-positive self-ratings, whereas results significantly below the mean are considered to be overly negative self-ratings. Raw scores > 10 on the BarOn EQ-i: YV Inconsistency Index are to be interpreted with caution.

  Analyses. Descriptive statistics were used to summarize questionnaire results and examine distributions of scores. To assess change in target outcome variables from pre- to post-intervention, two-tailed paired samples *Student t*-tests were conducted. As well, Cohen's d_{av} values[13] were calculated to provide a standardized estimate of the magnitude of change between pre- and post-intervention scores. Recent trends in statistical analyses consider the inclusion of

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[13] Interpretation of effect sizes in within-subjects designs require special attention as there is risk of overestimating the true effect size due to reduced standard error that typically results in a small denominator than comparable between-subjects designs (Lakens, 2013). Cohen's d_{av} provides a conservative estimate of effect size estimate in within-subjects designs, although it is less conservative than Cohen's d_{rm} (Lakens, 2013). It is calculated by dividing the mean difference observed by the average standard deviation of both groups of observations.

effect sizes in statistical reporting a necessary standard of good research practice (Cumming, 2014; Hoyle, 1999; Lakens, 2013). Effect sizes are important in this type of research as they are less affected by sample size than null hypothesis significance testing, the latter which can increase Type II errors (retaining the null hypothesis when it is false) in small samples, and may lead researchers to overlook important relationships. Additionally, they help quantify the practical significance of effects. Cohen's *d* values of .20, .50, and .80 are interpreted as small, medium, and large effects, respectively (Cohen, 1992).

To explore whether change in target outcome variables could be attributable to degree of home practice adherence and/or changes in ER (Hypothesis 3 and 4), difference scores were computed for ER and all dependent variables. Pearson's correlation coefficients were then computed and tested for statistical significance to examine the associations between home practice adherence ratings and changes in dependent outcome variables, and changes in ER with changes in other dependent outcome variables. The magnitude of the association was interpreted according to guidelines set by Cohen (1992), where a correlation of .1 to .3 is considered weak, .3 to .5 moderate, and > .5 strong. As well, coefficient of determination (r^2) values were computed to identify the shared variance between these variables.

A note on pilot study findings. The analyses conducted in this pilot study were considered exploratory because the examination of mindfulness in individuals with ASD is a relatively new area of research and the sample of participants recruited was small. As previously mentioned, the only known publications of investigations of mindfulness in youth with ASD at the time of this study involved diverse instructional formats and small sample sizes, and were also considered exploratory (Bögels et al., 2008; de Bruin et al., 2014; Singh et al., 2011a; Singh et al., 2011b). Results should, therefore, be interpreted with caution, as the current study was

considered a pilot study, and a larger sample recruitment with a control group and random assignment was not feasible. As well a large number of comparisons were conducted without corrections for increased risk of Type I errors (rejecting the null hypothesis when it is true), which helped ensure that potential effects were not overlooked (Perneger, 1998; Rothman, 1990). Conversely, this means that effects found may not hold in larger studies. However, the preliminary results may inform where future research efforts may be best directed.

Results

Results of the evaluations of program implementation and participant satisfaction[14] are presented first, followed by a presentation of inferential statistical analyses that describe pre-post-intervention score comparisons, and interrelations between variables of interest.

Program Implementation

Course attendance was deemed acceptable, with all participants attending a minimum of seven out of the nine sessions. Results from the program fidelity assessment indicated that the program was generally implemented as outlined in the manual, meeting most to all of the lesson objectives, and delivered in a consistent manner within and across the sessions. As well, the reviewer rated the instructor's use of language, ability to engage participants, and effective problem behaviour management as acceptable. For a summary of results see Appendix H.

Program Feasibility and Acceptability

Results from the Program Feedback surveys highlight that both adolescents and their parents reported moderate to high levels of program satisfaction and perceived feasibility.[15] All

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[14] A thematic analysis of open-ended items was restricted to one item on the Parent Feedback Survey and three items on the Adolescent Feedback Survey due to some respondents not providing written responses to all survey items.

[15] An additional note on program satisfaction: In response to the enthusiasm and requests expressed by participants and their parents, the researcher and her co-facilitator offered ongoing mindfulness programming for both adolescents and their parents, and continued after the end of the *.b* course for several months. This programming focused on providing parents and their children with opportunities to continue developing their mindfulness skills, strategies for wellbeing, friendships, and a sense of community. It was provided at a minimal cost to participants.

parents responded that their child had benefitted from participating in the *.b* course, and that they

would continue to encourage their child to practice mindfulness. As well, all parents indicated

that they would recommend the course to other parents. Parent satisfaction ratings are

summarized in Table 5.

Table 5

Parent Ratings of Satisfaction with Program Components

	Mean Rating (1 = very poor, 10= very good)	*SD*
Program Content	9.50	.76
Home Exercises	8.79	1.58
Class Time/Day	8.57	1.83
Instructor Quality	9.86	.36

A majority of parents (57.14%) rated their experience of incorporating the mindfulness

home exercises into their child's daily routine as "easy" to "very easy", while a minority rated

their experience as "neither easy or hard" (21.43%) or "hard" to "very hard" (21.43%). While

some parents indicated that the home practices gradually became a matter of routine for their

child and that their child required fewer reminders with time, one parent who rated integration of

home practices as being "hard" commented that "Changes in routines are always a challenge.

The fact that *different skills* needed to be incorporated at *different times* in the day made it even

more difficult."

Overall, adolescents reported predominantly positive ratings of perceived program

feasibility and satisfaction. Rating their level of enjoyment for learning about mindfulness, a

majority (57.14%) of adolescents responded that they "liked it" or "liked it a lot", while about a

More than two-thirds of the original participants and their parents continued to participate in this program, with issues in travel and scheduling being reasons cited for some non-attenders. The post-intervention program ended due to limited instructor availability, although some participants continued on with their own meet-up group.

third (35.71%) responded "it was okay", and 14.29% reported "did not like it." Adolescents provided diverse responses for what they liked best and least about the *.b* program. Some indicated that they enjoyed everything and could not identify a favourite part of their experience, while others mentioned specific lessons or exercises, the experience of being with other adolescents, or watching entertaining *.b* video clips. A few adolescents also mentioned the supplied snacks, which were often voted on by the group, in their comments on favourite course aspects. Reporting on what they disliked in the program, several students indicated that there was "nothing" they disliked. A few participants reported disliking the mindful eating exercise, while others indicated sharing verbal responses in class discussions, or class time (i.e., a weekend) as their least favourite aspect of the course. One student reported disliking the videotaping (used for the program fidelity evaluation), which reportedly caused him/her significant anxiety and he/she had to be ensured that they were seated outside the camera frame during filming.

All but two adolescents indicated that they would recommend the course to a friend, with one participant who would not recommend it explaining that the course was too hard for them personally. Notably, both participants who responded "no" to this item reported having multiple concurrent mental health diagnoses, and also indicated that they did not like the course. One of these participants explained that while mindfulness was easy to learn, it was hard for him/her to practice, particularly with regard to observing thoughts, which were reported to be often emotionally-charged and/or frightening for him/her. Aside from this, most participants rated learning mindfulness as being "easy" to "very easy" (57.14% of participants), or "about right" (28.57%). Only two participants (14.29%) responded it was "hard". Ratings of home practice adherence were generally favourable, indicating that most participants engaged in home practices

at least "sometimes" (i.e., 2-3 days per week; see Table 6 for a summary of results). All but one

participant indicated that they would continue practicing mindfulness.

Table 6

Home Practice Adherence Ratings Reported by Adolescents

	f	Percentage of Sample (%)
Everyday, 6-7 days/week	2	14.29
Frequently, 4-5 days/week	7	50.00
Sometimes, 2-3 days/week	3	21.43
Infrequently, 0-1 days/week	2	14.29

Reflecting on what they had learned in the course, most adolescents reported having

learned skills that benefited their emotional wellbeing and coping skills. For example, one

adolescent reported that in the course he/she learned "To better control [my] emotions, be more

positive about [myself], think before [I] react, and to just try and savour all of the good in life

even if it is just for that one moment." Another participant responded "I have learned to be more

mindful and careful and how to calm down in stressful situations. I've learned how to relax and

how to control anxiety." A few adolescents reported that they had learned more about what

mindfulness is and how it can be used.

Similar to adolescents' responses, nearly all of the parents reported that they noticed

gains in their child's emotional well-being and coping, particularly with regard to managing

anxiety or coping with unexpected events. As well, a few parents reported gains in their child's

interpersonal and/or self-awareness. For example, as a result of participating in the course, one

parent commented:

[My child] seems more aware of the world around [him/her] and how people are reacting.

It seems to us that [he/she] is getting less upset, less often. We think [his/her] ability to

empathize has improved – [his/her] ability to tune in to the feelings of people around

[him/her], because [he/she] is more aware of [his/her] own feelings). [He/she] seems

more actively caring. Also, [my child] shows better impulse control.

Another parent reported strong enthusiasm for the course on this item:

The results have been incredible! From dealing with thoughts that get stuck in [his/her]

mind to relaxing when [he/she] is feeling anxious and even falling asleep! This is a tool

that will make all the difference to [his/her] success for [his/her] whole life.

Quantitative Assessment of Intervention Impact

Verification of validity indices. Minimal to no concerns were noted regarding the

validity of adolescents' responses on the BarOn EQ-i: YV protocols. Specifically, no protocols

contained scores that exceeded the cut-off on the Inconsistency Index, indicating that participants

generally were consistent in their ratings of similar items on individual protocols. Adolescents'

Positive Impression Scale scores on the BarOn EQ-i: YV did not significantly differ from the

normative sample mean at either assessment time ($t_{pre}(13)= .62$, $p = .549$, $t_{post}(13) = .76$, $p =$

.464), indicating that participants were not reporting overly positive self-impressions relative to

same-aged adolescents. Further, adolescents' Positive Impression Scale scores on this measure

were not significantly different from pre- to post-intervention ($t_{pre-post}(13) = .22$, $p = .831$),

suggesting that adolescents' tendency toward positive or negative self-impressions was similar

across the two assessment times.

Results of the BASC-2: PRS and SRP yielded few concerns regarding the validity of

parent and adolescent responses on this measure. Validity concerns, however, were observed for

parents' ratings of adolescents' social skills and problem behaviours on the SSIS: PRS.

Specifically, approximately one third to half of the parent forms scored in the Caution to

Extreme Caution range at pre- and post-intervention assessment times for the SSIS: PRS

Response Pattern and Response Consistency indices. Closer inspection of scores falling in the

Caution to Extreme Caution range for these scales found that parents reported high levels of

variability across test items. Although caution is warranted when validity scales are elevated, a

review of items contributing to each scale indicated that this may be a valid representation of the

relatively scattered performance youth with ASD tend to exhibit in social and adaptive domains,

and may reflect a realistic and literal response style to nuanced differences in item content.

Consequently, responses were considered appropriate in the context of ASD. See Appendix I for

a summary of the validity findings.

   Distributions of scores before and after intervention. While statistical analysis of

change is a critical element of this study, it is also helpful to situate performance in terms of

functioning and clinical guidelines for interpretation. Consequently, pre- and post-intervention

mean scores, standard deviations and their clinical interpretation are briefly presented below (see

Appendix C for test-by-test interpretation guidelines).

   Collectively, adolescents' self-reporting of socioemotional functioning on the BarOn EQ-

i: YV and BASC-2: SRP subscales generally fell within an "Average" range, indicating that

adolescents, as a group, endorsed levels of positive affect, inter/intrapersonal emotional

awareness, emotional symptoms, and problem behaviours that were comparable to same-aged

typically developing youth at both assessment times. The exception to this was on the BarOn

EQ-i: YV Interpersonal scale, on which the group mean fell within the "Low" range at pre-

intervention, and indicated that, collectively, adolescents reported slightly poorer social

understanding and less satisfying interpersonal relationships than same-aged typically

developing youth. Overall, some caution is warranted when focusing on group-level analysis, as

the standard deviations on most measures exceeded the normative standard deviations, indicating

that across the sample, adolescents were reporting more diverse levels of socioemotional

functioning and skills.

As a group, parent ratings of adolescents' socioemotional functioning and behaviour were

comparatively much more elevated than adolescents' self-ratings. Specifically, critically

elevated levels of maladaptive behaviour falling in the "Clinically Significant" range were

reported on BASC-2: PRS Behavioral Symptoms Index (pre/post-intervention), and Atypicality

(pre/post), Withdrawal (pre/post), and Hyperactivity (pre-only) subscales. Further, moderately

elevated levels of maladaptive behaviour (or the absence of positive behaviours) in the "At-Risk"

range were reported on the BASC-2: PRS Emotional Self-Control (pre-only), Anxiety (pre/post),

Depression (pre/post), Adaptability (pre/post), Attention Problems (pre/post), and Hyperactivity

(pre/post) subscales. Speaking again to the heterogeneity of the sample, particularly large

standard deviations exceeding the normative standard deviation were noted on the BASC-2: PRS

Anxiety and Depression subscales at both assessment times, which may be attributable to

differences in concurrent mental health diagnoses. Notably, the only BASC-2: PRS subscale that

fell within the "Average" range was Emotional Self-Control at post-intervention.

On the SSIS: PRS, parents reported that adolescents' displayed significantly fewer

positive social behaviours than same-aged children, such that adolescents' Social Skills

composite fell within the "Well-Below Average" range at pre-intervention, and "Below

Average" at post-intervention. Further, parents also reported significantly elevated problem

behaviours, with adolescents' Problem Behaviours composite falling in the "Above Average"

range at both assessment times. Taken together, the results highlight that while the adolescents

generally self-reported relatively few behavioural, social, and emotional concerns, parents

reported significant behavioural concerns across multiple domains. Table 7 provides a summary

of means and standard deviations for outcome variables at pre- and post-intervention.

Table 7

Means and Standard Deviations of Outcome Variables at Pre- and Post-Intervention

Variable	Pre-Intervention *Mean (SD)*	Post-Intervention *Mean (SD)*	Normative Sample *Mean (SD)*
CAMS	30.36 (4.43)	32.21 (6.07)	n/a
DERS			
Total Score	96.14 (23.12)	101.64 (25.82)	78.90 (23.20)[a]
EQ-i:YV			
Intrapersonal	92.71 (18.09)	95.21 (17.70)	100.00 (15.00)
Interpersonal	87.79 (17.49)	91.79 (17.85)	
Mood	93.21 (18.16)	95.36 (20.42)	
BASC-2: SRP			
Emotional Symptoms	56.07 (14.27)	52.50 (13.03)	50.00 (10.00)
Anxiety	58.86 (14.30)	53.79 (14.02)	
Depression	53.64 (12.89)	50.14 (9.76)	
Hyperactivity	54.71 (13.15)	56.29 (10.20)	
Attention Problems	59.00 (12.62)	59.71 (11.37)	
Social Stress	51.93 (10.59)	49.14 (8.56)	
BASC-2: PRS			
Emotional Self-Control	63.79 (10.09)	59.86 (12.20)	50.00 (10.00)
Behavioural Symptoms Index	75.43 (11.06)	70.00 (10.72)	
Anxiety	67.79 (20.28)	63.14 (19.37)	
Depression	67.36 (16.83)	65.00 (19.77)	
Hyperactivity	70.50 (12.69)	65.71 (11.96)	
Attention Problems	66.29 (8.35)	62.86 (9.38)	
Atypicality	78.79 (14.24)	71.79 (10.15)	
Adaptability	32.14 (9.52)	35.14 (10.24)	
Withdrawal	81.86 (14.88)	76.50 (12.15)	
SSIS: PRS			
Social Skills	68.36 (10.77)	75.50 (14.96)	100.00 (15.00)
Problem Behaviours	129.79 (14.48)	121.14 (16.58)	

Note. A consistent metric is used for subscales on the BarOn EQ-i: YV, BASC-2, and SSIS.
[a]Mean and standard deviation is based on research reporting on the DERS scores for a community sample of adolescents 13-17 years (*N* = 428), see Weinberg & Klonsky (2009).

Comparison of Pre- to Post-Intervention scores.

Normality of Difference Scores. Preliminary descriptive analyses were conducted to

examine the distributions for normality and the presence of outliers in order to determine

whether planned statistical testing would be appropriate for the data. The Shapiro-Wilk test was used to verify normality of difference scores and significant results were found for adolescents' DERS Total Score and BarOn EQ-i: YV Interpersonal subscale, indicating that these distributions were not normally distributed. Skewness and kurtosis values were also examined to assess the shape of the distributions.[16] Skewness and kurtosis values between ± 2 are considered acceptable in order to prove normal univariate distribution (George & Mallery, 2010). Kurtosis values exceeding 0 ± 2 were noted on the DERS Total Score, BarOn EQ-i: YV Interpersonal subscale, and BASC-2: SRP Depression subscale. The significance levels from the Shapiro-Wilk test and skewness and kurtosis statistics for each variable examined are presented in Appendix J.

A visual inspection of boxplots for the scores and analysis of standard deviations (using z-scores) was conducted to verify whether distributions of difference scores contained outliers. As recommended by Aguinis, Gottfredson and Joo (2013), a cut-off value of ± 2.24 standard deviations units was used, as this captures observations in the top and bottom 2.5 % of distributions. Both methods of inspection led to the identification of outliers within specific distributions of difference scores, including the DERS Total Score, BarOn EQ-i: YV Interpersonal subscale, BASC 2: SRP Anxiety and Depression subscales, and BASC-2: PRS Emotional Self-Control Problems. A summary of the findings is presented in Table 8.

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[16] Skewness is a measure of the symmetry of the distribution, and kurtosis is a measure of the peakedness of the distribution (Tabachnik & Fidell, 2007). According to Tabachnik and Fidell (2007), values of skewness and kurtosis are equal to zero when distributions are perfectly normally distributed. When values deviate from zero, a positive skewness value indicates scores tend to cluster of scores to the left and a negative skewness value indicates that there is a cluster of scores to the right. Positive kurtosis values indicate that a distribution is too peaked, while a negative value indicates the distribution is too flat.

Table 8

Outliers Identified in Boxplots ± 2.24 Standard Deviation Units (SD)

Participant	Subscale (T_1-T_2)	Outlier in Boxplot	Raw Score	Z-Score
2204	DERS Total Score	Yes	-44.00	-2.88
2206	BarOn EQ-i: YV Interpersonal	Yes	27.00	2.71
2204	BASC-2: SRP Anxiety	Yes	26.00	2.35
2221	BASC-2: SRP Depression	Yes	23.00	2.61
2206	BASC-2: PRS Emotional Self-Control	Yes	-20.00	-2.35

Given that extreme values in a distribution may impact statistical power and impede the detection of potentially meaningful trends (Osborne & Overbay, 2004), the values for participant scores identified in Table 7 were replaced by winsorizing, an accepted method for cleaning data (Bollinger & Chandra, 2005; Dixon & Tukey, 1968). Winsorizing replaces an outlying value with a less extreme value in the distribution.[17] In the current study, the extreme outliers appeared to be exaggerated versions of true values and were consequently 'winsorized' using the method which assigns the next closest non-outlier value in the data set (Dixon & Tukey, 1968). Winsorizing the aforementioned outliers resulted in a normalized distribution of difference scores for the DERS Total Score ($W = .94$, $p = .406$) and BarOn EQ-i:YV Interpersonal subscale ($W = .92$, $p = .190$), and also kurtosis values that fell within an acceptable range for on the DERS Total Score, EQ-i: YV Interpersonal subscale, and BASC-2: SRP Depression subscale.

Cleaning the data using such a strategy, while advantageous in some ways, also has pitfalls. For example, cleaning the data can create selection bias (Bollinger & Chandra, 2005), and in intervention studies it can mask extreme positive gains exhibited by individual participants. However, given the goal of this study was to explore general patterns of changes in

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[17] According to Angrist and Kreuger (2000), "loosely speaking, winsorizing the data is desirable if the extreme values are exaggerated versions of the true values, but the true values still lie in the tails. Truncating the sample is more desirable if the extremes are mistakes that bear no resemblance to the true values" (p. 1349).

outcome variables across the group (as opposed to within the group – i.e., at an individual level of analysis) this was deemed an appropriate concession. For this study, winsorizing select variables also confounded the calculation of d_{av} for those variables as the distribution of difference scores no longer directly coincided with the distribution of pre- and post-intervention scores. More specifically, for these variables the descriptive statistics that were used in effect size calculations were based on slightly different pre/post-intervention distributions than those represented by the distribution of the difference score. To maintain consistency in reporting, however, Cohen's d_{av} values were still calculated for the winsorized variables as an estimate of the magnitude of change from pre- to post-intervention.

Inferential Statistics

The results of the hypothesis testing are explained below. Results are also summarized in Tables 9, 10, 11 and 12 to assist the reader.

Hypothesis 1 – Assessing Change in Emotion Regulation (ER). Support for hypothesis that changes in ER would be observed following mindfulness training was mixed. Specifically, on the BASC-2: PRS Emotional Self-Control scale, parents reported a significant reduction in ER problems that was associated with a small effect size ($t(13) = 2.27, p = .041, d = .35$). In contrast, adolescents reported a non-significant increase in ER problems, as measured by the DERS Total Score, associated with a small effect size ($t(13) = -1.56, p = .143, d = .22$).

Hypothesis 2 – Changes in Socioemotional Wellbeing and Behavioural Problems. Overall, adolescents reported changes in their socioemotional adjustment that were reflected at both a broad and narrow level. Specifically, adolescents reported significant reductions in symptoms of Anxiety ($t(13) = 2.21, p = .046, d = .36$), and reductions that approached significance in their overall Emotional Symptoms ($t(13) = 2.06, p = .060, d = .26$), and

symptoms of Depression ($t(13) = 1.82$, $p = .093$, $d = .31$) on the BASC-2: SRP. Reductions in

these areas were associated with a small effect size. Further, although non-significant, a small

effect size reduction was observed for adolescents' BASC-2: SRP Social Stress symptoms ($t(13)$

$= 1.58$, $p = .138$, $d = .29$). Adolescents reported minimal to no changes on the BASC-2: SRP

Hyperactivity ($t(13) = -.76$, $p = .462$, $d = .14$) and Attention Problems subscales ($t(13) =$ $-.74$,

$p = .474$, $d = .06$). Additional evaluation of adolescents' emotional functioning using the BarOn

EQi-YV revealed that adolescents reported a significant improvement on the Interpersonal

subscale that was associated with a small effect size ($t(13) = -2.39$, $p = .033$, $d = .22$), suggesting

an improvement in their social understanding and interpersonal relationships. Minimal to no

change was detected on adolescents' BarOn EQi-YV Intrapersonal ($t(13) = -1.43$, $p = .175$, $d =$

$.14$) or Mood subscale scores ($t(13) = -1.27$, $p = .226$, $d = .11$), suggesting minimal to no changes

in participants' self-ratings of positive affect, understanding of their own emotions, and ability to

communicate their feelings. Taken together, results from the self-report measures suggest that at

post-intervention adolescents reported feeling less depressed, anxious, and socially stressed, and

more positive about their social relationships. Conversely, as a group, they did not report

significant differences in their levels of positive affect, intrapersonal emotional awareness,

hyperactivity or inattention from pre- to post-intervention.

Results from the parent-report measures (BASC-2: PRS, SSIS: PRS) indicated that

parents observed adolescents were better adjusted and exhibited fewer behavioural problems at

post-intervention. On broad measures of emotional and behavioural symptoms, including the

BASC-2: Behavioural Symptoms Index and SSIS: Problem Behaviours composite score, parents

reported a significant medium sized reduction ($t(13) = 2.92$, $p = .012$, $d = .50$, and $t(13) = -2.83$,

$p = < .001$, $d = .56$, respectively). Closer inspection on the BASC-2: PRS of where specifically

these improvements occurred indicated that parents reported significant reductions in

adolescents' Withdrawal behaviours ($t(13) = 3.20$, $p = .007$, $d = .40$), Hyperactivity ($t(13) = 2.74$,

$p = .018$, $d = .39$), and increases in Adaptability ($t(13) = -2.50$, $p = .027$, $d = .30$) that were

associated with a small effect size. Further, parents reported reductions that appraoched

significance for adolescents' symptoms of Anxiety ($t(13) = 2.15$, $p = .051$, $d = .23$) and

Atypicality ($t(13) = 2.07$, $p = .059$, $d = .57$), which were associated with a small and medium

effect size, respectively. Changes in parent-reported Attention Problems on the BASC-2: PRS

were non-significant, although a reduction associated with a small effect size was observed ($t(13)$

$= 1.64$, $p = .125$, $d = .39$). Parent-ratings of depression symptoms did not change across

assessment times, as evidenced by the BASC-2: PRS Depression scale ($t(13) = .76$, $p = .460$, $d =$

.13).

Table 9

Changes in Mindfulness and Socioemotional Functioning from Pre- to Post-Intervention

Variable (T1-T2)	Mean Difference (*SD*)	*t*	*p*	d_{av}
CAMS	-1.86 (4.17)	-1.67	.119	.35
DERS				
Total Score[a]	-3.36 (8.05)	-1.56	.143	.22
EQ-i:YV				
Intrapersonal	-2.50 (6.53)	-1.43	.175	.14
Interpersonal[a]	-5.29 (8.27)	-2.39	.033[*]	.22
Mood	-2.14 (6.31)	-1.27	.226	.11
BASC-2: SRP				
Emotional Symptoms	3.29 (5.97)	2.06	.060	.26
Anxiety[a]	4.36 (7.39)	2.21	.046[*]	.36
Depression[a]	2.71 (5.59)	1.82	.093	.31
Hyperactivity	-1.57 (7.75)	-.76	.462	.14
Attention Problems	-.71 (3.63)	-.74	.474	.06
Social Stress	2.79 (7.14)	1.58	.138	.29
BASC-2: PRS				
Emotional Self-Control[a]	4.93 (8.14)	2.27	.041[*]	.35
Behavioral Symptoms Index	5.43 (6.96)	2.92	.012[*]	.50
Anxiety	4.64 (8.09)	2.15	.051	.23
Depression[b]	2.36 (11.59)	.76	.460	.13

Hyperactivity	4.79 (6.53)	2.74	.018[*]	.39
Attention Problems	3.43 (7.83)	1.64	.125	.39
Atypicality	7.00 (12.63)	2.07	.059	.57
Adaptability	-3.00 (4.49)	-2.50	.027[*]	.30
Withdrawal	5.36 (6.26)	3.20	.007[**]	.40
SSIS: PRS				
Social Skills	-7.14 (9.45)	-2.83	.014[*]	.55
Problem Behaviours	8.64 (7.14)	4.53	< .001[***]	.56

* $p < .05$ ** $p < .01$ *** $p < .001$

[a.] Variable was winsorized due to a significant outlier in the data.

[b.] Variable was non-normally distributed. Results of the paired *t*-test are presented here as they did not differ from the results of the non-parmetric Wilcoxon Sign Rank test result.

In addition to improvements in adolescents' anxiety and behavioural problems, parents reported a significant increase in adolescents' positive social behaviours, as measured by the Social Skills composite ($t(13) = -2.83$, $p = .014$, $d = .55$), which was associated with a medium effect size. To further clarify the potential impact of the mindfulness program had on adolescents' social skills, post-hoc comparisons of the subscales contributing to the SSIS: PRS Social Skills composite score were conducted using paired-samples *Student-t* tests and effect size calculations. This examination of where parents reported changes across specific Social Skill subscales revealed small to medium sized improvements that were statistically significant for adolescents' Cooperation ($t(13) = -2.42$, $p = .031$, $d = .60$), Responsibility ($t(13) = -5.20$, $p = <$ .001, $d = .52$), and Self-Control ($t(13) = -3.74$, $p = .002$, $d = .62$). Additionally, parents reported improvements in adolescents' Engagement that approached significance ($t(13) = -2.08$, $p = .057$, $d = .33$). Minimal to no changes were observed in the areas of Communication ($t(13) = -1.41$, $p = .181$, $d = .16$), Assertion ($t(13) = -.348$, $p = .734$, $d = .06$), or Empathy ($t(13) = .00$, $p = 1.00$, $d = .00$).   Taken together, the results of the SSIS: PRS indicate that parents rated adolescents as more cooperative, responsible and better at managing themselves in social situations at post-intervention, but not different in their empathy, assertiveness or social communication behaviours across assessment times. See Table 10 for a summary of the findings.

Table 10

Post Hoc Comparisons of SSIS: PRS Social Skills Subscales

SSIS: PRS Social Skills Subscale	Mean Difference (*SD*)	*t*	*p*	d_{av}
Communication[a]	-.79 (2.08)	-1.41	.181	.16
Cooperation[a]	-1.36 (2.10)	-2.42	.031[*]	.60
Assertion	-.29 (3.07)	-.348	.734	.06
Responsibility	-2.07 (1.49)	-5.20	<.001[***]	.52
Empathy	.00 (3.31)	.00	1.00	.00
Engagement	-1.36 (2.44)	-2.08	.057	.33
Self-Control	-2.50 (2.50)	-3.74	.002[**]	.62

* p < .05 ** p < .01 *** p < .001
a. *Note*. Variable was winsorized due to a significant outlier in the data.

Hypothesis 3 – Impact of Home Practice on Outcome Variables. Examination of the

impact of home practice adherence on changes in outcome variables was limited by having to

use an alternative and less sensitive measure of home practice adherence than originally

proposed. Using a retrospective self-rating of home practice adherence, mixed evidence was

provided for the third study hypothesis. Specifically, correlational analyses between degree of

home practice adherence and changes in dependant outcome variables (using computed

difference scores) indicated that only the BASC-2: PRS Attention Problems scale was

significantly associated with home practice adherence, although associations between home

practice adherence and the BASC-2: SRP Hyperactivity Scale, and BASC-2: PRS Emotional

Self-Control Problems and Behavioral Symptoms Index approached significance. Examining the

magnitude of the relationships between home practice adherence and changes in dependant

variables, moderate sized correlations were demonstrated between home practice ratings and

self-reported changes on the BarOn EQ-i: YV Interpersonal subscale BASC-2: SRP

Hyperactivity, and parent-reported BASC-2: PRS Behavioural Symptoms, Anxiety, Depression,

and Hyperactivity, and SSIS: PRS Social Skills, and Problem Behaviors composites. Large

associations were observed between home practice ratings and parent-reported Emotional Self-

Control and Attention Problems (BASC-2: PRS). Interestingly, in examining the *direction* of the

relationships between home practice adherence and changes in the aforementioned dependent

variables, home practice adherence ratings were *positively* associated with changes in all parent-

reported dependent outcome variables, indicating greater improvement was associated with

increased practice. In contrast, home practice ratings were *inversely* associated with adolescents'

self-reported changes on Interpersonal functioning (BarOn EQ-i: YV) and Hyperactivity (BASC-

2: SRP), indicating greater improvement on outcome variables was associated with less home

practice. Weak to negligible associations were observed between home practice ratings and

adolescents' self-reported mindfulness (CAMS-R), Attention Problems, Emotional Symptoms

(including Depression, Anxiety, and Social Stress; BASC-2: SRP), Mood, and Intrapersonal

emotional functioning (BarOn EQ-i: YV), and parent-reported Atypicality, Adaptability, and

Withdrawal behaviour (BASC-2: PRS).

Taken together, the results of these correlational analyses suggest that greater home

practice adherence may contribute to more favourable intervention outcomes for parent-reported

emotional and behavioural problems. In contrast, the relationship between degree of home

practice adherence and self-reported emotional and behavioural functioning appears much less

clear, and potentially in the opposite direction than anticipated for a small number of social and

behavioral variables (see Discussion section for further details). A summary of these results is

provided in Table 11.

Table 11

Correlations between Home Practice Adherence and Dependent Variable Difference Scores

x	Difference Score (T$_1$-T$_2$)	r_{xy}	r_{xy}^2	p
---	y	---	---	---
Home Practice Adherence Rating	**CAMS**	-.19	.03	.528
	DERS			
	Total Score[a]	-.29	.82	.322
	EQ-i:YV			
	Intrapersonal	.02	.00	.948
	Interpersonal[a]	.36	.13	.211
	Mood	.14	.02	.645
	BASC-2: SRP			
	Emotional Symptoms	-.12	.01	.682
	Anxiety[a]	-.08	.01	.783
	Depression[a]	-.17	.03	.563
	Hyperactivity	-.47	.22	.091
	Attention Problems	-.22	.05	.453
	Social Stress	-.14	.02	.633
	BASC-2: PRS			
	Emotional Self-Control	.52	.27	.059
	Behavioral Symptoms Index	.39	.16	.085
	Anxiety	.47	.22	.088
	Depression	.31	.10	.276
	Hyperactivity	.42	.17	.137
	Attention Problems	.57	.33	.032[*]
	Atypicality	.21	.04	.472
	Adaptability	.04	.00	.900
	Withdrawal	.25	.07	.380
	SSIS: PRS			
	Social Skills	-.33	.11	.249
	Problem Behaviours	.34	.11	.219

* p < .05

Hypothesis 4 – Associations Between Gains in Emotion Regulation (ER) and

Dependent Variables. Unusual findings in adolescents' self-reported ER was observed on the

DERS, such that adolescents self-reported a non-significant change in ER (DERS Total Score)

that was trending in the opposite direction than anticipated. Further, adolescents' self-ratings of

changes in ER were found to have no relationship with parent-rated changes in ER. An

inspection of the scatterplot corresponding to these variables indicated a wide dispersal of paired scores across the graph area, indicating that the relationship was not better captured by a non-linear correlational measures. Further, adolescents' self-reported changes on the DERS Total Score were generally inconsistent with other changes in emotional and behavioural functioning as observed on the self- and parent-report measures. Because of these unusual findings, difference scores from the BASC-2: PRS Emotional Self-Control scale were used in the statistical analyses for the fourth study hypothesis.

Correlational analyses examining the associations between changes on the BASC-2: PRS Emotional Self-Control scale with changes in parent- and self-reported socioemotional outcomes found that gains in parent-reported ER were associated with improvements in a wide range of adolescents' socioemotional adjustment. Specifically, changes in parent-reported ER were significantly correlated with changes in adolescents' self-reported Emotional Symptoms (BASC-2: SRP), and parent-reported Anxiety and Depression symptoms (BASC-2: PRS), and Social Skills (SSIS: PRS). Further, associations between changes in parent-reported ER and changes in adolescents' self-reported Anxiety and Depression (BASC-2: SRP) and parent-reported Behavioral Symptoms Index (BASC-2: PRS) approached statistical significance. Inspection of the *magnitude* of the relationships between changes in ER and changes in the outcome variables indicated moderate associations with in self-reported Mood (BarOn EQ-i: YV), Emotional Symptoms (including Depression and Anxiety; BASC-2: SRP), and parent-reported Behavioral Symptoms and Attention Problems (BASC-2: PRS). Large associations were observed between changes in ER and self-reported mindfulness (CAMS-R), and parent-reported Anxiety and Depression (BASC-2: PRS), and Social Skills (SSIS: PRS). Inspection of the *direction* of the relationships observed indicated that greater improvements in parent-reported ER improved were

associated with associated with greater improvements on the aforementioned dependent

variables.

Weak to negligible associations were observed between changes in parent-reported ER

and changes in adolescents' self-reported BarOn EQ-i: YV Intrapersonal and Interpersonal

subscale scores, BASC-2: SRP Attention Problems and Social Stress symptomss, and parent-

reported BASC-2: PRS Hyperactivity, Atypicality, Adaptability, and Withdrawal behaviours,

and SSIS: PRS Problem Behaviours composite.   Although a lack of measurement sensitivity in

the ER parent-reported measure may have influenced results, this finding suggests that additional

group factors may have contributed to specific improvements in adolescents' behaviour (see

Discussion section for further details).   Specific details of these results are provided in Table 12.

Table 12

Correlations between BASC-2: PRS Emotional Self-Control Difference Scores and Dependent

Variable Difference Scores

Emotion Regulation $(T_1$-$T_2)$	Outcome Variable $(T_1$-$T_2)$	r_{xy}	$r_{xy}{}^2$	p
x	y			
BASC-2: PRS	**CAMS**	-.56	.31	.038[*]
Emotional Self-	**DERS**			
Control	Total Score[a]	.00	.00	.995
	EQ-i:YV			
	Intrapersonal	-.02	.00	.959
	Interpersonal[a]	.26	.07	.362
	Mood	-.43	.18	.129
	BASC-2: SRP			
	Emotional Symptoms	.46	.21	.095
	Anxiety[a]	.47	.22	.087
	Depression[a]	.48	.23	.082
	Hyperactivity	-.13	.02	.670
	Attention Problems	.00	.00	.995
	Social Stress	.07	.00	.819
	BASC-2: PRS			
	Behavioral Symptoms Index	.49	.24	.078
	Anxiety	.56	.31	.038[*]

Depression[b]	.62	.39	.017[*]
Hyperactivity	.28	.08	.326
Attention Problems	.34	.11	.240
Atypicality	.18	.03	.539
Adaptability	-.22	.05	.443
Withdrawal	.22	.05	.440
SSIS: PRS			
Social Skills	-.63	.40	.016[*]
Problem Behaviours	.18	.03	.546

* p < .05 ** p < .01 *** p < .001

Hypothesis 5. Some support for the hypothesis that mindfulness training would lead to changes in trait mindfulness, was provided by a comparison of CAMS-R scores across pre- and post-intervention times. Specifically, although the observed increase was non-significant ($t(13) = -1.67$, $p = .119$, $d = .35$), effect size calculation provided some evidence that the program had a small practical (and positive) effect on adolescents' trait mindfulness.

Hypothesis 6. Consistent with the hypothesis that changes in mindfulness and ER would be correlated with one another, changes in parent-reported ER problems were found to be significantly associated with changes in trait mindfulness (CAMS-R). Specifically, greater gains in adolescents' self-reported trait mindfulness on the CAMS-R were associated with greater reductions in ER problems on the BASC-2: PRS (see Table 12). This provides some evidence for the relationships between ER and trait mindfulness, and suggests that ER may be one mechanism by which mindfulness supports wellbeing in ASD.

Discussion

Adolescence is a challenging time for many youth, such that it is frequently referred to as a period of "storm and stress" (Arnett, 1999). Adolescents with HFASDs appear to be particularly at-risk of experiencing a "perfect storm" – a whirlwind of difficulty that is fostered by persisting social and behavioural impairments that become increasingly salient at this time,

recurrent negative social experiences, an inherent vulnerability to psychiatric symptoms, and a lack of evidence-based and accessible support services (Reaven et al., 2012). Adolescents with HFASDs have, thus, been identified as a group at-risk of a variety of poor social and emotional outcomes, which may be exacerbated in adulthood. Importantly, scholars have argued that interventions targeting ER-deficits in ASD may provide a promising avenue to improving the resiliency and socioemotional outcomes of this population (e.g., Jahromi et al., 2013; Mazefsky & White, 2014; Samson et al., 2012). Adolescence appears to be a key transitional period ripe with opportunity for effective intervention (Bellini et al., 2007; Masten et al., 2004), however, research regarding socioemotional and ER-focused interventions for adolescents with ASD remains limited.

Mindfulness training has emerged in the literature as an acceptable and feasible approach to improving self-management skills and socioemotional outcomes in diverse groups of children and adults (Harnett & Dawe, 2012; Keng et al., 2011; Wisner et al., 2010; Zenner et al., 2014; Zoogman et al., 2014; Weare, 2013). Practitioners and scholars alike suggest that mindfulness facilitates adaptive coping and wellbeing by increasing an individuals' self-awareness and self-management skills, including ER (Chambers, Gullone, & Allen, 2009; Chiesa et al., 2013; Zelazo & Lyons, 2012). Emerging research has suggested the socioemotional benefits of mindfulness training extend to individuals with HFASDs (Bögels et al., 2008; Bruin et al., 2014; Kiep et al., 2015; Singh et al., 2011a, 2011b; Spek et al., 2013), although conclusions are difficult to draw from this small pool of research, as there are significant differences in their research methodology, and research design quality and rigor is mixed (Cachia, Anderson, & Moore, 2016). The current study aimed to contribute to the growing body of research by examining the impact of mindfulness training on the ER and socioemotional functioning of

adolescents with HFASDs, and to understand how changes in ER may be related to improved socioemotional adjustment in this population. An additional goal of this research was to provide program feedback from parents and participants to facilitate required modifications or adaptations with program developers.

Context: Clinical Presentation and Heterogeneity of Participants

Youth with HFASDs are a heterogeneous population. Similar to related studies with individuals with HFASDs (Matson et al., 2007; Mayes et al., 2011; Siegel & Minshew, 1996), the participants in this study displayed significant variability in their verbal intelligence (VIQ scores ranged from 80 to 137), concurrent diagnoses, prescription medication status and type, and autism symptom severity (AQ scores ranged from 20 to 45). Comparable to rates reported in previous research (Mazefsky et al., 2011), over half of the sample had two or more concurrent diagnoses. Notably, the reported prevalence of anxiety disorders (57.14%) and depression (21.42%) in this study's sample was similar to previous research (Leyfer et al., 2006). Elevated rates of ADHD were observed, such that over three-quarters of the participants reported a diagnosis of ADHD. Although this rate is higher than the 28.2-30.6% reported in studies using diagnostic clinical interviews (Leyfer et al., 2006; Simonoff et al., 2008), it is somewhat comparable to other research using parent and teacher DSM-IV referenced rating scales (Gadow, Devincent, Pomeroy, & Azizian, 2005). However, given this information, the findings of this study should be cautiously interpreted as they may not generalize to adolescents with HFASDs who do not present with elevated symptoms of ADHD.

Collectively, parents reported significant impairments in adolescents' functioning across a broad range of socioemotional areas, which is consistent with previous research (Mayes et al., 2011; Mazefsky et al., 2014; Volker et al., 2010). Specifically, similar to the aforementioned research, in the current study parents rated adolescents as exhibiting increased emotional, social,

and behavioural problems, including deficits in ER, interpersonal skills, and adaptability, and

elevated symptoms of anxiety, depression, hyperactivity, attention problems,

withdrawal/avoidance. Significant discrepancies were noted between parent- and self-report

ratings of socioemotional functioning, such that adolescents consistently rated themselves as

being more similar to the normative test sample than their parents did, a finding similar to other

studies exploring self-perceptions in ASD (Johnson et al., 2009; Mazefsky et al., 2011).

Initial Course Impressions

This was the first study to our knowledge to examine the *.b* mindfulness curriculum with

youth with HFASDs. The *.b* curriculum was originally developed for use with typically

developing adolescents, and, thus, its utility and application in a clinical population with elevated

levels of social, emotional, and behavioural challenges was unclear prior to the commencement

of this study. Results of this study suggest that the *.b* program is suitable for use with

adolescents with HFASDs, and that it requires relatively few modifications to support

participants' engagement with and comprehension of course activities and content[18]. The results

provide evidence that *.b* is also an acceptable program for this group of youth, as, similar to the

previous research on *.b* with typically developing adolescents (Huppert & Johnson, 2010), most

adolescents (and their parents) in the current study reported being moderately to highly satisfied

with the course and specific course components.   Further, in describing perceived course

benefit, both adolescents and their parents commonly described gains in emotional wellbeing and

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[18] Results from this study suggest that beneficial modifications that do not result in significant deviations from core curriculum content may include: inclusion of additional visual aids (e.g., classroom posters, cue cards); greater repetition and use of concrete language; increased opportunities for parent communication and/or training; and/or slowly increasing the duration of more challenging home practice exercises. As well, a substitute exercise to help adolescents observe stress reactions was used, in light of heightened sensory, emotional, and behavioural symptoms common to ASD. Overall, modifications did not appear to deviate significantly from the standard delivery outlined in the *.b* manual. An assessment of program fidelity received high ratings in the current study.

coping on the Program Feedback Survey, which were mostly consistent with the results of the

standardized questionnaires (see Discussion: Assessing for Course Impact).

Reports of home practice adherence for this study were quite positive with a majority of

adolescents reporting they completed their home practice exercises on average "everyday" to

"frequently". This suggests that the recommended practice was achievable for most group

members. Notably, completion of home practices in mindfulness-based interventions has been

described by Richard Burnnett, one of the *.b* program developers, as the "holy grail" of teaching

mindfulness to youth (Burnett, 2015). Home practice adherence was likely supported in the

current study by several factors, including increased parental involvement that is commonly

reported for children/youth with ASD (Karst, Vaughan, & Van Hecke, 2012), take-home audio

recordings and student workbooklets, and the small group format utilized, which allowed for

close teacher-pupil and peer relationships. Moreover, the clinical profiles of participants (i.e.,

elevated levels of stress and worry) suggests that the mindfulness exercises may have been

particularly relevant for this particular group.

For a minority of participants who reported particular difficulty engaging in home

practices, special considerations may be required to promote more favourable program

experiences. For example, Spek et al. (2013) encouraged participants to explore which

meditation exercises were most helpful to them throughout the course, potentially introducing

some flexibility to the circumscribed sequence of home exercises in mindfulness training

programs. Further, these authors paid special attention to in-class planning for home practices

and addressing barriers in their mindfulness training program with adults with HFASDs, which

the authors state assisted with incorporating skills into participants' home environment and daily

routine. Organizational supports that may also be relevant for youth with HFASDs have been

advocated by other researchers examining research on mindfulness and ADHD (van der Oord, Bögels, & Peijnenburg, 2012). These include the use of abbreviated practices, emphasis of informal practices, 1-1 pre-intervention meetings with parents and their children to discuss course expectations, potential benefits/barriers, and home practice strategies, token-economy systems for completing homework, rewards for positive in-class behaviours, and active involvement of classroom teachers to facilitate generalization of skills (van der Oord et al., 2012). These suggestions may be particularly relevant for future researchers and clinicians in light of the documented high comorbidity of ASD and ADHD.

Of note, not all participants reported favourable course impressions. A minority of .b participants reported limited satisfaction and perceived helpfulness of the course, which has been observed in previous .b research with typically developing youth (Huppert & Johnson, 2010). Further, a small number of participants reported disliking the mindful eating exercise, which may be associated with the sensory aversions frequently reported in children with ASD (Laurent et al., 2004; Samson et al., 2013). Although the sensory concerns of some youth with ASD may warrant special considerations for sensory-based mindfulness activities, it should also be noted that integrating a range of sensory-based exercises may help individuals to develop more tolerance toward sensory stimuli, which, consequently, may increase resiliency and wellbeing (Laurent et al., 2004). Given that mindful eating may hold potential as an important exercise to help youth build tolerance for high intensity sensory experiences, they may benefit from beginning with abbreviated practices that gradually increase in length and intensity.

Assessing for Course Impact

Six experimental hypotheses were examined using a quasi-experimental pre-test post-test single sample design that included parent- and self-report measures. Generally, results provided preliminary support for most of the study hypotheses, with small to medium effect sizes

observed across a number of dependent variables and predicted relationships. Although no large effect sizes were observed in the current study, it should be noted that a conservative estimate of effect size was used (d_{av}), as recommended by Lakens (2013) for within-subjects designs, and small effect sizes do not necessarily signify small impact on an individual's life and wellbeing (Lakens, 2013).   Small to medium effect sizes are also not surprising for a short-term intervention with this population, as previous researchers have noted that adolescents with ASD require increased practice and exposure opportunities, and that the benefits of mindfulness may require weeks to months to appear (Singh et al., 2011a; White et al., 2009). The improvements in participants' socioemotional symptoms and behaviour observed here are, hence, particularly favourable, in light of the limited number of sessions delivered over a short period of time.

Impact on emotion regulation (ER). Support for the hypothesis that mindfulness training would lead to changes in ER was mixed. Specifically, parents reported significant reductions in adolescents' ER difficulties (BASC-2: PRS Emotional Slef-Control), and this was associated with a small effect size. Interestingly, adolescents reported a small non-significant increase in ER problems (DERS: Total Score). This finding stands in contrast to previous research that has observed improvements in ER in children and adults following mindfulness training (including measurement with the DERS), although some studies observing ER improvements have used programs of much longer duration (e.g., 18 sessions; van Dam etal., 2013; Metz et al., 2013). While the slight increase in self-reported ER problems may raise concern, a few considerations should be noted.

First, such an increase may reflect an increase in self-awareness, as mindfulness courses generally focus on bringing awareness to internal experiences, personal responses to difficulty, and choice-making opportunities (Rechtschaffen, 2014). Secondly, participants in mindfulness-

based programs may initially report experiencing elevated distress due to increased exposure to challenging experiences and the nature of the wandering mind. However, this tends to subside with increased exposure and practice, as individuals learn to observe difficulty with nonjudgment and kindness, and, as adolescents cited herein reported, "*respond* instead of *react*" (Bowen, Vieten, Qitkiewitz, & Carrol, 2015; Rechtschaffen, 2014). Finally, the pattern of increased self-reported ER problems did not coincide with what adolescents and their parents reported informally and anecdotally on the Program Feedback Surveys, suggesting that this reported increase may indeed reflect improvements in self-awareness (see Montgomery et al., 2010) and, thus, more accurate responses at post-test.

Impact on socioemotional functioning and behavior. Moderate support was found for the hypothesis that mindfulness training would lead to changes in socioemotional functioning. Specifically, small to medium size improvements were observed on a number of socioemotional outcome variables, suggesting that adolescents were better socially and emotionally adjusted at post-intervention. Adolescents reported a significant decrease in Anxiety, and decreases in Depression and overall Emotional Symptoms (BASC-2: SRP) that approached significance. These reductions, as well as a non-significant decrease in Social Stress symptoms (BASC-2: SRP), were associated with a small effect size, which together suggest that after participating in the course, adolescents were experiencing fewer symptoms of emotional disturbance, such as worry, loneliness, sadness, and feelings of tension with peers. Further, adolescents reported a significant increase on the BarOn EQ-i: YV Interpersonal subscale associated with a small effect size, suggesting that the group, as a whole, perceived improvements in their ability to understand and relate to other people, and that they felt more positive about their interpersonal relationships. These findings were generally consistent with gains in interpersonal wellbeing and emotional

health that have been observed in previous research on mindfulness training with children and

adolescents without ASD, which has documented reductions in self-reported emotional

reactivity, anxiety, depression, and behavioural problems, and improvements in interpersonal

relationships following intervention (for a review see Greenberg & Harris, 2012, & Weare,

2013).

Contrary to study expectations, adolescents did not report changes in Mood, as measured

by the BarOn EQ-i: YV. Currently, the evidence for the impact of mindfulness training on mood

is mixed. For example, while gains in positive affect have been reported following mindfulness

training in individuals with and without ASD (e.g., Anderson, Lau, Segal, & Bishop, 2007;

Huppert & Johnson, 2010; Schroevers & Brandsma, 2010; Spek et al., 2013), others have

observed a minimal impact on participants' affect (e.g., Mendelson et al., 2010). However,

differences between studies may reflect measurement differences and/or diverse participant

characteristics, such as age, concurrent psychiatric symptoms, and/or emotional awareness. In

the current study, items contributing to the BarOn EQ-i: YV Mood subscale generally query

about feelings of optimism and happiness, rather than a broad range of emotions. More

specifically, the previously presented results of the BASC-2: SRP suggest that adolescents were

experiencing fewer symptoms related to negative affect at post-intervention. However, the

BarOn EQ-i: YV Mood subscale may have not been sensitive to these particular changes in

mood given the brevity and structure of items. The absence of change in positive affect may

suggest that mindfulness training did not impact participants' feelings of happiness and

optimism, although this may alternatively reflect measurement limitations and/or changes in

participants' introspective ability.

The minimal change observed on the BarOn EQ-i: YV Intrapersonal subscale for the group was also contrary to study expectations. This subscale aims to measure the capacity to understand and express one's own feelings. Subscale items, however, focus more exclusively on being able to describe and talk about your emotions. The null finding for this subscale, thus, may suggest that the intervention had little impact on adolescents' emotional vocabularies and comfort with sharing their personal feelings with others.

Collectively, adolescents reported minimal to no changes in Attention Problems or Hyperactivity (BASC-2: SRP), indicating that they did not perceive a change in their distractibility, tendencies to be overly active, or act without thinking. This is somewhat surprisingly in light of the majority of the sample having a diagnosis of ADHD, and in the context of previous research with adolescents and young adults with ADHD (without ASD) reporting decreases in self-reported ADHD symptoms following participation in a mindfulness training program of similar length (Zylowska et al., 2008). The lack of change in these areas in the current study may suggest that mindfulness training has little impact on these symptoms for adolescents with HFASDs or that adolescents with HFASDs lack particular insight into their ADHD symptoms. In terms of insight, the finding that parent-rated changes in adolescents' ADHD symptoms were inconsistent with adolescents' ratings provides some evidence that this may be indeed the issue. Specifically, parents' ratings of adolescents' Hyperactivity and Attention Problems (BASC-2: PRS) were elevated compared to the normative sample at both assessment times. Further, parents reported reductions in these areas that were associated with a small effect size, although only statistically significant for Hyperactivity.

Other improvements reported by parents included adolescents' overall level of maladaptive behaviours, as noted by significant reductions on the BASC-2: PRS Behavioural

Symptoms Index and SSIS: PRS Problem Behaviours composite, both of which were associated

with a medium effect size. Consistent with adolescent ratings, parents also reported a small

effect size reduction in adolescents' Anxiety symptoms (BASC-2: PRS) that approached

significance. Contrary to adolescents' self-ratings, parents did not report a decrease in

adolescents' Depression symptoms (BASC-2: PRS). This may indicate that although adolescents

may have reported feeling less depressed, observable behaviours related to depression may have

generally remained unchanged. Alternatively, differences in measurement between the BASC-2:

SRP and PRS, and participant characteristics (e.g., concurrent diagnoses) and/or limited

measurement of depression symptoms (i.e., the BASC-2 is intended to be a screening tool, and

not comprehensive assessment of specific psychopathologies) may have contributed to these

findings.

Similar to interpersonal improvements reported by adolescents, improvements in social

behaviours were noted for a number of subscales on both the SSIS: PRS and BASC-2: PRS.

Specifically, parents reported adolescents were better able to adapt to changes in their

environment, as evidenced by a significant improvement on the BASC-2: PRS Adaptability

subscale, which was associated with a small effect size. Parents also rated adolescents as

exhibiting fewer social oddities, and being less avoidant of and withdrawn from social contacts,

as evidenced by a significant reduction on the BASC-2: PRS Withdrawal subscale and a

reduction that approached significance on the BASC-2: PRS Atypicality subscale. These

reductions were small in effect size. On the SSIS: PRS, a comprehensive assessment measure

that includes a broad coverage of social behaviours, adolescents' Social Skills composite scores

significantly increased from pre- to post-intervention and this change was associated with a

medium effect size. This finding indicates that parents observed adolescents as exhibiting more positive social behaviours at post-intervention.

Post-hoc follow-up testing examining specific SSIS subscales revealed that parents rated their adolescents as being more engaged, cooperative, socially responsible, and better at managing conflict post-intervention (as indicated by significant results on the Cooperation, Responsibility, and Self-Control subscales, and approached significance for Engagement). Further, these differences were associated with small to medium effect sizes. Parents did not report changes in adolescents' other social skill behaviours such as Communication, Assertion, or Empathy. The null finding for Empathy stands in contrast to research supporting the associations between mindfulness, empathy, and perspective taking (e.g. Block-Lerner et al., 2007), and may suggest that deficits in these sociocognitive areas in ASD may be difficult to change with a short-term intervention. Alternatively, the lack of change in empathy may reflect measurement limitations, as the Empathy subscale of the SSIS is limited to six questions, most of which emphasize prosocial behaviors.

Relationships between home practice adherence and changes in dependent variables. Mixed support was provided for the study hypothesis that degree of home practice adherence would be correlated with changes observed in dependent outcome variables. Overall, the results of analyses on the impact of home practice should be taken cautiously as the measure of home practice adherence lacked sensitivity, and the distribution of home practice adherence ratings was disproportionate. Further, changes in self-reported social and emotional functioning were potentially confounded by changes in introspective ability and/or self-awareness.

Consistent with study expectations, correlational analyses found that degree of home practice adherence was positively associated with parent-reported improvements in adolescents'

socioemotional adjustment and ER, as evidenced by small to medium correlations between degree of home practice adherence and changes on the Behavioural Symptoms Index, Emotional Self-Control, Anxiety, Depression, Hyperactivity, and Attention Problems subscales on the BASC-2 PRS, and Social Skills and Problem Behaviours composites on the SSIS: PRS. This was consistent with previous research in mindfulness that has observed positive associations between degree of home practice adherence and improvements in emotional health (Huppert & Johnson, 2010).

　　　　Contrary to study expectations, associations between home practice adherence and improvements in parent-reported Atypicality, Withdrawal, and Adaptability (BASC-2: PRS) were weak to negligible, suggesting that these variables were not directly impacted by home practice and may be better accounted for by other group factors. Associations between home practice adherence and changes in self-reported socioemotional outcomes also contrasted study expectations, such that, for a small number of variables (BASC-2: SRP Hyperactivity and the Interpersonal subscale of the BarOn EQ-i: YV) correlations between home practice adherence and changes in outcome variables were in the opposite direction anticipated (as well, were in the opposite direction of the correlations between home practice adherence and changes in parent-reported variables). Specifically, lower ratings of adolescents' home practice adherence were associated with more favourable self-reported changes in areas related to social relationships and understanding, and levels of activity. Home practice adherence ratings were not moderately or strongly associated with changes in adolescents' self-ratings for any other socioemotional outcome variables, potentially signifying that increased experienced with mindfulness exercises was not associated with greater gains in self-perceived social and emotional wellbeing.   These findings contradict previous research where positive associations between home practice

adherence and self-reported emotional wellbeing have been observed in typically developing youth, although differences in self-report scales used are apparent (Huppert & Johnson, 2010).

The surprising findings in the current study may suggest that self-perceived improvements in adolescents' socioemotional functioning and parent-reported gains in ASD-related behaviours may be attributable to other group factors including opportunities to form friendships, and/or normalizing or acceptance of ASD-related behaviours. Alternatively, as highlighted above, measurement limitations for home practice adherence may have restricted our analyses. Further, changes in introspective ability may account for the unusual relationship observed for self-reported variables, such that adolescents reporting greater home practice may have been reporting more accurately at post-intervention than those who reported less home practice, resulting in smaller changes on standardized pre-test to post-test measures.

Relationship between ER and socioemotional behaviours. Unusual results for pre/post-intervention comparisons on the DERS Total Score precluded the use of adolescents' self-report of ER in the correlational analyses for hypothesis four. Consequently, the correlational analyses focused exclusively on parent-reported ER problems (Emotional Self-Control subscale of the BASC-2 PRS). Consistent with study expectations, reductions in parent-reported ER were moderately to strongly associated with gains in adolescents' socioemotional wellbeing. Specifically, reductions in parent-reported ER problems showed small to moderate negative correlations with improvements in adolescents' self-reported trait mindfulness (CAMS-R) and Mood (BarOn EQ-i: YV), and parent-reported Social Skills (SSIS: PRS). Reductions in parent-reported ER problems showed small to medium positive correlations with reductions in self-reported Emotional Symptoms, including Depression and Anxiety (BASC-2: SRP), and parent-reported Anxiety, Depression, and Attention Problems (BASC-2: PRS). This suggests

that gains in ER are associated with more favourable social and emotional outcomes for youth

with HFASDs, similar to results of research with typically developing adolescents (Metz et al.,

2013). It also provides evidence that mindfulness training in youth with HFASDs may represent

a promising approach to improving ER and wellbeing.

         Changes in mindfulness and its relationship to ER. The analyses of whether

mindfulness training would lead to changes in trait mindfulness, as measured by the CAMS-R,

indicated that there was a non-significant small effect sized increase in adolescents' mindfulness.

This finding is similar to previous *.b* research by Huppert and Johnson (2010) with typically

developing adolescents, which observed that in contrast to controls, youth in the intervention

group reported a non-significant small increase in mindfulness on the CAMS-R. Further, in the

current study a significant relationship was observed between changes in parent-reported ER

problems (BASC-2: PRS Emotional Self-Control) and changes in adolescents' self-reported

mindfulness (CAMS-R), providing evidence for the relationship between mindfulness and ER in

ASD. This finding suggests, as cited elsewhere (e.g., Chambers et al., 2009), that the mechanism

by which mindfulness may benefit social and emotional wellbeing is by facilitating gains in ER,

including in ASD. Additional research using more stringent protocols and additional analytical

methods is required to determine this with more certainty.

Limitations and Future Directions

         A number of limitations were apparent with the current study. Firstly, recruitment

methods were such that participants were generally parent-referred, and this could limit the

generalizability of findings to other youth with HFASDs. For example, it may have been that

parents of adolescents who suffer from increased dysregulation were attracted to the course, as

the recruitment poster stated that the course included instruction in strategies for stress-

management, mood, and concentration. Secondly, challenges associated with recruiting

adolescents with HFASDs in the current study resulted in a smaller sample size than anticipated and limited the statistical power of the analyses, although the sample size was comparable to other research in mindfulness and HFASDs (e.g., de Bruin et al., 2014; Spek et al., 2013). Notably, despite difficulties in initially recruiting participants, minimal issues with participant retention were observed once the program commenced, and participants and their parents generally reported favourable impressions of the mindfulness program. To support recruitment strategies, future studies could explore the utility of offering several pre-intervention workshops to dispel myths about mindfulness and provide adolescents, parents and/or caregivers with sample exercises that could facilitate increased awareness and interest.

A third weakness the absence of a control group (and lack of random assignment) in the current study makes it difficult to rule out other explanations for the observed results. For example, it may have not been mindfulness training per-say that was associated with improved outcomes, but other factors associated with the group- programming, such as friendship opportunities, intensive small-group instruction, and/or changes in interactions between parents and adolescents. Hence, an "active" control group that compares mindfulness-based interventions with other standard forms of care could help to delineate effects that are specific to this type of instruction. Generally speaking, results from this study suggest that the .*b* training had a positive impact on adolescents' ER and socioemotional adjustment, warranting a more resource-intensive follow-up study which could utilize a randomized active-control group design and larger sample size.

Future research could also address the measurement weaknesses inherent in the current study. For example, the lack of a post-intervention follow-up precluded examination of the durability of intervention effects and/or impact of long-term practice, which would be important

to address as many participants expressed the intent to continue practicing. Currently, the durability of intervention effects and impact of long-term practice in individuals with HFASDs remains unclear as research exploring the longitudinal impact of mindfulness training in individuals with ASD is limited to two studies (de Bruin et al., 2014; Kiep et al., 2015). Further, given the limitations of self-reporting in ASD, future research would benefit from incorporating measurement tools that rely less on subjective ratings, are more sensitive to target outcomes, and/or can provide converging evidence. For example, scholars have cited various 'naturalistic' methodologies for examining socioemotional behaviours in children with ASD, such as roleplaying, behavioural paradigms, performance tasks, and behavioural frequency tracking (Matson & Wilkins, 2007; Jahromi et al., 2013; Samson et al., 2013; Singh et al., 2011a, 2011b).

In the current study, measurement tools were restricted to subjective ratings and reporting methods, which were likely influenced by introspective ability, motivation to complete items, comprehension of items, and/or familiarity of the rater with adolescents' behaviour in certain settings. As well, since the BASC-2 is intended to serve as a comprehensive screening tool for variety of emotional, social, and behavioural difficulties (Kamphaus & Reynolds, 2004), some subscales and their items may be less representative of experimental target outcomes, and, thus, less likely to capture subtle and meaningful changes in adolescents' functioning. For example, the Emotional Self-Control scale of the BASC-2: PRS consists of five items, which focus almost exclusively on emotional reactivity and acting out of control. It does not contain items querying the use of adaptive or maladaptive ER strategies, and, consequently, measures including ER strategy usage may be important and informative for future research. Despite this potential limitation, converging evidence for improved ER was provided in the current study via significant changes on the Self-Control subscale of the SSIS: PRS, which contains items that

reflect both social and behavioural responses to emotionally difficult interpersonal situations. As

well, the majority of adolescents and their parents reported observing improvements in emotional

coping on the open-ended items of the Program Feedback Survey. Taken together, these results

provide corroborating evidence that adolescents did indeed exhibit improvements in ER,

including reduced emotional reactivity and improved abilities to respond to difficulty with

adaptive strategies. They also highlight the utility of mixed methods in research.

An additional measurement consideration for future research pertains to home practice

recording. Although home practice adherence ratings in the current study were generally

favourable, the measure utilized lacked sensitivity and may have been influenced by biases and

issues related to retrospective self-reporting, such as poor recall and increased social desirability

effects (Schwarz, 2007). Measuring home practice adherence was generally difficult and the

initial plan for quantifying and recording weekly practices in the current study had to be

discarded and replaced with a simple retrospective rating item. Although similar methods of

measuring home practice adherence have been employed in previous .b research with typically

developing adolescents (Huppert & Johnson, 2010), self-reporting methods that focus on more

current behaviours or experiences may be more accurate and desirable for researchers (Schwarz,

2007). Such approaches might include a brief in-class survey of home practice adherence using

a rating scale that is administered on a weekly basis at the beginning of class or app-friendly

strategies that participants can use to report home practices on their mobile devices or home

computers.

Another important task for future research in mindfulness is to analyze different

components of these interventions to determine which practices are most related to specific

target areas of intervention. Examining the essential components of mindfulness interventions in

terms of specific outcomes could help to determine the core units underlying the treatment

effects, which would contribute to a better empirical understanding of the mechanisms of

mindfulness, help direct treatment efforts, and assist with developing cost-efficient interventions

that have a maximum impact (Embry & Biglan, 2008). Presently, the limited research on

mindfulness training with individuals with HFASDs has utilized a diversity of instructional

formats, content, activity types, program duration, concurrent parent training, and target

outcomes. Although this has provided corroborating evidence for the potential benefits of

mindfulness interventions in this population, it is not clear which components of the programs

contributed to the results. For example, several studies have involved some training for both

parents and adolescents (e.g., de Bruin et al., 2014; Singh et al., 2011a, 2011b), and, thus, it is

difficult to ascertain whether parent and/or adolescent training contributed to the results of these

studies.

Further, it remains unclear whether or not mindfulness is more beneficial for some

individuals with HFASDs than others. Consequently, it is important to understand if certain

participant characteristics, such as gender, verbal intelligence, ASD symptom severity, and/or

baseline socioemotional functioning, contribute to different responses to treatment. For example,

following participation in an 8-week mindfulness program, Flook et al. (2010) observed that

children who were 'less-regulated' at baseline showed greater improvement in executive

function compared to those who were more 'well-regulated'.   Analysis of covariation was

beyond the scope of the current study, but it should be noted that a few adolescents reported that

the course was difficult for them, and some exhibited poorer outcomes on certain socioemotional

outcome variables at post-intervention, including on self-reported Interpersonal functioning

(BarOn EQ-i: YV), Depression (BASC-2: SRP), parent-reported Depression and/or Emotional

Self-Control (BASC-2: PRS). This pattern of poorer outcomes following intervention has not often been reported or examined in previous research, and, consequently, the assertion is typically held that mindfulness interventions with youth do not carry iatrogenic harm (Zoogman et al., 2014). Findings of poorer outcomes following mindfulness training may be attributable to the increased exposure to difficult internal experiences that accompanies mindfulness training, or other internal and external factors (e.g., family conflict, medical issues) that are less easily controlled for in intervention studies. Closer inspection in future research using single case study methods or multiple regression analytic techniques may provide important information about participant characteristics associated with differential treat treatment responses. This is especially important in light of the significant heterogeneity in ASD (Matson et al., 2007; Mayes et al., 2011; Siegel & Minshew, 1996).

Conclusion

Adolescents with HFASDs represent a critically at-risk group who exhibit increased rates of social and mental health problems, further exacerbating functional impairments associated with core ASD symptoms. Emotion regulation (ER) has been identified as a key target variable for improving the social and emotional outcomes in this population, yet evidence-based programming remains limited. The current study sought to investigate the applications of a mindfulness intervention for this population, including impact on ER, socioemotional outcomes, and the role of home practice adherence. Results of this pilot study are promising and suggest that mindfulness training is an acceptable and engaging approach for youth with HFASDs, and that it can facilitate gains in a number of socioemotional areas, in part by improving ER. Effect sizes observed were generally small to medium, and indicate that gains observed had some

practical benefit for participants. As well, they are particularly favourable in light of the short

duration of the intervention (i.e., nine weeks).

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Appendix A

Summary of the 10 lessons of the *.b* curriculum

Lesson Number/Title	Description
Introduction to Mindfulness	Introduces students to the benefits and relevance of learning mindfulness.
1. Puppy training	Introduces students to the concept of "attention," and how, like a puppy, it needs to be trained.
2. Taming the Animal Mind	Focuses on cultivating an attitude of curiosity and kindness in everyday experiences
3. Recognizing Worry	Explains the tricks the mind plays that leads to stress and anxiety, and offers techniques to deal with it.
4. Being Here Now	Focuses on teaching students how to respond, rather than react, to whatever happens in their lives.
5. Moving Mindfully	Focuses on teaching students that mindfulness is not just something that is practiced while sitting or lying down.
6. Stepping Back	Focuses on how students relate to their own thoughts
7. Befriending the Difficult	Focuses on how students deal with difficult emotions
8. Pulling it all together	Consolidates the key techniques from .b and inspires students to use what they have learned in the future.

Appendix B

Description of Scales Selected for Analysis

Scale	Description
CAMS-R	
Total Score	A measure of trait mindfulness.
DERS	
Total Score	An overall measure of emotion dysregulation.
EQ-i: YV	
Intrapersonal	Perceived ability to understand emotions, express and communicate personal feelings and needs.
Interpersonal	Perceived ability to understand and appreciate the feelings of others, and have satisfying interpersonal relationships.
Mood	Perceived feelings of optimism and positive affect.
BASC-2: SRP	
Emotional Symptoms (Composite)	A global indicator of serious emotional disturbance, particularly internalized disorders. Composed of four scales form the Internalizing Problems composite, and two scales from the Personal Adjustment composite.
Anxiety	Feelings of nervousness, worry, and fear; the tendency to be overwhelmed by problems.
Depression	Feelings of unhappiness, sadness, and dejection; a belief that nothing goes right.
Social Stress	Feelings of stress and tension in personal relationships; a feeling of being excluded from social activities.
Attention Problems	The tendency to report being easily distracted and unable to concentrate more than momentarily.
BASC-2: PRS	
Emotional Self-Control	The ability to regulate one's affect and emotions in response to environmental changes. High scores reflect a variety of negative emotions, and problems regulating affect.
Behavioral Symptoms Index	Reflects overall level of problem behaviour, including symptoms of Hyperactivity, Aggression, Depression, Attention Problems, Atypicality, and Withdrawal. Estimates general level of functioning.
Anxiety	The tendency to be nervous, fearful, or worried about real or imagined problems.
Depression	Feelings of unhappiness, sadness, and stress that may result in an inability to carry out everyday activities or may bring on thoughts of suicide.
Hyperactivity	The tendency to be overly active, rush through work or activities without thinking.
Attention Problems	The tendency to be easily distracted and unable to concentrate more than momentarily.
Atypicality	The tendency to behave in ways that are considered "odd" or commonly associated with psychosis.

Withdrawal	The tendency to evade others to avoid social contact.
Adaptability	The ability to adapt readily to changes in the environment. (An adaptive scale).
SSIS: PRS	
Problem Behaviours (Composite)	Behaviours that interfere with either the acquisition or performance of socially skilled behaviours. Includes externalizing, internalizing, and atypical behaviors.
Social Skills (Composite)	Learned behaviours that promote positive social interactions while simultaneously discouraging negative social interactions.
Communication	E.g., Taking turns and making eye contact during a conversation, using appropriate tone of voice and gestures.
Cooperation	E.g., Helping others, sharing materials, and complying with rules and directions.
Assertion	E.g., Initiating behaviors, such as asking others for information, introducing oneself, and responding to the actions of others.
Responsibility	E.g., Showing regard for property or work and demonstrating the ability to communicate with adults.
Empathy	E.g., Showing concern and respect for others feelings and viewpoints.
Engagement	E.g., Joining activities in progress and inviting others to join, initiating conversations, making friends, and interacting well with others.
Self-Control	E.g., responding appropriately in conflict (disagreements, teasing) and non-conflict situations (taking turns and compromising).

Appendix C

Interpretation Guidelines by Test

Measure	Description
CAMS-R	Higher scores reflect greater levels of trait mindfulness.
DERS	Higher scores indicate greater levels of emotion dysregulation.
EQ-i: YV	Higher scores indicate better developed emotional and social capacity. • Markedly High (S.S. ≥ 130) • Very High (S.S. 120-129) • High (S.S. 110-119) • Average (S.S. 90-109) • Low (S.S. 80-89) • Very Low (S.S. 70-79) • Markedly Low (S.S. ≤ 70)
BASC-2: SRP, PRS	
Clinical Scales	Higher scores indicate greater behavioural/socioemotional concerns. • Clinically Significant (T-Score ≥ 70) • At-Risk (T-Score = 60-69) • Average (T-Score = 41-59) • Low (T-Score = 31-40) • Very Low (T-Score ≤ 30)
Adaptive Scales	Higher scores indicate higher levels of adaptive/positive behaviours. • Very High (T-Score ≥ 70) • High (T-Score = 60-69) • Average (T-Score = 41-59) • At-Risk (T-Score = 31-40) • Clinically Significant (T-Score ≤ 30)
SSIS: PRS	
Social Skills	Higher scores indicate individual greater positive social behaviors. • Above Average (S.S. > 115) • Average (S.S. = 85-115) • Below Average (S.S. ≤ 85)
Problem Behaviours	Higher scores indicate more behavioural concerns. • Above Average (S.S. > 115) • Average (S.S. = 85-115) • Below Average (S.S. ≤ 85)

Appendix D

Participant Information Questionnaire

This questionnaire should be completed by a parent/guardian of the participant, as it asks about early developmental history. If a parent/guardian is unavailable, a close relative who has knowledge of the individual's early history is acceptable. In order to establish the appropriateness of your son/daughter's participation, the researchers require background information about your adolescent. Please complete the following questionnaire.

Adolescent's Full Name: _____

Gender (circle): Male   Female

Adolescent's date of birth: Month _____ Day_____ Year _____

Age: _____

School: _____

Grade: _____

<u>Official Diagnosis</u>

What autism spectrum diagnosis has your adolescent received?
_____
_____

Who originally diagnosed your adolescent (name and title)?
_____
_____

How old was your adolescent at the time of the original diagnosis? _____

Has anyone else given a diagnosis to your adolescent? (Circle) Yes No

>   If yes, who gave the diagnosis and what is their title?
>   _____
>   _____

>   What was the diagnosis & how old was your adolescent when they received this
>   diagnosis?_____
>   _____

Has your adolescent been diagnosed with any other psychological disorders (If yes, please explain).

_____
_____
_____

Has your adolescent been diagnosed with any medical disorders (If yes, please explain, and also indicate when the diagnosis was given, who gave the diagnosis, and what their title was).

_____
_____
_____

Language Development

Did your adolescent receive speech therapy before the age of 5? (If yes, please explain- eg., where they received supports and how often they received speech supports).

_____
_____
_____

As far as you recall, how old was your adolescent when s/he began speaking in single words? How old was your adolescent when s/he began speaking in short but meaningful phrases?

_____
_____
_____

Has your adolescent ever experienced a head injury? (Circle)   Yes No

        If yes, were they unconscious?   Yes   No

If yes, for how long was your adolescent unconscious? _____

Was your adolescent hospitalized for the head injury? (Circle) Yes No

If yes, how long was the hospitalization? _____

Is your child currently taking any prescription medications? If so, please list the name and dosage of the prescription(s).

_____
_____

Appendix E

Mindfulness Home Practice Record Sheet

WEEK #: _____   **NAME: _____**

Day	What I practiced…	How long I practiced it (minutes)	Parent/Guardian Initial
Sunday			
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Saturday			

Appendix F

Teen Program Feedback Survey

We need your help to make this course better for other teens! Please help us by sharing with us what you thought about the class and any changes you think we should make ☺

What have you learned in this course?

_____

_____

_____

_____

_____

_____

_____

_____

How easy was it to learn about mindfulness?

Please mark your response with an X in the appropriate box

Very Hard	Hard	About Right	Easy	Very Easy

Comments _____

_____

_____

_____

_____

How much did you enjoy learning about mindfulness?

Did not like at all	Did not like	It was okay	Liked	Liked it a lot

What did you like best in this class?

_____

_____

_____

What did you like the least in this class?

_____

_____

_____

On average, how often did you practice mindfulness *outside* of class each week? (check box)

Infrequently (0-1 days/week)	Sometimes (2-3 days/week)	Frequently (4-5 days/week)	Everyday (6 + days/week)

Do you think you will continue practising mindfulness?

Please circle: YES   NO

If no, can you tell us why not?

_____

_____

If yes, which exercises do you think you will continue to practice? Check off all that apply.

☐	**.b** breathing exercise (stop, breathe and be)	☐	7-11 breathing exercise
☐	FOFBOC (Feet on Floor, Bum on Chair)	☐	beditation
☐	mindful eating	☐	mindful walking (Samurai walking)
☐	breath counting (counting number of breaths taken in a minute)	☐	Sitting like a Statue
☐	Three Good Things	☐	Ten Finger Gratitude Practice
☐	Finger breathing	☐	Other: _____ _____ _____

Would you recommend this program to a friend?

Please circle: YES   NO

Thank you very much for your participation and feedback! ☺

Appendix G

Program Feedback – Parent Form

We need your help to make this course better for other teens! Please help us by sharing with us what you thought about the class and any changes you think we should make ☺

Relationship to Adolescent: _____

*Adolescent's Age:*_____ _____   *Adolescents Gender (circle): M   F*

Do you feel that your child has benefitted from this course? (Please circle)

Yes   No

Please explain:

_____

_____

_____

_____

_____

_____

Do you feel that your child has learned something valuable about mindfulness as a result of taking this course? (Please circle)

Yes   No

*Comments*_____

_____

_____

_____

_____

_____

How much do you think your child enjoyed learning about mindfulness?

Please circle:

  Did not like it at all   Did not like   Somewhat liked   Liked   Liked it a lot

Do you plan to continue to encourage your child to practice mindfulness? (Please circle)

                                    Yes   No

If yes, which exercises do you think you will continue to practice? Check off all that apply.

□ **.b** breathing exercise (stop, breathe and be)	□ 7-11 breathing exercise
□ FOFBOC (Feet on Floor, Bum on Chair)	□ beditation
□ mindful eating	□ mindful walking (Samurai walking)
□ breath counting (counting number of breaths taken in a minute)	□ Sit like a Statue
□ Three Good Things	□ Ten Finger Gratitude Practice
□ Finger breathing	□ Other: _____ _____ _____

If no, please explain:

_____

_____

_____

_____

How easy was it for you and your child to incorporate mindfulness exercises in your daily routine? (Please check)

Very Hard	Hard	Neither easy nor hard	Easy	Very easy

Comments_____

_____

_____

Overall, were you satisfied with this course? (Please circle)

Yes   No

Please rate your <u>satisfaction</u> of the following areas, with 1 = very poor and 10 = very good

Program Content	
Home Practice Exercises	
Class Time/Day	
Instructor Quality	

Other Comments on your Satisfaction with this Course:

_____

_____

_____

_____

Are there any changes you would make to this course? (Please circle)

Yes   No

If yes, please explain:

_____

_____

_____

_____

_____

Would you recommend this course to other parents? (Please circle)

Yes   No

If no, please explain:

_____

_____

_____

_____

Thank you very much for your participation and feedback! ☺

Appendix H

Program Fidelity Questionnaire and Results

Program Fidelity Ratings by Independent Reviewer (1= Strongly Disagree, 5 = Strongly Agree)

Area Assessed	Mean Rating	SD
Treatment Adherence (Overall)	4.75	0.46
1. *All of the objectives of the lesson were achieved.*	4.75	0.50
2. *The session closely followed the lesson plan as outlined in the instructor's manual.*	4.75	0.50
Instructor Quality (Overall)	4.50	0.73
3. The instructor was able to engage students in the lesson.	4.50	
4. Instructor's use of language enabled for a clear understanding of lesson material.	4.50	1.00
5. Instructor's manner of delivery was consistent across the entire session.	4.75	0.50
6. Instructor addressed problem behaviours appropriately as they arose.	4.25	0.96

Appendix I

Results of Validity Scales from Select Self- and Parent-Report Measures

Validity Scale Results of the BASC-2: PRS, SRP and SSIS: PRS Presented as Frequencies

Scale	Pre-Training (*f*)			Post-Training (*f*)		
	Acceptable	Caution	Extreme Caution	Acceptable	Caution	Extreme Caution
BASC-2: PRS *F* Index	14	0	0	13	1	0
BASC-2: PRS Response Pattern	14	0	0	14	0	0
BASC-2: PRS Response Consistency	14	0	0	14	0	0
BASC-2: SRP *F* Index	13	0	1	14	0	0
BASC-2: SRP Response Pattern	14	0	0	14	0	0
BASC-2: SRP Response Consistency	13	1	0	14	0	0
BASC-2: SRP *L* Index	12	1	1	11	2	1
BASC-2: SRP *V* Index	14	0	0	14	0	0
SSIS: PRS *F* Index	12	2	0	13	0	1
SSIS: PRS Response Pattern	6	2	6	8	3	3
SSIS: PRS Response Consistency	7	4	3	10	2	2

Appendix J

Assessment of Normality for Subscale Differences Scores

Significance Levels form Shapiro-Wilk Tests and Skewness and Kurtosis Statistics for
Difference Scores

Difference Score (T1-T2)	p	Skewness	Kurtosis
CAMS	.945	-.04	.03
DERS			
Total Score	.012[*]	-1.83	5.20[**]
EQ-i:YV			
Intrapersonal EI	.234	-.48	-.48
Interpersonal EI	.020[*]	1.62	3.31[**]
Mood	.557	-.48	-1.44
BASC-2: SRP			
Emotional Symptoms	.377	-.76	.24
Anxiety	.450	.84	1.10
Depression	.094	1.37	2.70[**]
Attention Problems	.053	-.17	-.48
Hyperactivity	.803	-.22	.41
Social Stress	.927	.10	-.81
BASC-2: PRS			
Emotional Self-Control	.253	-.57	1.30
Behavioral Symptoms Index	.647	-.23	-.75
Anxiety	.477	.50	-.61
Depression	.023	1.08	.17
Hyperactivity	.218	.38	-.80
Attention Problems	.922	-.29	-.20
Atypicality	.665	-.32	-.51
Adaptability	.387	-.74	.46
Withdrawal	.398	-.29	-1.19
SSIS: PRS			
Social Skills	.723	-.26	-.64
Problem Behaviours	.425	-.34	-.07

*p < .05 ** value exceeds acceptable level (i.e. 0±2)