

The Influence of Mindfulness Training on Social Functioning in Children with Fetal  
Alcohol Spectrum Disorders

by

Lesley Baker  
B.Sc., University of Victoria, 2011

A Thesis Submitted in Partial Fulfillment  
of the Requirements for the Degree of

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in the Department of Psychology

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## Abstract

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It is well documented that children with Fetal Alcohol Spectrum Disorders (FASD) experience difficulties in several domains of social functioning. Despite this evidence, there are very few interventions that target underlying components of social behaviour. The current study aimed to add to this literature by implementing a mindfulness-based training program for adolescents with FASD. The goals of the study were to analyze the influence of mindfulness training on several aspects of social functioning including perspective taking, emotion regulation, and social problem solving. The study used a pre-post-test design that included 10 children with FASD (ages 12- to 17-years). Participants were assessed using experimental measures of social cognition at baseline and 8-week follow-up. In addition, caregivers completed measures that assessed children's emotionality and social skills at both time points. Analyses revealed that mindfulness training may be effective for improving perspective taking skills in children with FASD. No significant treatment effects were observed for emotion regulation, social skills or social problem solving. Overall, results from this study suggest that mindfulness training is a feasible intervention for children with FASD.

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## **Introduction**

Prenatal alcohol exposure (PAE) can result in damage to the structure and function of the central nervous system in a developing fetus. Affected individuals may be diagnosed under the umbrella term Fetal Alcohol Spectrum Disorder (FASD) which encompasses a range of developmental disabilities varying in severity of psychological, social, behavioural and physical impairments. The most devastating outcome, Fetal Alcohol Syndrome (FAS), is characterized by a pattern of physical and neurological birth defects. To receive a medical diagnosis of FAS, an individual must show signs of facial dysmorphism, prenatal or post-natal growth deficiencies, and central nervous system dysfunction. In terms of central nervous system impairment, damage may include abnormal brain development, neurocognitive deficits or mental retardation (Streissguth, 1991). Other conditions represented in this spectrum include Partial FAS (pFAS) and Alcohol-Related Neurodevelopmental Disorder (ARND).

Currently, FAS is the leading known cause of mental retardation in the Western World (National Institute of Alcohol Abuse and Alcoholism (NIAAA), 1990). It is also one of the leading causes of preventable birth defects and developmental delay in Canada (Koren, 2003). The exact rates of FAS are unknown, but current estimates suggest a rate of approximately 9 cases per 1000 births, resulting in thousands of children born affected by PAE each year (Health Canada, 2006). The disorder can affect anyone regardless of race, income or education level. Furthermore, there does not appear to be a “safe” amount of alcohol to consume or a safe time to consume it.

From birth, children with FASD experience significant behavioural and cognitive challenges in their everyday life. Research has identified several domains that are commonly affected in individuals with FASD, including executive functioning, abstract

reasoning, memory, attention, language, social functioning, and adaptive behaviour (Carmichael Olson, Feldman, Streissguth, & Gonzalez, 1992; Carmichael Olson, Feldman, Streissguth, Sampson, & Bookstein, 1998; Green et al., 2009; Mattson & Riley, 1998; Streissguth et al., 1986; Whaley, O'Connor, & Gunderson, 2001; Willford, Richardson, Leech, & Day, 2004). The long-term implications of prenatal alcohol exposure are also significant. Several longitudinal studies suggest that children with FASD are at greater risk for a number of secondary problems including academic failure, mental health problems, substance abuse problems and difficulties with the law (Carmichael Olson, et al., 1998; Streissguth et al., 1997).

An area of functioning that is particularly relevant to the development of later secondary problems is social functioning. Research indicates that children with FASD experience significant impairment in a number of social domains including interpersonal relationships, social communication and social cognition (Coggins, Timler, & Olswang, 2007; Greenbaum, Stevens, Nash, Koren, & Rovet, 2009; Thomas, Kelly, Mattson, & Riley, 1998). Given that social difficulties are associated with a number of negative outcomes (e.g., school dropout, psychopathology, criminality), it is important to develop and implement effective interventions that target underlying social deficits in children with FASD in order to reduce the likelihood of secondary disabilities (Greene, Biederman, Faraone, Sienna, Garcia-Jetton, 1997; Parker & Asher, 1987).

Currently, there is a paucity of evidence-based interventions targeting social deficits in children with FASD. The two social intervention studies that have been published have focused on training social skills (e.g., peer communication, entry into a group of children), providing social knowledge, and role-playing appropriate social behaviours (O'Connor et al., 2006; Timler et al., 2005). To date, no social intervention

studies have targeted affective aspects of social functioning in children with FASD.

Treatments that target emotion regulation and emotion understanding may be helpful for this population given the socioemotional and behavioural deficits reported in the literature. In addition, social interventions that simultaneously target emotion-related aspects of social functioning as well as cognitive aspects (e.g., attention training, inhibition) may be beneficial given that research shows a strong link between top-down cognitive influences and bottom-up emotional influences on self-regulation and information processing (Zelazo & Lyons, 2012).

The current study focused on two main research goals. The first goal was to examine the influence of a mindfulness-based intervention on aspects of social functioning in children with prenatal alcohol exposure. Pre- and post-measures of social functioning were examined in an effort to determine whether mindfulness training led to changes in parent-reports of social functioning and children's social strategizing. A second major goal of this investigation was to examine the relations between social functioning and two potential mechanisms by which mindfulness training may influence social functioning in children with FASD: perspective taking and emotion regulation. Ultimately, this study will provide information regarding the usefulness of a mindfulness intervention for enhancing social cognition in children with FASD.

This paper has been divided into three sections. The first section provides an overview of FASD; describes the impact of prenatal alcohol exposure on cognitive and behavioural functioning; and introduces social functioning as a primary deficit in children with FASD. In this section, two aspects of social functioning, namely affective perspective taking and emotional reactivity will be examined in depth. The second section reviews previous interventions used with children with FASD; provides a brief

overview of mindfulness-based training; and reviews the evidence for mindfulness interventions with children and adults. Finally, the third section of this paper integrates the findings described in the earlier sections by discussing mechanisms of mindfulness from a theoretical perspective.

### **A Brief History of FASD**

Anecdotal accounts of the adverse effects of alcohol on the developing fetus have been circulating for centuries. In fact, some argue that evidence of the association between alcohol and birth defects dates back to Judeo-Christian customs. For example, in Carthaginian tradition, men and women were forbidden to drink alcohol on their wedding night out of fear of producing a defective child (Streissguth, Landsman-Dwyer, Martin, & Smith, 1980). Aristotle purportedly remarked that “Foolish, drunken and harebrained women most often bring forth children like unto themselves, morose and languid” (Streissguth et al., 1980). In the 1700s, references to the adverse effects of alcohol were noted by doctors who reported birth defects in children of alcoholic mothers and described these children as “weak and feeble” (Nguyen, et al., 2011). Animal studies also provide early evidence for the damaging effects of PAE on the developing fetus. For example, in 1910, Stockard, found that exposing guinea pigs to alcohol during pregnancy resulted in early mortality of their offspring (as cited in Streissguth et al., 1980).

Regardless of historical accounts and animal research, clinical reports of the teratogenic effects of PAE were not scientifically published until the late 1960’s. In 1968, the first clinical account was published by French researcher Paul Lemoine and colleagues who reported facial anomalies and growth deficiencies in 127 infants exposed to alcohol during pregnancy. Following this publication, researchers in the United States published a series of case studies outlining the physical and developmental defects in

infants and children with PAE (Jones & Smith, 1973). From this research, the term Fetal Alcohol Syndrome (FAS) was coined.

### **Diagnosis**

Current diagnostic criteria for FAS require abnormalities in three areas: (1) prenatal and postnatal growth deficiency, (2) facial abnormalities, and (3) central nervous system dysfunction (Chudley et al., 2005). Growth deficiencies are defined by Canadian guidelines as evidence of prenatal or postnatal weight at or below the 10<sup>th</sup> percentile (Chudley, et al., 2005). In terms of facial features, the Canadian guidelines recommend evidence of three characteristic facial abnormalities: short palperable fissures, smooth philtrum, and a thin upper lip. Central nervous system dysfunction may be presented as structural brain abnormalities, neurological problems, low IQ, deficits in executive functioning and motor functioning, and abnormal behaviour. The Canadian guidelines recommend evaluating nine neurobehavioural domains: 1) hard and soft neurological signs; 2) brain structure (e.g., using magnetic resonance imaging [MRI]); 3) cognition (IQ); 4) communication: receptive and expressive; 5) academic achievement; 6) memory; 7) executive functioning and abstract reasoning; 8) attention deficit/hyperactivity; and 9) adaptive behaviour, social skills, social communication (Chudley et al., 2005). According to these guidelines, impairment in at least three of these areas is sufficient evidence for neurobehavioural dysfunction. This diagnostic approach is useful in that it takes into account the wide range of cognitive and behavioural deficits in children with PAE.

Individuals who have a confirmed history of PAE but do not present the full facial features or growth deficiencies are typically diagnosed with partial FAS (pFAS), or Alcohol-Related Neurodevelopmental Disorder (ARND). Although these individuals do not exhibit all of the physical features of FAS, their condition is equally severe as they

still present the neurobehavioural deficits. In fact, research suggests that it is the underlying neurological deficits that result in the most devastating consequences in terms of academic, social and occupational functioning (Riley & McGee, 2004; Aase, Jones, & Clarren, 1995). Often, the signs and symptoms of these conditions are more subtle, thus many individuals that fall under the umbrella of FASD go undiagnosed. Given that the majority of children with FASD are diagnosed with ARND and thus do not present the full features of FAS but do present the behavioural and cognitive problems, diagnosing these children early and providing support is a critical issue (Nguyen, Coppens, & Riley, 2011).

### **Social Functioning and Children with FASD**

In recent years, there has been an increasing amount of literature documenting deficits in social functioning in children with FASD (Carmichael Olson, et al., 1998; Greenbaum, et al., 2009; Kodituwakku, 2007; McGee, Fryer, Bjorkquist, Mattson, & Riley, 2009; Thomas, et al., 1998; Timler, 2000; Timler, Oslwant, & Coggins, 2005; Siklos, 2008; Streissguth et al., 1991; Whaley et al., 2001). These studies have found that children with FASD experience difficulties in a number of different areas of social functioning including interpersonal relationships (Thomas et al., 1998), social judgement (Kodituwakku, 2007), social cognition (Timler, 2000; Siklos, 2008; Greenbaum, et al., 2009) and social problem-solving (McGee et al., 2008). To date, the majority of these studies have used caregiver-reports to assess social functioning.

In a detailed investigation of the patterns of deficits in adolescents and adults with FASD, Streissguth and colleagues (1991) administered the Vineland Adaptive Behaviour Scale (VABS; Sparrow, Balla, & Ciccheetti, 1984) to caregivers of 43 adolescents aged 12- to 17-years with diagnosed FAS. Their results indicated that adolescents with FASD

have a low level of adaptive functioning and are most impaired on tasks assessing socialization skills including consideration of social consequences, deciphering subtle social cues, and maintaining reciprocal friendships. Interestingly, on the socialization scale of the VABS, individuals with FASD had a mean age equivalent of approximately 6 years of age. Given that social deficits appear to be considerably pronounced in adolescence, this period may be a particularly important time to intervene and address the social needs of children with FASD.

In a similar caregiver-report study, Thomas and colleagues (1998) used the social skills domain of the VABS to determine whether differences in social abilities between typically developing children and children with FAS are a result of differences in IQ. Three groups of children ages 5- to 12-years were compared in this study with each group containing equal sample sizes (N=15). The first group consisted of children with a diagnosis of FAS, the second group consisted of children with matched verbal IQ scores (in the lower range), and the third group consisted of typically developing children with verbal IQ scores in the average to above-average range. Based on caregiver reports, Thomas and colleagues found that all three groups differed significantly on the social skills domain of the VABS with children with FAS showing the greatest impairment. This finding suggests that deficits in social skills in children with FAS cannot be entirely accounted for by poor verbal intelligence.

Whaley and colleagues (2001) examined social and adaptive functioning in two groups of children: children with known prenatal alcohol exposure and children referred to psychiatric treatment with no known prenatal alcohol exposure. The purpose of this study was to determine whether social deficits are more pronounced in children with FASD in comparison to deficits observed in other clinical samples of children. They

found that children with prenatal alcohol exposure were significantly impaired on all three subdomains of the VABS (i.e., communication, socialization, daily living skills). However, there were no significant differences between the exposed group and referred group on any of the VABS outcome measures. Interestingly, they did find that children in the alcohol-exposed group showed significantly greater declines in the socialization domain with increasing age.

McGee and colleagues (2008) examined social problem solving in adolescents with and without prenatal alcohol exposure using a self-report social problem solving questionnaire. The scale includes two adaptive problem solving domains (positive problem orientation and rational problem solving) and three maladaptive problem solving domains (negative problem solving, impulsivity, and avoidance style). Compared to a group of age-matched controls, adolescents with PAE showed poorer performance on all domains of the problem solving inventory. Specifically, alcohol-exposed adolescents were found to be more impaired at identifying problems, making decisions and implementing solutions when faced with social situations. In addition, they were found to take a more impulsive, careless, or avoidant approach when solving everyday problems.

Other studies have used the Social Skills Rating System (SSRS; Gresham & Elliot, 1990; Schonfeld et al., 2006) to examine social functioning in children with FASD. Schonfeld and colleagues (2006) used the SSRS and the Behaviour Rating Inventory of Executive Functioning (BRIEF) to investigate the relation between executive functioning and social deficits in 98 school-age children with FASD. They found that, according to parent reports, children displayed clinically significant impairment in both social and executive functioning (EF) and that EF was predictive of social behaviours. However, according to teacher reports their social functioning was low

but within the average range. The discrepancies in reporting may be accounted for by the reporter's knowledge of normative child development and by the different contexts in which teachers and caregivers observe their children's behaviour. For example, teachers observe children in structured settings where their behaviour is likely different from their behaviour at home.

In a more recent study, Rasmussen and colleagues (2010) used the SSRS to investigate differences in social functioning between children ages 3- to 8-years with and without prenatal alcohol exposure who were referred to a Family Respite Care Program for behavioural difficulties. Thus, the purpose of the study was to examine whether children with FASD have unique or similar social skills when compared to a group with similar externalizing symptoms. Based on caregiver's and respite worker's evaluation of 37 children with PAE and 23 non-exposed children, it was found that children with PAE were more impaired on caregiver's ratings of responsibility, hyperactivity, and overall social skills. The authors concluded that children with PAE display a unique pattern of social skills deficits when compared to children with similar behavioural problems. Furthermore, the findings were consistent with Schonfeld and colleague's (2006) study in that caregivers rated children's social skills as more impaired than respite workers.

In sum, parent- and teacher-reports provide evidence to suggest that children with FASD experience considerable difficulty with several aspects of social functioning. In addition, their difficulties become significantly pronounced with age and can persist into adulthood. These findings are useful for providing a broad depiction of the social profile of individuals with FASD; however, they fail to describe the more subtle difficulties in social processing that this group may experience. Furthermore, several of these studies illustrate the discrepancies between parent and teacher evaluation of normative social

behaviour. Consequently, it is important to administer performance-based measures in addition to parent- and teacher-evaluations in order to directly examine social functioning in children with FASD.

### **Social Cognition and Children with FASD**

To date, there is a limited amount of research examining specific aspects of social functioning in children with FASD. Notable exceptions are the studies that have focused on the domain of social cognition (Greebaum, et al., 2009; McGee et al., 2009; Siklos, 2008; Way, & Rojahn, 2012). Social cognition refers to the higher-order cognitive processes involved in storing information about the self, others, and interpersonal norms that enable us to operate efficiently in the social world (Van Overwalle, 2008). Studies investigating social cognition in children with FASD will be summarized next.

Timler (2000) conducted one of the first systematic studies of social cognition in children with FASD. The study used the social information processing (SIP) model developed by Crick and Dodge (1994) to provide a theoretical framework for the study. According to this model, social information processing involves six steps: 1) encoding of social cues; 2) interpreting social cues; 3) goal selection; 4) strategy generation; 5) response decision; and 6) behavioural enactment. In Timler's (2000) study, she used social conflict vignettes to examine the third and fourth steps of the SIP model. After reading each vignette, children were required to answer a number of open-ended and forced-choice questions that corresponded to the goal selection and strategy generation steps of the SIP model.

Participants included nine children with FASD and nine typically developing children ages 8- to 11-years. The groups did not differ on the number of strategies generated to resolve a problem however; the FASD group produced fewer pro-social

strategies and more hostile strategies. Similarly, the FASD group tended to select goals that were considered hostile and coercive.

McGee and colleagues (2009) used the same SIP model (Crick & Dodge, 1994) to examine social cognition in children ages 7- to 11-years with FASD. However in this study, the authors attempted to assess all six steps of the SIP model to provide a more in depth look at social information processing. Children with and without prenatal alcohol exposure were required to view videotaped vignettes depicting problematic social situations. Next they were asked to answer questions that corresponded to each of the 6 steps in Crick and Dodge's (1994) SIP model. The responses of children with prenatal alcohol exposure were then compared to the responses of a control group matched on age, sex, socioeconomic status, and race. Based on the responses given, it was found that children with PAE had substantial impairment in all of the social information processing steps. In addition, the type of social situation dictated the type of difficulty suggesting that social deficits are situationally based. For example, situations that involved approaching a group of peers elicited difficulties in the goal selection, response generation, and response evaluation, whereas situations that involved negative social outcomes elicited difficulties in the encoding, attribution, response evaluation and enactment.

### **Social perspective taking.**

To date there is only one published study directly examining social-perspective taking in children with FASD (Greenbaum, et al., 2009). The purpose of this study was to compare social cognition and emotion processing in three groups of children: (1) children with FASD, (2) children with attention deficit hyperactivity disorder (ADHD), and (3) typically developing children. All children were between the ages of 6- to 13-

years. For the perspective taking tasks, children completed three subtests from a test battery developed by Saltzman-Benaiah and Lalonde (2007): (1) false belief, intention, deception and sarcasm, (2) interpretive theory of mind, and (3) strategic control of emotions. The false belief task involved judging the beliefs of characters and predicting their actions after listening to 10 short stories. The interpretive theory of mind task involved judging where puppets would think a hidden object was placed. Finally, the strategic control of emotions task involved selecting emotional expressions to represent characters in stories in which people hid their true emotions to protect others or themselves from embarrassment. No group differences were found for the false belief and interpretive theory of mind tasks; however, children with FASD were more impaired on the strategic control of emotions task. Unlike the other two tasks, strategic control of emotions requires knowledge of subtle differences in emotional expression such as differences between experienced and expressed emotion (Saltzman-Benaiah & Lalonde, 2007). Thus, the authors concluded that children with FASD may struggle more with affective perspective taking skills than with cognitive perspective taking skills. Although a relation between affective perspective taking and caregiver-reports of social functioning has not yet been examined, this area of perspective taking likely plays an important role in the quality of children's peer interactions (Denham, Zoller, & Couchoud, 1994).

A study by Rasmussen and colleagues (2009) looked at theory of mind skills (ToM) in 25 children with FASD and 28 typically developing children. Theory of mind refers to the ability to attribute mental states to oneself and to others. It also refers to the ability to understand that others can have beliefs and knowledge that differ from our own. It differs from social perspective taking in that many of the tasks used to measure ToM focus on inferring cognitive states of others (e.g., knowledge and beliefs) rather than

affective states. In addition, the ToM-tasks typically have less of an emphasis on social interaction. In this study, the authors administered two false belief tasks (the Mark Story and the Sally-Anne story). The authors found that older children (ages 6- to 8-years) with FASD performed more poorly on the ToM tasks compared to same age peers. However, there was no observed difference among the younger children (ages 4- to 6-years). This finding is discrepant from the findings of Greenbaum et al. (2009) that showed no significant differences on the false belief task between children with FASD and typically developing children. One explanation may be that the false belief tasks used in Rasmussen et al.'s study relied more strongly on executive functioning skills as children had to exercise working memory and verbal comprehension skills in order to achieve a high score on the story tasks. In Greenbaum et al.'s study, children were also provided with a picture to accompany the story which may have reduced the demands on working memory and verbal comprehension. If this is the case, children with FASD may struggle more with the language and executive requirements of ToM tasks rather than with the ability to infer the mental states of others.

### **Emotional regulation.**

Learning how to express and regulate our emotions effectively is a critical component of social functioning. Indeed, children who fail to fully develop this skill are reported to have lower levels of social functioning in school settings and increased peer conflict (Calkins Gill, Johnson, & Smith, 2001; Eisenberg et al., 1995). One aspect of emotion regulation is emotional reactivity which has been referred to by Zentner and Bates (2008) as “biological arousability, which includes arousal in neuroendocrine, autonomic and affective systems” in response to an emotional event. In early childhood, emotional reactivity has important adaptive purposes. For example, infants and toddlers

cry when they are injured to attract the attention of soothing caregivers. As children develop, however, they learn to regulate the intensity of their emotions in order to adapt to the cultural standards set in their specific contexts. According to Denham (1998), this level of emotional competence requires three components: (1) effective regulation of emotions, (2) knowledge about when and how to communicate emotional experiences, and (3) emotional understanding of one's own and others' emotional experiences. Consequently, deficits in any of these three areas may result in developmentally inappropriate emotional reactivity. Based on the aforementioned studies on social cognition (i.e., Greenbaum, et al., 2009; McGee, 2009; Timler, 2000) there is evidence that children with FASD have deficits in the latter two components (i.e., effective social communication and emotional understanding); however, recent evidence also suggests that they may experience deficits in emotional reactivity.

In support of this view, there is a significant amount of behavioural evidence indicating that individuals with FASD have difficulty modulating their emotional states. Increased rates of depression, anxiety, and disruptive behavioural disorders are common to this group (O'Connor et al., 2002) as well as reactive attachment disorders (O'Malley, 2007). Additionally, children with FASD commonly present with a variety of regulation disorders including hypersensitivity to environmental stimuli, under-responsiveness or withdrawal in response to stimuli or social situations, and increased impulsivity and sensation seeking (O'Malley, 2007).

Experimental research also indicates disruptions in emotion regulation in children with FASD. Kodituwakku and colleagues (2001) compared emotional-related aspects of executive functioning in twenty children with prenatal alcohol exposure and twenty matched controls. Children were administered an emotion-related learning test designed

to measure their ability to modify their behaviour following changes in reinforcement conditions. Participants were shown one of two images on a computer screen, a winning image or a losing image. If they responded correctly (i.e., they clicked the mouse when they saw the winning image), they would receive positive feedback; however, if they responded incorrectly (i.e., they clicked the mouse when they saw the losing image) they would receive negative feedback. After a certain number of trials, the reinforcement contingencies reversed. The researchers found that children with FASD had significantly more difficulty on this task than typically developing children. They required more trials to learn the task and they completed fewer overall reversals. Furthermore, difficulties in emotion-related learning were associated with parent-rated behavioural problems. Overall, these findings suggest that individuals with FASD have difficulty modulating their behaviour in response to emotion-related stimuli. Difficulty in this area could account for a number of behaviour problems including impulsivity, risk-taking, and hypersensitivity.

Finally, neuroimaging research provides further indication of deficits in emotional regulation in children with FASD. In a study by Bjorkquist and colleagues (2010) youth between the ages of 8- to 16-years with prenatal alcohol exposure and matched controls underwent structural magnetic resonance imaging (MRI). The purpose of the study was to examine the influence of prenatal alcohol exposure on the cingulate gyrus, an area thought to play a role in cognitive control and emotion regulation. Results showed that children with FASD had significantly smaller raw cingulated grey matter, white matter, and tissue volume compared to same-age controls. Given that the cingulate gyrus is active in tasks involving cognitive and emotional control, the researchers concluded that

the observed impairment in this region may have important implications for the deficits in social functioning, and the psychopathology observed in individuals with FASD.

In sum, children with FASD are often described as emotionally reactive and, as a result, are easily distressed and may experience a number of mood-related clinical disorders throughout their lifetime. The observed deficits in emotional competence may be in part due to difficulties in emotional understanding, expression and regulation. In addition, deficits in emotion regulation may be a direct consequence of underlying neurological differences. Given that emotional reactivity and emotion regulation are strongly associated with social functioning, it is important to address this area when designing interventions. Furthermore, to help children with FASD regulate the intensity of their emotional responses, it would be important to implement programs that improve Denham's three components of emotional competence and ultimately influence underlying neural systems responsible for emotion regulation. The following section will provide further detail on the literature examining interventions for children with FASD.

### **Current Interventions for Children with FASD**

Early intervention programs have been shown to enhance cognitive and socio-emotional development in children with neurocognitive impairment (Ramey, & Ramey, 1998). Indeed, in a comprehensive study examining risk and protective factors in adults with FASD, Streissguth and colleagues (2004) found that two of the best predictors of a healthier outcome were early diagnosis and early access to interventions. Although a large number of evidence-based programs exist for certain populations (e.g., children with ADHD), there is a paucity of empirically supported interventions for children with FASD. In fact, only a small number of evidence-based interventions have been published in the literature. Current intervention approaches include language and learning

programs (Adnams, 2007; Coles, Strickland, Padgett, & Bellmoff, 2007; Kabel, Coles, & Taddeo, 2007), social skills and communication programs (O'Connor et al., 2006; Timler, et al., 2005), and behavioural programs (Kerns, MacSween, Vander Wekken, & Gruppuso, 2010). The results of these interventions are encouraging in that the majority of studies have reported improvements in functioning following the intervention.

Although the body of literature examining interventions for children with FASD is growing, evaluation of these interventions indicate that many suffer from several methodological problems. For example, the majority of studies include small sample sizes and lack randomized control trials. In addition, many of the reported intervention studies are restricted to short-term rather than long-term outcomes, thus little is known about the stability of intervention effects over time. Finally, very few of the existing interventions target higher-order cognitive processes which are thought to be important for enhancing brain plasticity and producing outcomes that are generalizable to a number of different domains rather than just one specific domain (e.g., mathematics).

### **Mindfulness-Based Stress Reduction**

One potential intervention program that targets a range of cognitive and emotional domains is mindfulness-based stress reduction (MBSR). The eight-week MBSR program was originally developed by Jon Kabat-Zinn in 1979 to treat patients with chronic pain. Since then the application of the program has evolved to include a wide range of populations including individuals with depression, anxiety, brain injury and neurodevelopmental disorders (e.g., ADHD). The intensive 8-week training focuses primarily on the contemplative practice of mindfulness meditation. Mindfulness meditation has its origins in the traditions of Buddhism; however, the 8-week MBSR program developed by Kabat-Zinn is typically delivered as a secular program,

independent from religion. The MBSR program is designed to help individuals cultivate an open and accepting awareness of the present moment (Baer, 2010). This involves helping participants become more aware of their feelings, thoughts and body sensations. To facilitate this process, instructors introduce exercises that encourage participants to bring purposeful attention to their thoughts, emotions and bodily states while maintaining a kind and nonjudgmental attitude.

In recent years, there has been an increasing interest in the benefits of mindfulness training on adult cognitive function. Studies have shown that mindfulness training can lead to improvements in attention (Jensen, Gaden, Signe, Vibe, & Steen, 2012), cognitive flexibility, (Heeren, Van Broeck, & Philippot 2009), emotion regulation (Goldin & Gross, 2010), anxiety (Koszycki, Benger, Shlik, Bradwejn, 2007), and depression (Ma, & Teasdale, 2004). In relation to the current study, Azulay and colleagues (2012) found that MBSR training is beneficial for individuals with mild traumatic brain injury (mTBI). Specifically, after a ten-week MBSR program, individuals with mTBI reported significant improvements in satisfaction with their current functioning and improved self-efficacy for the management of their symptoms. The finding that individuals with brain injury can benefit from mindfulness training is encouraging given that individuals with FASD have also endured permanent damage to their brains.

There are also several studies examining the benefits of mindfulness training in children. In a school setting, Flook and colleagues (2010) examined the influence of mindful awareness practices (MAPs) on executive functioning (EF) in sixty-four elementary school children. Based on parent and teacher reports, they found significant improvements in EF, behavioural regulation and metacognition when comparing children with low EF to a control group. The authors concluded that mindfulness training may be

most effective for children who struggle with self-regulation skills. In a similar school-based study, Napoli and colleagues (2005) investigated the effects of mindfulness on attention, anxiety, social skills and problem behaviours. Participants between the ages of 6- to 9-years were assigned to either the mindfulness group (n = 114) or the silent reading control group (n = 114). Results showed that mindfulness training improved selective attention, test anxiety and social skills. The authors concluded that mindfulness training in a classroom context is helpful for reducing anxiety and improving attention.

Other studies have examined the effects of mindfulness training in clinical populations of children. Zylowska and colleagues (2007) demonstrated that mindfulness training can be an effective method for improving cognition and clinical symptoms in adolescents and adults with ADHD. Seven adolescents (mean age of 15.6 years) and eighteen adults (mean age of 48.5 years) participated in the eight-week intervention and completed several pre- and post-measures including measures of psychiatric symptoms and cognitive functioning. When adolescent's pre- and post-training results were combined with the adult self-report data, the researchers found that participants reported significant reductions in ADHD symptoms and improvements in executive components of attention.

Following this study, Bogels and colleagues (2008) examined whether mindfulness training for adolescents (ages 11- to 18-years) with externalizing disorders (e.g., ADHD, Oppositional Defiant Disorder [ODD], Autism Spectrum Disorder [ASD]) would lead to improvements in behaviour and cognition. The eight-week program was adapted from Segal, Williams and Teasdale's (2002) Mindfulness Based Cognitive Therapy (MBCT) and included meditation, yoga, awareness activities and homework exercises. Immediately after training, mindfulness was shown to improve attention,

internalizing and externalizing problems, subjective happiness, sustained attention and mindful awareness. Furthermore, these results were maintained at the 8-week follow up assessment.

These studies are unique in that they demonstrate the feasibility of mindfulness training as an intervention for adolescent populations with clinical symptoms; however, the methodological constraints prevent these studies from providing conclusions about the effectiveness of mindfulness in regards to cognitive and behavioural functioning. Without the presence of a control group, it is unclear whether the reported changes are a result of developmental strides over the weeks. In addition, generalizability of the two studies is limited by small sample sizes. Future studies will need to use more rigorous methods in order to obtain empirical evidence to support the effectiveness of these interventions. However, despite methodological limitations, the aforementioned studies suggest that mindfulness training may be a promising intervention for children with FASD who experience similar patterns of deficits as those children with ADHD and other neurodevelopmental disorders.

### **Mechanisms of Mindfulness**

It is clear that mindfulness meditation can lead to significant improvements in psychological and physical functioning. The mechanisms underlying these improvements however, are much less clear. Within the last ten years, researchers have started to address this gap, but an established theoretical model of mindfulness has yet to be developed. (Baer, 2003; Brown, Ryan, & Creswell, 2007; Shapiro, Carlson, Astin, & Freedman, 2006). One recent preliminary model of mindfulness meditation was developed by Hölzel and colleagues (2011). Their model is based on a comprehensive review of the neuropsychological and psychological research available on the topic of

mindfulness. Based on this research, Hölzel and colleagues (2011) propose four highly interrelated mechanisms through which mindfulness works to influence self-regulatory processes: (1) attention regulation, (2) body awareness, (3) emotion regulation, and (4) change in perspective on the self. The following section will focus on the emotion regulation component of this model, which has already been previously established as an important aspect of social functioning.

### **Emotion regulation as a mechanism of mindfulness.**

According to the model developed by Hölzel and colleagues (2011), emotion regulation is a major component of mindfulness meditation. Indeed, there are a number of studies suggesting that mindfulness leads to improvements in emotion regulation. For example, research has shown that mindfulness training can reduce emotional interference (e.g., interference of emotionally valent stimuli) (Ortner et al., 2007), improve mood-related symptoms (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010), and diminish emotional reactivity to negative stimuli (Arche & Craske, 2006). Additionally, neurological research indicates that mindfulness can lead to changes in activation in areas of the brain associated with emotion regulation including the dorsal medial prefrontal cortex, the anterior cingulate cortex and the amygdala (Hölzel et al., 2007).

Although there is evidence to support the notion that mindfulness meditation influences emotion regulation, the nature of this relation is still unclear. To address this, Hölzel and colleagues propose three elements of mindfulness that are responsible for the observed changes in emotion regulation: (1) reappraisal of aversive stimulus, (2) exposure to unpleasant emotions, and (3) extinction and reconsolidation. Reappraisal refers to the process of reconstructing difficult events as neutral or positive, exposure refers to engaging in sensations and emotional experiences on a moment-by-moment

basis, and extinction refers to the process of rewriting previously learned stimulus-response associations (Hölzel et al., 2011). These elements are elicited during practice where meditators allow themselves to fully experience their emotional and bodily states. Regardless of whether their feelings are positive or negative, they are encouraged to accept their experience for what it is and refrain from judgement. Consequently, by confronting difficult or uncomfortable emotions, mindfulness practitioners are better able to tolerate and accept their emotional states and effectively cope with negative emotional events as they arise.

Zelazo and Lyons (2012) propose an alternative developmental cognitive explanation of emotion regulation as a mechanism of mindfulness meditation. They suggest that mindfulness practice enhances top-down sources of control such as focused attention and inhibition by evoking a state of “purposeful reflection”. In this state, one’s attention is sustained in the moment rather than wandering in the past or future. The result is an increase in focused attention and cognitive flexibility, which in turn, reduces the influence of bottom-up processes such as emotional reactivity and anxiety.

To summarize, research indicates that emotion regulation is a central mechanism of mindfulness; however, it is still unclear which specific emotion regulation strategies are affected. One possible explanation is that mindfulness training influences a variety of interrelated strategies (e.g., increased top-down processing, cognitive reappraisal, and emotional flexibility) that are then applied in different contexts to effectively facilitate emotion regulation (Goldin & Gross, 2010). This view is corroborated by research showing a wide range of improvements in emotional regulation following mindfulness training. In relation to the current study, it was expected that mindfulness training would

improve emotion reactivity in children with FASD and that these improvements would correlate with changes in overall social functioning.

**Perspective taking as a mechanism of mindfulness training.**

In addition to examining the effects of mindfulness training on emotion reactivity, the current study predicted changes in perspective taking following the intervention. There are a number of reasons why mindfulness would influence perspective taking. First, previous studies with adults have found correlations between mindfulness and perspective taking (Krasner et al., 2009; Wachs & Cordova, 2007). For example, Krasner and colleagues (2009) examined the effect of a mindfulness-based program for physicians on a variety of measures including measures of mindfulness and perspective taking. They found that, following an 8-week treatment program, physician's mindfulness and perspective taking scores were significantly improved. Furthermore their results showed that mindfulness and perspective taking are positively correlated, suggesting that mindful individuals are more adept at noticing and identifying the emotional states of others. Similarly, a study by Block-Lerner and colleagues (2004) found a significant correlation between mindfulness and perspective taking scores based on self-report measures from a community sample of forty women.

Second, several studies have found a positive correlation between mindfulness and empathy; individuals who are more mindful are also more likely to demonstrate empathetic concern for others (Block-Lerner et al., 2007; Block-Lerner et al., 2004). Block-Lerner and colleagues (2007) propose that mindfulness training elicits an open and accepting attitude towards one's experiences, which in turn, opens one up to the experiences of others. Empathy and perspective taking are also highly related. In fact, perspective taking has been described as one of the prerequisites for empathy (Batson,

1991). It appears that the degree to which an individual can “walk in someone else’s shoes” influences their level of empathy. For example, in a study by Stotland (1969), participants were asked to either simply watch a videotape of someone in pain or watch the videotape and imagine how the person might feel. It was found that participants who adopted the perspective of the individual in pain demonstrated increased physiological indicators of empathy (e.g., vasoconstriction and sweating) and self-reported empathy. Thus, it is possible that increases in empathy reflect an underlying improvement in an individual’s ability to identify with and assume the perspective of others. This view is in line with Block-Lerner and colleagues (2007) who suggest that increased empathy is the outcome of improvements in perspective taking.

A final rationale for including perspective taking as an outcome measure in this study is based on preliminary research indicating that mindfulness leads to changes in brain areas associated with perceiving the viewpoint of others. Findings from a neuroimaging study revealed that making judgments from a third-person perspective activated the dorsal medial prefrontal cortex (dmPFC), an area that has shown to be more active in meditators (D’Argembeau et al., 2007; Hölzel et al., 2007). Other studies have reported that MBSR training is associated with increases in gray matter concentration within the cingulate cortex and temporo-parietal junction (Hölzel et al., 2010). Again, previous studies have found associations between these brain regions and perspective taking tasks (Lam, Batson, & Decety, 2007; Saxe & Kanwisher, 2005).

Given the apparent relation between mindfulness and perspective taking, this study examined whether mindfulness training influences perspective taking ability in children with FASD. It was assumed that increased awareness of their own emotional states through mindfulness training would lead to a deeper understanding of self, which

in turn would lead to a deeper understanding of others and a greater capacity for conceiving the feelings of others.

### **The Still Quiet Place: A Mindfulness Training Program for Children**

The current study implemented an adapted version of an already established mindfulness-based stress reduction program for children and adolescents (see Saltzman & Goldin, 2008). The program, titled the “Still Quiet Place” was developed by Dr. Amy Saltzman and comprises a detailed curriculum designed to introduce children and teens to the practices and concepts of mindfulness. Saltzman’s Still Quiet Place program is based on the adult MBSR program developed by Dr. Jon Kabat-Zinn and is delivered in a group format. Specific adaptations to the original program include shorter weekly sessions (e.g., 40 to 90 minutes), age appropriate language (e.g., concrete versus abstract language), additional exercises that are designed for children (e.g., thought parade practice, seaweed practice), and “Mindful Reminders” throughout the week to encourage children to practice. The curriculum includes a manualized, 8-week training guide and provides adaptations for different age groups and skill level. The program begins by introducing children to their breath and the stillness between the breaths. It then progresses to include more traditional mindfulness exercises that are introduced individually each week (e.g., mindful eating, mindful listening, body scan, loving kindness). In addition to the practices, each class explores the other group members’ experiences practicing mindfulness. In addition to the group discussion related to subjective experiences, concepts of mindfulness are also introduced and discussed (e.g., reacting versus responding, self compassion, self-perception, and kindness). Between each weekly session, children are asked to practice the Still Quiet Place exercises throughout the week

using their guided CD and through daily life practices (e.g., paying attention while brushing their teeth).

In terms of research examining the effectiveness of the Still Quiet Place program, a study by Saltzman and Goldin (2008) investigated the pre- and post-intervention effects of the 8-week training with children in grades four through six. Although the results are still preliminary, the researchers found that the program enhanced attention, decreased negative emotion reactivity, and improved children's self-compassion and general well-being. They also found that the amount of formal practice throughout the week explained a significant amount of variance in post-MBSR control of attention.

### **Summary and Purpose for the Current Study**

The literature clearly demonstrates that children with FASD have significant difficulties in social functioning. In addition, there is evidence to suggest that broad social deficits are due to more subtle impairments in underlying cognitive abilities such as self-regulation, emotion recognition and perspective taking. Although it is widely known that socioemotional difficulties can contribute to the development of later mental health problems, very few evidence-based interventions are available to ameliorate these difficulties in children with FASD. The studies that do exist examine interventions that target very broad and general areas of social functioning. Although deficits in general social competence have been reported in the literature, a growing body of research suggests that more specific aspects of social functioning are contributing to the social problems exhibited in children with FASD (Greenbaum, et al., 2009; Siklos, 2008; Timler, 2000; Schonfeld, Paley, Frankel, & O'Connor, 2007). Currently there are no published interventions that aim to remediate underlying cognitive processes as a method for improving overall social functioning in this group.

The current study aimed to examine the influence of mindfulness training on social functioning using a pre-test post-test design. Specifically, this study investigated whether mindfulness training leads to improvements in specific aspects of social functioning (i.e., emotion reactivity and perspective taking) in addition to more general measures of social functioning. Given that emotion reactivity and perspective taking are important elements of overall social functioning it was expected that these factors would be significantly correlated.

### **Hypotheses**

1. Children with FASD will demonstrate improvements in social functioning following the 8-week MBSR training as measured by parent-report questionnaires and performance-based measures.
2. Children with FASD will perform significantly better on the perspective taking measures following the mindfulness training program, consistent with previous research.
3. Based on parent-reports of emotion reactivity, children will show less emotion reactivity and greater emotion regulation following the 8-week intervention.
4. Given that it is proposed that perspective taking and emotion regulation are potential mechanisms of mindfulness and strongly related to social functioning, it is expected that there will be significant correlations between change in social functioning and change in perspective taking and emotion regulation.

### **Method**

#### **Participants**

Thirteen participants were recruited throughout the period of January 2012 to March 2013; however, the final sample consisted of 10 twelve- to seventeen-year-old children (2 females,  $M = 13.80$  years,  $SD = 1.99$ ). Children within this age range were

recruited for a number of reasons. First, during this period, children are capable of self-reflection and perspective taking (Selman, 1980). Having the capacity to skilfully self-reflect is important for this study because it is an essential component of mindfulness. Additionally, several of the experimental tasks used in this study require social perspective taking. A second reason for recruiting this age group was that during this time period, adolescents are experiencing a host of interrelated physical, social, cognitive and interpersonal changes that increase their vulnerability to internalizing and externalizing problems, negative peer influences and drug and alcohol influences (Galambos, Barker, & Almeida, 2003). Considering that the risk for developing secondary disabilities is much higher for children with FASD, early adolescence is an important time to intervene.

Specific exclusion criteria for this study included factors that would interfere with the child's performance in the group and on the measures: age, significant psychological, physical or medical impairment, and limited English fluency. Eligible participants diagnosed along the fetal alcohol spectrum were first identified through the administration centres of Victoria and Sooke school districts. Once children were identified, a letter of invitation was distributed to families via email or paper flyer. If the student and his or her guardian were interested in participating in the project, they were asked to contact the researcher. Flyers were also posted at community centres, grocery stores and yoga centres to seek out additional participants from the surrounding community. The public flyers included a description of the study and contact information for the researchers. Guardians that contacted the researchers were required to complete a telephone screening to determine eligibility and confirm their child's diagnosis. One child in the group did not have a confirmed diagnosis but was included on the basis that he met

all but one of the requirements for a diagnosis (i.e., confirmation from the biological mother).

The small sample reflects the challenges associated with recruiting children from this population for a long-term study. Although the rates of children with FASD are relatively high, the rates of diagnosed children are much lower. Thus, it can be difficult recruiting children who meet the criteria. Furthermore, in a small community such as Victoria, the appropriate infrastructure to connect with and access this population is not yet in place. Furthermore, given the time that was required for this study, some families may have not been able to balance the study among their other obligations. Lastly, given that mindfulness training for children is a relatively new concept, some families may have been hesitant to sign their children up for a program that is somewhat unfamiliar.

## **Measures**

### **Measure of intellectual functioning.**

*Wide Range Intelligence Test (WRIT; Glutting, Adams, Sheslow).* The Wide Range Intelligence Test is a standardized intelligence measure that was used to assess verbal reasoning and general cognitive functioning. The measure has been validated for individuals from 4 to 85 years of age and is reported to be highly reliable. The verbal subtasks include a word definition task and a verbal-reasoning task. The composite IQ score is based on verbal and non-verbal ability.

### **Mindfulness questionnaire.**

*Child and Adolescent Mindfulness Measure (CAMM; Greco, Baer, Smith, 2011).* To test for changes in mindfulness from baseline to post-intervention, the Child and Adolescent Mindfulness Measure was used. The measure is a 10-item self-report questionnaire based on a 5-point Likert scale ranging from 0 (“never true”) to 4 (“always

*true*”). The questions are designed to tap into an individual’s awareness of their thoughts, feelings and body sensations (e.g., “At school, I walk from class to class without noticing what I’m doing”). A total score was calculated by summing the 10 questions.

**Emotion reactivity measure.**

*Emotion Questionnaire (Rydell, Berlin, & Bohlin, 2003)*. The Emotion Questionnaire is a caregiver-report measure that was used to examine emotion reactivity and emotion regulation. It includes 40 items differentiated by four types of emotional content (i.e., fear, sadness, anger, positive emotion). For the purposes of this study, only the anger subscale was examined prior to and following the intervention. Caregivers responded to each item by rating their child’s emotion reactivity and regulation in specific situations on a 5-point Likert-type scale ranging from 0 (“*doesn’t apply at all*”) to 5 (“*applies very well*”). A total score was calculated for Total Emotion Dysregulation (ER) and Total Emotionality (EM) by summing the items within each category. High scores on both subscales corresponded to greater emotion dysregulation and greater emotionality respectively. Total Subscale scores for the anger dimension were also calculated for both emotion dysregulation and emotionality.

**Perspective taking measures.**

*Social Language Development Test (SLDT; Bowers, Huisingh, LoGiudice, 2010)*. Children’s perspective taking abilities were assessed using two subtests from the Social Language Development Test: Making Inferences and Social Interaction. The Making Inferences subtest required children to take the perspective of someone in a photograph and, based on the social cues (e.g., facial expression, context), say what the person is thinking as a direct quote from the character. The child then must tell the

examiner what cue facilitated their response. For the Social Interaction subtest, children were asked to assume the perspective of a character in a peer situation and consider the perspective of the other peer. Higher scores on both subtests indicated stronger perspective taking skills.

*Social Understanding Task (Bosacki & Astington, 1999).* Perspective taking skills were also evaluated using the Social Understanding Task, developed by Bosacki and Astington (1999). The measure contains two brief vignettes of ambiguous social scenarios designed to assess children's Theory of Mind (ToM) skills. The first story depicts a social situation in which two girls exchange nonverbal social gestures (e.g., nodding and nudging) before approaching a new girl who is alone on the swing set. The second story involves a similar scenario; however, the story characters are male. One additional vignette that used the same social situation but different context was also created. Following the presentation of a vignette, participants were asked a number of questions that tested four general areas: 1) conceptual role-taking, 2) empathetic sensitivity, 3) person perception, and 4) alternative explanations.

The detailed scoring guidelines developed by Bosacki and Astington (1999) were used to rate each answer. Responses to the questions in each of the four subscales were given a score of zero to three. Zero points were given for "I don't know" answers or tangential responses; one point was given for responses that include behavioural or situational descriptions; two points were given for responses that include a mental state or acts of communication or perception; and three points were given for more complex responses that integrated two or more mental states. In addition to each of the averaged subscale scores, a total score was obtained by summing all of the subscale scores resulting in a maximum score of 21 for each story.

In terms of psychometric properties, internal consistency for this measure has been found to range between .67 and .69 for the female and male stories respectively (Bozacki & Astington, 1999). An inter-rater reliability analysis revealed that Cohen's kappa for the female and male stories have been as high as .98 and .99 respectively.

### **Measures of social functioning.**

*Social Skills Rating Scale (SSRS; Gresham & Elliot, 1990).* Social functioning was assessed using the Social Skills Rating Scale. The measure is a 60-item norm-referenced measure that contains both parent-report and student-report questionnaires. The test contains three scales: Social Skills, Problem Behaviours, and Academic Competence. However, for the purposes of this study only the Social Skills and Problem Behaviours scales were used. Items within each scale measure behaviours such as cooperation, interpersonal skills, social communication, and empathy. Each item is rated by caregivers and students on a 3-point Likert scale: "0" = never, "1" = sometimes, and "2" = very often. Scoring the measure required converting raw scores into standard scores ( $M = 100$ ,  $SD = 15$ ). The SSRS has demonstrated strong psychometric properties with test-retest reliability coefficients ranging from .65 to .85 for caregiver-rated Total Social Skills.

*Social Conflict Vignettes, (adapted from Chung & Asher, 1996).* Thirteen conflict vignettes were also utilized to examine children's social functioning. Specifically, this measure assessed children's ability to select strategies and goals when faced with hypothetical peer conflict situations. Each vignette consists of approximately 40 to 50 words all written below a fourth grade reading level. Prior to beginning the open-ended task, participants are presented with a training protocol consisting of two sample vignettes, questions and responses. Next, participants are given the test items and

are required to rate a series of response strategies or goals based on a 5-point scale. For example, in reference to a scenario about finishing a puzzle, a strategy was “Ask my friend to help me finish the puzzle” or “Grab the puzzle piece back”. Three subscale scores were calculated for the goal selection task by averaging the child’s ratings for items shown to load on one of the three different factors: prosocial, antisocial, and avoidant. Four subscale scores were calculated for the strategy selection task by averaging the child’s ratings for items shown to load on one of four different factors: aggressive, prosocial, help seeking, and withdrawal.

### **Procedures**

A quasi-experimental pre-test post-test design was used. All children were assessed at baseline and reassessed within 2 weeks following the 8-week group (post treatment). Two separate mindfulness groups were conducted in order to maximize recruitment and provide therapy opportunities to outside communities. Group 1 ran from October, 2012 to December, 2012 (2 girls, 4 boys,  $M = 14.00$  years,  $SD = 1.90$ ) and group 2 ran from February, 2013 to April, 2013 (4 boys,  $M = 14.00$  years,  $SD = 2.40$ ). Both groups participated in the same intervention; however, the location of the groups differed. Group 1 took place in the child development lab at the University of Victoria whereas group 2 took place at Spencer Middle School in Langford, BC.

All testing for both groups took place within the child development lab at the University of Victoria. Children completed the questionnaires and tasks in a quiet room in the lab while their caregivers completed the questionnaires. During the baseline testing, which took place the week prior to the first mindfulness session; the measures were grouped into three sections: (1) perspective taking tasks, (2) social functioning tasks, and (3) the mindfulness questionnaire. The three groups of tests were

counterbalanced to remove any order effects. Children then completed 8 weekly group sessions of 60 minutes length. The therapy rooms for both groups contained floor mats organized in a circle; any distracting objects were moved either away from the room or to the outer edges. Given that one group was situated in a public school, it was more difficult to control for visual or auditory distractions. Post-test measures were collected within 2 weeks of completing the 8 sessions of MBSR. At the post-test session, children were administered the same three groups of tests; however, the vignettes were changed to minimize practice effects.

An overview of the mindfulness training program used in the current study is provided in Table 4. The MBSR program used in this study was based on the manualized treatment of MBSR established for typically developing children, namely the Still Quiet Place (SQP) (Saltzman & Goldin, 2008). The (SQP) curriculum, which was originally based on Kabat-Zinn's 8-week MBSR program, was further adapted for the current population. Adaptations were based on Dr. Smart and Dr. Kern's experience working with children and adults with cognitive impairment. Modifications to the SQP curriculum included changes in the order in which exercises were presented (e.g., the "feelings" practice moved to the 6<sup>th</sup> week), increased repetition of exercises and concepts, and text message reminders that were sent out daily throughout the week. Dr. Smart, Dr. Kerns and the author of the present paper delivered the program together. Dr. Smart has extensive experience teaching and practicing mindfulness and was responsible for creating the program manual. Dr. Kerns and the author of this paper both completed the 10-week Still Quiet Place online Training program with Dr. Amy Saltzman prior to starting the groups. The program covered many learning outcomes related to teaching mindfulness to children. In addition to formal training, all three instructors engaged in

their own personal mindfulness practice. The first stage of the program consisted of learning several different meditative practices including mindful eating, the “bodyscan” and sitting meditation. This stage also included learning how to label body sensations. Once students were comfortable with these basic practices, the second stage of the program taught children to shift their “flashlight” of attention to their thoughts and emotions. In this stage, the sessions focused more on monitoring automatic thoughts and drawing attention to the associations between automatic thoughts and emotions. There was also considerable discussion around how their thoughts and emotions influence their everyday interactions. Throughout the practice, the mindfulness instructors encouraged participants to share their experiences in open and safe discussions. Participants were also expected to engage in home practice and were provided with an MP3 player containing all of the practices discussed in each group. Each week the instructors would do “homework checks” to see if the children were practicing each day. Ethics approval for the research was obtained from the University of Victoria Human Research Ethics Board (Protocol Number 11-541) and the research was conducted in accordance with these standards.

Table 1. *Outline of Still Quiet Place Curriculum Adapted for Children with FASD*

	<b>Mindfulness Exercises</b>	<b>Topics of Discussion</b>	<b>Daily Homework</b>
Week 1	<ul style="list-style-type: none"> <li>• Mindful Eating</li> <li>• “Rest”</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion of the rules</li> <li>• Why am I here?</li> <li>• Introduction to Stress &amp; SQP</li> </ul>	<ul style="list-style-type: none"> <li>• Rest Practice (mp3)</li> <li>• Mindful eating</li> </ul>
Week 2	<ul style="list-style-type: none"> <li>• Mindful Eating</li> <li>• Being in the Body (like a body scan)</li> </ul>	<ul style="list-style-type: none"> <li>• Homework</li> <li>• “Auto Pilot”</li> </ul>	<ul style="list-style-type: none"> <li>• Being in the Body (mp3)</li> <li>• Mindful Tooth Brushing</li> </ul>
Week 3	<ul style="list-style-type: none"> <li>• Mindful Eating</li> <li>• “Flashlight Practice”</li> </ul>	<ul style="list-style-type: none"> <li>• Unkind Mind</li> <li>• Pleasant Events</li> <li>• Flashlight of attention</li> </ul>	<ul style="list-style-type: none"> <li>• Flashlight (mp3)</li> <li>• Record Pleasant Events</li> <li>• Look for “unkind mind”</li> </ul>

Week 4	<ul style="list-style-type: none"> <li>• Mindful Eating</li> <li>• Thought Watching</li> </ul>	<ul style="list-style-type: none"> <li>• Unpleasant Events</li> <li>• Suffering = pain X resistance</li> </ul>	<ul style="list-style-type: none"> <li>• Thought Watching (mp3)</li> <li>• Record Unpleasant Events</li> </ul>
Week 5	<ul style="list-style-type: none"> <li>• Mindful Eating</li> <li>• Stretch and Balance</li> </ul>	<ul style="list-style-type: none"> <li>• “holes in the road”</li> <li>• Reacting vs. Responding</li> </ul>	<ul style="list-style-type: none"> <li>• Stretch and Balance (mp3)</li> <li>• “Walking”</li> </ul>
Week 6	<ul style="list-style-type: none"> <li>• Mindful Eating</li> <li>• Feelings</li> </ul>	<ul style="list-style-type: none"> <li>• Feelings</li> <li>• Communication with others</li> </ul>	<ul style="list-style-type: none"> <li>• Feelings (mp3)</li> <li>• Notice when you get stuck in a hole</li> </ul>
Week 7	<ul style="list-style-type: none"> <li>• Mindful Eating</li> <li>• Loving Kindness</li> </ul>	<ul style="list-style-type: none"> <li>• Being kind to ourselves and others</li> </ul>	<ul style="list-style-type: none"> <li>• Loving Kindness (mp3)</li> <li>• Noticing kind moments</li> </ul>
Week 8	<ul style="list-style-type: none"> <li>• Mindful Eating</li> <li>• Exercise chosen by the group members</li> </ul>	<ul style="list-style-type: none"> <li>• What did we learn?</li> <li>• What does the still quiet place mean to us?</li> </ul>	<ul style="list-style-type: none"> <li>• Your choice</li> </ul>

### Statistical Analysis

Statistical analysis was conducted using IBM SPSS software, Version 20 and SYSTAT, Version 13. Prior to analysis, screening procedures were carried out to verify the assumptions required for running univariate and multivariate analysis of variance on all variables. Procedures included examining the data for missing values, errors in data entry, univariate and multivariate outliers, normality, and linearity. Next, descriptive analyses using independent-samples t-tests were carried out to examine whether the two groups were comparable at the start of the study. Univariate and multivariate repeated measures/mixed-model analysis of variance were also used to examine whether the mean change in the outcomes from pre to post differed in the two groups. Following the descriptive analysis, correlations were run to determine whether relations existed between the measures. Procedures for data analyses for the four research questions follows.

**Hypothesis #1:** Children with FASD will demonstrate improvements in social functioning following the 8-week MBSR as measured by parent-report questionnaires and performance-based measures.

Scores from the parent and child social skills rating scales (SSRS) were analyzed using separate repeated measures ANOVAs with an alpha level of .05. In total, three separate analyses were run; two corresponding to the Problem Behaviour and Social Skills domains from the parent questionnaire and one corresponding to the Social Skills domain from the child questionnaire. Raw scores, in addition to scaled scores, were examined to assess actual pre and post change within participants and provide a more sensitive measure of change. Raw scores are argued to be more sensitive as they use values associated with real change rather than values associated with a standardized sample (Kerns, Eso, Thomson, 1999). Seven subscale scores from Chung and Asher's (1996) Conflict Vignette task were submitted to univariate and multivariate repeated measures analysis of variance. Groupings of variables were derived from the correlation tables which showed relations between two different sets of subscales: 1) prosocial goals, prosocial strategies, and avoidance and 2) help-seeking and withdrawal. Based on these findings, the two sets were submitted to multivariate analysis of variance. No relations were found between the antisocial and aggression subscales so these variables were ran independently.

**Hypothesis #2:** Children with FASD will perform significantly better on the perspective taking measures following the mindfulness training program, consistent with previous research.

Scaled scores and raw scores from the Inference and Social Interaction subtests of the SLDT were submitted to a repeated measures analysis of variance with an alpha level

of .05. Similarly, total pre- and post-scores for Bosacki and Astington's Social Understanding Task were calculated and a repeated measures ANOVA was used to assess significant differences between time one and time two.

**Hypothesis #3:** Based on parent-reports of emotionality, children will show less emotion reactivity and greater emotion regulation following the 8-week intervention.

Separate repeated measures ANOVAs were run to assess whether scores on four separate subscales of the Emotion Questionnaire changed from pre-test to post-test. Overall scores for emotion regulation and emotionality were included in the analysis as well as subscale scores for anger calculated for both emotion regulation and emotionality.

**Hypothesis #4:** Given that it is proposed that perspective taking and emotion regulation are potential mechanisms of mindfulness and strongly related to social functioning, it is expected that there will be significant correlations between change in social functioning and change in perspective taking and emotion regulation.

Pearson's correlation tests were used to compare the relations between pre and post change in social functioning measures (i.e., the conflict vignettes and SSRS questionnaires) and change in perspective taking and emotion reactivity measures (i.e., the social understanding and SLDT tasks, and the parent-ratings of participants emotion reactivity).

In reading the following results, it is critical to be aware of the small sample size used in this study and, consequently, the limits this poses to interpreting the data. In particular, group differences at time 1 and time 2 should be interpreted with caution. Although the N was small, group comparison analysis as opposed to more idiographic

approaches to analyzing the data were carried out in order to obtain a sense of the efficacy of the program for this particular population.

## **Results**

### **Data Screening**

Missing data. After visually inspecting the data, several of the variables in the data set were found to be missing. Specifically, one variable was missing one data point (mindfulness), four variables were missing two data points (Inferences, Social Interaction, parent-rated problem behaviours and parent-rated social skills), three variables were missing three data points (total emotionality (EM), Total Emotion Dysregulation (ER), child-rated social skills), and two variables were missing four data points (Anger ER and Anger EM). To assess whether the data were missing completely at random, Little's Missing Completely at Random (MCAR) test was applied. The MCAR procedure is chi-squared statistical method that tests whether identifiable patterns of missing data exist within a dataset. Little's MCAR test produces a single test statistic that summarizes the information within a dataset as opposed to less ideal methods that use case-by-case procedures that result in multiple test statistics (Little, 1988). The Little's MCAR test obtained for the current study revealed that the data was indeed missing at random (i.e., no statistically significant deviation from randomness was found),  $\chi^2 = 9.991$ ,  $df = 13$ ,  $p = 0.695$  (within SYSTAT 13). Given that the missing data was found to be completely random, the expectation-maximization (EM) procedure was used to compute the Maximum Likelihood (ML) estimates for the missing data. EM is an iterative method that provides estimates of the mean vector and covariance matrix for a set of parameters. The iteration procedure involves two steps. In the first step, missing values are estimated based on the observed values in the data set. Next, the new estimated

data set is processed a second time and the covariance matrix and vector mean are updated. Finally, a new data set is estimated based on the updated matrix and mean vector (Dempster, Laird, Rubin, 1977). The EM method for dealing with missing values is simple to implement, numerically stable and widely recognized as an acceptable method in the psychological sciences (Couvreur, 1999). All analyses were based on the sample with imputed values unless otherwise noted.

Outliers, normality, and linearity. Graphical and numerical measures were taken to assess for univariate outliers. The box plots and normal probability plots showed no univariate outliers in the data set. Further support for this interpretation was found by visually examining z-scores for the variables, which showed no scores larger than an absolute value of three. To detect multivariate outliers, bivariate plots were evaluated. After a visual inspection of plots it was determined that there were no bivariate outliers in the data set. In terms of skew, prosocial, aggression, and avoidance subscales of the Social Conflicts Vignettes (SCV) test as well as parent-rated social skills were shown to be moderately skewed (skewness = -1.657, 1.931, -1.605, 1.87 respectively). Violations of kurtosis were also observed on the aggression, avoidance and parent-rated social skills variables (kurtosis = 4.391, 2.90, 3.44 respectively). Q-Q probability plots for each pre and post variable indicated that data were approximately normally distributed for all variables. Notably, the post avoidance and pre and post aggression variables deviated somewhat from normality. However, since the skewness and kurtosis values were not especially problematic for the abovementioned variables, no transformations were made on the data.

### **Descriptive Statistics**

Of the 10 children recruited to participate in the intervention, all 10 completed baseline and 8-week post-treatment phases of the study. Six of the children (4 males,  $M = 13.83$  years,  $SD = 1.94$ ) completed the testing and intervention stages of the study during the time period of October 2012 to January 2013 (group 1). The remaining four children (4 males,  $M = 13.75$  years,  $SD = 2.36$ ) completed the group during the period of March 2013 to May 2013 (group 2). Groups did not differ significantly at baseline in age. Standard Verbal IQ scores for group 1 ( $M = 86.2$ ,  $SD = 8.25$ ) did significantly differ from group 2 ( $M = 63.75$ ,  $SD = 20.07$ ) at baseline ( $t(8) = 2.50$ ,  $p < 0.05$ ); however, an analysis of the distribution showed an outlier in group 2. When removed, the difference was no longer significant ( $t(7) = 2.15$ ,  $p > 0.10$ ). In terms of standard scores for overall cognitive functioning, group 1 ( $M = 89.6$ ,  $SD = 10.73$ ) scored significantly higher than group 2 ( $M = 62.5$ ,  $SD = 15$ ) at baseline ( $t(8) = 4.29$ ,  $p < .01$ ). With the outlier removed from group two, group 1 still scored significantly higher in comparison to group 2 ( $M = 69$ ,  $SD = 9.17$ ,  $p < 0.05$ ).

Baseline scores on the parent SSRS revealed that caregivers, on average, were rating children in the low average clinical range on the Social Skills dimension ( $M = 80.8$ ,  $SD = 13.9$ ); however, standard scores ranged from mild impairment to average functioning. On the Problem Behaviour dimension of the SSRS, caregivers were rating children in the high average range in terms of clinical severity ( $M = 115.7$ ,  $SD = 17.9$ ). However, on this dimension, scores ranged from low average (e.g., few reported problem behaviours than average) to very superior (e.g., significantly more problem behaviours than average).

On the Social Conflict Vignettes, children were scoring almost at ceiling on the prosocial items (e.g., an average score of 4.3 out of a possible score of 5 at baseline).

Baseline scores also indicated that they were giving low ratings to aggressive strategies (e.g., an average score of 2 out of a possible score of 5). On the avoidance, help seeking, antisocial and withdrawal items, children's scores appeared to be relatively distributed with average scores in the mid range (e.g., 2.7 – 3.8).

On the Social Language Development Test (SLDT), children's average baseline scores on the Inferences subscale were in the borderline impaired range compared to same age peers ( $M = 78.2$ ,  $SD = 11.52$ ). However, scores on this task ranged from mildly impaired to average functioning. Baseline data on the Social Interaction subscale revealed that children were performing within the average range ( $M = 98.7$ ,  $SD = 10.79$ ) with scores ranging from low average to average.

Total scores on the Social Understanding questionnaire (summing scores at time 1 and time 2) revealed that children's total social understanding score was lower compared to a sample of one hundred and seventy-two 6<sup>th</sup>-grade children who completed the same measure (17.80 and 24.20, respectively) (Boasacki, 1998).

The average baseline score on the Emotionality subscale of the Emotion Questionnaire was 50.1 ( $SD = 10.21$ ) out of a possible score of 75, with high scores indicating greater emotionality (i.e., a more intense presentation of emotions). On the Emotion Dysregulation subscale of the Emotion Questionnaire the average baseline score across participants was 76.90 ( $SD = 11.51$ ) out of a total possible score of 125, with higher scores indicating greater emotion dysregulation.

Baseline scores on the Child and Adolescent Mindfulness Measure (CAMM) ranged between 17 and 36 out of a total possible score of 40. The average total score at baseline was 25.60 with a standard deviation of 5.20. This finding is comparable to mean scores reported for a sample of typically developing children in grades 7 to 8 ( $M = 23.22$ ,

$SD = 7.41$ ) and children in grades 9 to 10 ( $M = 24.52$ ,  $SD = 7.50$ ) (Greco, Baer, & Smith, 2011).

**Group 1 and group 2 differences on social measures.** No significant differences between the groups were found for any of the baseline measures. However, visual inspection of the group statistics showed a pattern suggesting greater variability on the baseline measures for group 2. Regarding differences in pre and post change between the two groups, repeated measures/mixed-model analysis of variance (ANOVA) showed significant interactions for a number of variables. Group 2 showed significantly greater change from time 1 prosocial strategizing to time 2 prosocial strategizing in comparison to group 1,  $F(1,6) = 5.70$ ,  $p = 0.04$ . Surprisingly, the change was in the opposite direction as expected (i.e., a decrease in selection of prosocial strategies). A significant interaction was also found for the social understanding task indicating that group 1 showed improvements in social understanding from time 1 to time 2 whereas group 2 showed declined performance at time 2,  $F(1,8) = 9.15$ ,  $p = 0.02$ . Finally, a significant interaction was observed for the anger emotionality scores (valid scores only) with group 2 showing improved performance and group 1 showing stable performance across pre and post testing sessions,  $F(1,4) = 9.31$ ,  $p = 0.04$ .

### **Social Functioning Treatment Effects**

Table 1 presents the results for this domain. There were no significant treatment effects for the Social Conflict Vignette subscales or the SSRS domains. On the Social Conflict Vignettes test, trend-level effects were seen for the Prosocial Strategy subscale,  $F(1,9) = 3.74$ ,  $p = .09$ ,  $d = 0.63$ , suggesting a trend towards selecting fewer prosocial strategies following the intervention. No treatment effects were observed for the Problem Behaviour and Social Skills domains of the SSRS. On the parent-rated Problem

Behaviour scale, trend-level effects suggested that children were demonstrating fewer problem behaviours post-intervention,  $F(1,9) = 3.75$ ,  $p = .09$ ,  $d = 0.22$ . However, the calculated effect size was still within the ‘small’ range according to Cohen’s guidelines (Cohen, 1988). Raw scores from the three SSRS domains were also submitted to a repeated measures ANOVA; however, in similarity to the scaled score results, no significant findings were observed.

Table 2. *Change in Social Functioning Scores From Time 1 to Time 2.*

Measure	N	Pre-treatment		Post-treatment		Repeated Measures ANOVA			
		Mean	SD	Mean	SD	F	df	p	Cohen’s d
Prosocial Goals	10	4.20	.95	3.94	1.11	0.71	1, 9	0.42	0.25
Prosocial Strategies	10	4.03	0.40	3.70	0.62	3.74	1, 9	0.09	0.63
Help-seeking	10	2.61	1.11	2.67	1.05	0.02	1, 9	0.89	-0.06
Withdrawal	10	2.67	1.15	2.70	1.19	0.01	1, 9	0.94	-0.03
Avoidance	10	3.72	0.94	3.95	1.25	0.30	1, 9	0.60	-0.21
Antisocial	10	3.36	0.67	3.09	0.73	1.32	1, 9	0.28	0.39
Aggression	10	2.16	1.26	1.67	0.72	1.25	1, 9	0.29	0.48
Social Skills Student	10	95.67	18.41	103.50	19.34	1.05	1, 9	0.33	-0.41
Social Skills Parent	10	80.73	13.90	78.46	11.00	0.89	1, 9	0.37	0.18
Problem Behaviours	10	115.68	17.91	112.05	15.09	3.75	1, 9	0.09	0.22

\* $p < .05$ , \*\* $p < .01$

### **Perspective taking Treatment Effects**

Results for perspective taking data are shown in Table 2. No significant treatment effects were observed for the Inferences and Social Interaction domains of the SLDT.

However, when raw scores from the SLDT were submitted to a repeated measures

ANOVA, a significant treatment effect was observed for the Inferences ( $F(1,7) = 12.44$ ,

$p = 0.01$ ,  $d = -0.85$ ) and Social Interaction ( $F(1,7) = 11.67$ ,  $p = 0.01$ ,  $d = 0.38$  subtests).

The significant result for the Inferences task suggests that children were more skilled at taking the perspective of another at time 2. In contrast, the raw score data for the Social Interaction task suggests that children were performing more poorly at time 2.

Due to the significant discrepancy in change from time 1 to time 2 across both groups on the Social Understanding Task, the data was analyzed separately on this measure. A significant treatment effect was observed for group 1 but not group 2,  $F(1, 5) = 13.00$ ,  $p = 0.02$ ,  $d = -0.76$ .

Table 3. *Change in Perspective Taking Scores From Time 1 to Time 2.*

Measure	N	Pre-treatment		Post-treatment		Repeated Measures ANOVA			
		Mean	SD	Mean	SD	F	df	p	Cohen's d
Inferences	10	78.25	11.52	81.25	6.71	0.98	1, 9	0.35	-0.32
Social Interaction	10	98.62	10.79	96.13	10.17	3.06	1, 9	0.11	0.24
Inferences (Raw Scores)	8	1.75	2.18	3.75	2.54	12.44	1, 7	0.01*	-0.85
Social Interaction (Raw Scores)	10	9.38	1.68	8.75	1.67	11.67	1, 7	0.01*	0.38
Social Understanding Group 1	6	9.33	2.80	11.50	2.88	13.00	1, 5	0.02*	-0.76
Social Understanding Group 2	4	8.25	0.96	5.00	3.16	2.50	1, 3	0.45	1.39

\* $p < .05$ , \*\* $p < .01$

### Emotion Regulation Treatment Effects

Table 3 presents the results for the emotion regulation analyses. The analyses found no significant treatment effect for Total Emotion Regulation (ER), Total Emotionality (EM), Anger ER, and Anger EM. Trend-level effects were observed for Total Emotion Regulation suggesting a trend towards greater emotion regulation

following the intervention,  $F(1,9) = 5.05, p = 0.05, d = 1.02$ . However, an analysis of the valid data showed a higher p-value and considerably smaller Cohen's effect size,  $F(1,5) = 1.27, p = 0.31, d = 0.18$ .

Table 4. *Change in Emotion Dysregulation from Time 1 to Time 2.*

Measure	N	Pre-treatment		Post-treatment		Repeated Measures ANOVA			
		Mean	SD	Mean	SD	F	df	p	Cohen's d
Total Emotion Dysregulation	10	76.86	11.51	67.15	6.99	5.05	1, 9	0.05	1.02
Total Emotionality	10	50.14	10.20	49.57	17.39	0.03	1, 9	0.87	0.04
Anger (ER)	6	19.00	4.83	17.83	0.98	0.32	1, 5	0.60	0.33
Anger (EM)	6	14.00	4.65	11.83	4.54	3.50	1, 5	0.12	0.47

\* $p < .05$ , \*\* $p < .01$

### **Mindfulness Treatment Effects**

To assess whether children showed improvements in self-reported mindfulness following the intervention, valid data (i.e., no imputed data) from the mindfulness questionnaires was submitted to a repeated measures ANOVA. No significant treatment effect was found; however, a trend towards an increase in reported mindfulness at time 2 was observed,  $F(1,9) = 4.03, p = 0.08, d = -0.73$ .

### **Difference Correlations**

Pearson's bivariate correlations for difference scores across the three domains of variables (i.e., Social Functioning, Perspective taking, and Emotion Regulation) were analyzed next. To avoid biased correlations, variables in which the two groups differed significantly in change across time 1 and time 2 were not included in the analysis (i.e., Prosocial Strategy, Anger EM, and Social Understanding) as significant findings indicated heterogeneous groups on these variables. Analysis revealed significant negative correlations between change in Prosocial Goals and Mindfulness ( $r = -.731, p = 0.02$ ),

change in Perspective Taking and parent-rated Social Skills ( $r = -.712, p = 0.02$ ), and change in Mindfulness and Total EM ( $r = -.831, p = 0.003$ ). A significant positive correlation was observed between change in parent-reported Problem Behaviour and Total Emotion Dysregulation ( $r = .652, p = 0.04$ ), change in Avoidance and Total EM ( $r = .650, p = 0.04$ ), change in Prosocial Goals and Total EM ( $r = .836, p = 0.003$ ) and change in Anger ER and Problem Behaviours ( $r = .887, p = 0.02$ ). However, after further screening of the bivariate plots, and z-scores for the difference variables, an outlier was observed within the difference in Total Emotionality variable. Thus, correlations that include this variable are uninterruptable. Indeed, once eliminated, the relations between change in Mindfulness and Total Emotionality, and change in Avoidance and Total Emotionality were no longer significant. No other bivariate or outliers were observed.

### **Discussion**

It is well documented in the literature that children with FASD demonstrate social deficits in a number of different areas (McGee et al., 2009; Greenbaum, Stevens, Nash, Koren, & Rovet, 2009; Thomas, Kelly, Mattson, & Riley, 1998; Whaley et al., 2001). Further, it has been suggested that difficulties with social functioning in children with FASD may put them at greater risk for developing future secondary disabilities (e.g., mental health problems, drug and alcohol abuse, and delinquency) (Greenbaum et al., 2009; Schonfeld, Mattson & Riley, 2005). Given the widespread implications of social deficits, it is important to examine the efficacy of interventions that target this domain.

A review of the current literature indicates that very few social interventions have been developed and implemented for children with FASD. Studies that have been conducted on this topic have concentrated on improving social knowledge, training social skills, and engaging in appropriate social communication (O'Connor et al., 2006; Timler

et al., 2005). These interventions are valuable because they improve children's awareness of appropriate reactions and provide them with opportunities to model and practice appropriate social behaviour. However, given the deficits reported in socioemotional functioning and top-down influences of control (e.g., inhibition, attention regulation) it is also important to implement interventions that target these important aspects of social functioning. Additionally, it has been shown that social knowledge and action do not always correspond. Indeed, Timler (2000) found that children with prenatal alcohol exposure are able to demonstrate basic social knowledge but have difficulty applying the knowledge in hypothetical social situations. Thus, the current study aimed to address this by implementing a mindfulness training intervention for children with FASD that theoretically targeted emotion and cognitive processes underling social behaviour.

The current study adds to the FASD intervention literature by examining the efficacy of an 8-week mindfulness-training program in adolescents affected by prenatal alcohol exposure. The influence of mindfulness training on social functioning, perspective taking and emotion regulation was examined using parent-report measures and experimental tasks. The findings suggest that children did not improve on social functioning, perspective taking, and emotion regulation measures following the intervention. These findings were surprising given that perspective taking and emotion regulation are thought to be central mechanisms of mindfulness. Additionally, these two mechanisms are closely related to social performance. Factors responsible for this outcome will be further discussed in later sections. However, while discussing the results and interpreting the findings, it is important to be mindful of the limitations of the study design (i.e., pre- post-design with no control) and small sample size.

Although only a few significant treatment effects were observed, a number of the measures indicated a trend towards enhanced performance following the intervention. In addition, interesting relations between mindfulness, perspective taking, emotion regulation and social measures were observed. In the next sections, the four primary hypotheses that were tested in the current study will be discussed in order as well as the results from the Children and Adolescent Mindfulness Measure (CAMM).

### **Assessing Mindfulness Based on the CAMM**

To evaluate changes in mindfulness skills, the CAMM was administered at pre-test and post-test. The CAMM provides a measure of how mindfully one is responding to everyday life (e.g., walking between classes at school). Overall, the baseline scores show that children with FASD were rating themselves comparably to typically developing children in the same age range. This suggests that children with FASD do not show developmental delays in different facets mindfulness (e.g., acting with awareness, accepting without judgement, observing thoughts and feelings). In terms of pre- and post-test change, children were consistently scoring higher at time 2; however, the change was not enough to yield significant results. This null finding could be due to the fact that children were scoring high on this measure to begin with. Thus, developmental restrictions on how ‘mindful’ one can be at this age may limit the amount of change that can occur from time 1 to time 2.

### **Hypothesis #1: Mindfulness Training and Social Functioning**

Mindfulness training has been shown to improve social skills in typically developing children and children with externalizing disorders (Bogels et al., 2008; Napoli et al., 2005). In addition, it is thought to target a variety of processes important for social

functioning including self-regulatory processes, emotion reactivity and attention (Hölzel, 2011). Consequently, it was hypothesized that children with FASD would show improvements on two groups of measures: 1) the SSRS measures (i.e., parent- and student-rated Social Skills and Problem Behaviours) and 2) the Social Conflict Vignettes. In terms of the SSRS measures, analyses showed that adult's ratings of their children's social skills and problem behaviours after the 8-week intervention were equivalent to their ratings prior to the intervention. Children's ratings of their own social skills revealed a similar pattern. A trend emerged on the Problem Behaviour domain of the SSRS that suggested parents were noticing fewer problem behaviours following the intervention. However, in general, the hypothesis that children would demonstrate improved functioning on the SSRS measure was not supported.

In regards to the Social Conflict Vignettes, children's selection of goals and strategies did not differ from time 1 to time 2 across the subscales. This is contrary to the expectation that children would select more prosocial goals and strategies and fewer antisocial goals and strategies after the 8-week training. Surprisingly, a trend was observed on the Prosocial subscale that suggested that children were less inclined to select prosocial strategies at time 2 in comparison to time 1. Prosocial strategies included actions that contained a polite response, compromise, or verbal assertion (e.g., "*I would like my lunch back*"). However, a closer examination of the data revealed that the majority of children scored high on both prosocial subscales at time 1 and time 2. Therefore, this result must be interpreted with caution.

The finding that children's social functioning was not enhanced after mindfulness training can be attributed to several different factors. First, it is possible that the types of

social behaviours assessed by the SSRS are difficult to change in the course of an 8-week training program. Indeed, some of the items on the SSRS reflect behaviours that are embedded in a rich web of individual factors including one's identity, and self-concept (e.g., "is self-confident in social situations"). In support of this explanation, other intervention studies using the SSRS have reported similar results. Ozonoff and Miller (1995) used the SSRS to measure treatment effects following an 18-week theory of mind intervention for children with autism. Although children showed improvements in theory of mind performance, the change did not transfer to general ratings of social functioning on the SSRS. Similarly, after a 10-week social skills intervention, parents reported no changes in social functioning even though the child data suggested significant improvements in social skills (Webb et al., 2004). In contrast to these findings, O'Conner and colleagues (2006) found significant treatment effects for the Problem Behaviours and Social Skills domains of the SSRS following a 12-week social skills intervention for children with FASD. It is important to note, however, that this program included a concurrent training group for parents that involved instruction on key social skills being taught to their children. Thus, the parents were invested in the study and may have produced biased ratings.

Second, parents' impressions of their children are based on their observations in real-life situations. During an 8-week program, parents may not have the opportunity to observe their child interacting in enough social situations to notice change across the time period. For example, one item on the SSRS asks parents to rate the statement "*Gives compliments to peers*". However, if parents have not seen their child interacting with peers recently they may rely on past experience to answer the question. Thus, their

response may not accurately reflect post-intervention behaviour. In sum, the SSRS used in the current study may not adequately assess pre- and post-change, particularly when the duration of the intervention is relatively short.

Third, with regard to the Social Conflict Vignette task, children's high performance on this task at baseline may account for a failure to find significant treatment effects across the subscales. Indeed, closer examination of the baseline data revealed that the majority of children were opposed to selecting social strategies that involved extreme physical aggression (e.g., hitting, breaking other's property), verbal threats, and verbal aggression (e.g., name calling). Similarly, children gave high ratings for strategies that involved polite requests and compromise. This interpretation is further supported by findings from studies using the same social conflict task with typical populations. Chung and Asher (1995) found that typically developing (TD) 4<sup>th</sup> and 5<sup>th</sup> grade children gave similar ratings for prosocial, anti social and avoidance goals in comparison to children with FASD (i.e., 3.48, 3.62, 3.15 respectively, compared to 4.3, 3.4, 3.8 for children with FASD). Similarly, results from Delveaux and Daniel's (2000) study with 4<sup>th</sup>- to 6<sup>th</sup>-graders showed that TD children and children with FASD rated prosocial strategies and aggressive strategies very similarly (i.e., 4.02, 1.90 respectively, compared to 4.0, 2.0 for children with FASD). It is important to note, however, that the TD populations used in the two abovementioned studies were younger than the children in the present study. Despite this however, these findings still indicate that children with FASD were scoring high on the Social Conflict Vignette task and, thus, there was limited room for improvement on this measure from time 1 to time 2.

The finding that children with FASD generated effective strategies when faced with hypothetical conflict situations is somewhat contradictory to Timler's (2000) study. Timler used a similar conflict vignette task to the one used in the current study. Timler found that, when compared to a group of typically developing peers, children with alcohol-related disability (ARD) tended to select more hostile strategies and fewer prosocial strategies when faced with conflict situations. The discrepancy in findings may be linked to a difference in the age of participants. The participants in Timler's study were between the ages of 8- and 12-years whereas participants in the current study were between the ages of 12- and 17-years. Thus, the social developmental level of the children in the current study may exceed that of the participants in Timler's study. Alternatively, the children's social developmental level may be equivalent but the older children may have gained more knowledge about what is and what is not appropriate response when responding to difficult social situations. To avoid ceiling effects, future studies examining social functioning in adolescents with FASD may want to modify the Social Conflict Vignette task by making the conflict vignettes more complex and age-appropriate (e.g., "*someone is spreading rumours about you at school*").

A further consideration is the generalization of skills learned in the mindfulness program to real-life situations and environments. In this study, children were trained to engage in reflective rather than reactive methods of responding when confronted with difficult social situations. To reinforce this learning outcome, one of the group activities involved discussing different ways of responding to conflict situations that were commonly experienced by the group members (e.g., bullying and sibling conflict). Although the majority of participants were able to generate and select socially

appropriate responses, the skills did not seem transfer to parent-reported social behaviours measured by the SSRS.

Children with FASD may be particularly challenged when it comes to generalizing skills to new environments. Deficits in higher order mental functions may account for children's difficulty transferring newly learned information into stored knowledge (Kalberg & Buckley, 2007). According to information-processing theory, generalization of knowledge occurs in a series of discrete, interdependent steps (Campion & Brown, 1978). Information is received by our senses and then distributed to higher order systems for further processing (Kalberg & Buckley, 2007). Factors involved in guiding these later stages include attention, long-term memory retrieval, working memory, and metacognitive strategies (e.g., awareness and self-monitoring). Children with FASD commonly present with impairment in one or more of the abovementioned factors (Gibbard et al., 2003; O'Malley, 2007). Thus, it is reasonable to infer that generalization of new skills is a challenge for this population. In support of this assumption are findings from a rodent study by Mihalick and colleagues (2001). The researchers found that subjects with prenatal ethanol exposure (PAE) were similar to non-exposed subjects when learning a correct response to a discrimination problem (go/no-go task); however, when the task was modified to reflect a novel environment, PAE subjects performed more poorly than non-exposed subjects. In addition, results from human studies have shown that children with FASD have specific deficits in abstraction and generalization (e.g., difficulty "filling in the blanks" when given instructions, (see Sampson et al., 1997). Furthermore, rigid and compulsive tendencies may make it

challenging for children to apply information and learned concepts to new environments (Strickland et al., 2007).

To enhance the generalization of social skills to new environments, researchers suggest a number of different strategies (O’Callaghan et al., 2003; Stokes & Baer, 1977; Strickland et al., 2007). Based on a review of the literature, Stokes and Baer (1977) identified nine general strategies to promote generalization of skills training. Strategies within this list included ensuring that participants are instructed to perform the skills in different settings, and introducing the skills using multiple settings, stimuli, and trainers. In future studies, it may be beneficial for mindfulness instructors to emphasize the importance of practicing the skills in different environments and request a record of this practice to discuss with the group. Other research has emphasized the importance of parent involvement when implementing interventions for children with FASD (Kalberg & Buckley, 2007; O’Connor et al., 2006). O’Connor and colleagues (2006) found that children who participated in a social skills intervention that included a parent training component, showed significant improvements in parent-reported social skills and problem behaviour in comparison to a delayed treatment control group. Although it is unclear whether parent involvement was a contributing factor, the parent-report data suggests that improvement in children’s social knowledge generalized to the home environment. Finally, another study found that virtual reality training was helpful for generalizing safety skills learned in the lab to real-world environments simulated by VR technology (Strickland et al., 1997).

In sum, a successful intervention should demonstrate improvements in individual skill level as well as noticeable differences in the participant’s behaviour as rated by

outside observers. The current study reported no change in either of these domains, suggesting that mindfulness training for children with FASD may not be effective for improving social skills. However, given the added challenges that children with FASD face when learning and generalizing new skills, it is possible that slight modifications to the structure and implementation of the program could result in more optimistic results.

### **Hypothesis #2: Perspective Taking and Mindfulness Training**

Past studies with adults have identified both cognitive and neurophysiological links between perspective taking, mindfulness, and empathy. Specifically, research has found that mindfulness training can lead to increases in self-reported perspective taking (Krasner et al., 2009). Furthermore, studies have shown that areas of the brain associated with perspective taking are more active in individuals who meditate (D'Argembeau et al., 2007; Hölzel et al., 2007). Based on these findings, the current study predicted that mindfulness training would lead to an increase in perspective taking in children with FASD. Specifically, it was hypothesized that mindfulness training would have the greatest influence on affective perspective taking since mindfulness is proposed to enhance awareness of one's emotional states. After examining the scaled scores, the results indicated that children with FASD performed similarly on the Inferences and Social Interaction subscales of the SLDT from time 1 to time 2. However, an analysis of the raw scores revealed that children's performance on the Inference task of the SLDT improved from time 1 to time 2 while their performance on the Social Interaction task significantly declined. Although this finding seems contradictory, it may be explained by differences in the type of emotional and social information provided in both tasks. Specifically, the Inferences task included items with more subtle emotional and social

information. In contrast, items on the Social Interaction task were straightforward and did not require extensive interpretation of subtle cues.

In the Inference task, participants were required to interpret the thoughts and emotions of a character in a photo and make an inference about what the person would be thinking. This task relied heavily on the individual's ability to pick up on subtle cues including context, complex emotions, and facial expressions. Complex emotions that were cued in the task included confusion, boredom, sarcasm and distrust. It was clear that participants in this study struggled on this measure. Indeed, baseline raw scores ranged from 0- to 3 out of a possible score of 12. Furthermore, looking at the standard scores for this measure, it appeared that children were scoring within the borderline impaired range in comparison to same age peers at baseline. This finding is in line with the results of a study by Siklos (2008) that showed children with FASD had poorer performance on tasks with more complex or subtle social stimuli. Overall, improved performance on this task suggests that children's awareness of subtle social and emotional as well as their ability to take the perspective of another person, increased from baseline to post-testing.

The Social Interaction task relied less heavily on interpreting another person's perspective. In addition, children were not required to interpret subtle visual cues or label complex emotions. Instead, children listened to a variety of social situations and provided answers to the questions. For example, one item stated "A close friend tells you, 'my mom has cancer' what do you say to your friend?" An appropriate response included anything that suggested supportiveness. In this example, children could rely on their knowledge of social situations rather than their ability to process subtle contextual cues. Overall, children performed well on the Social Interaction task. Indeed, the majority of

children were able to correctly answer 75% – 92% of the items correctly at baseline. Indeed, average baseline scores fell within the average clinical range on this subscale. Given the participant's high scores at time 1, there was little room for improvement at post-testing. Similarly, the likelihood that scores would increase was much lower than the likelihood of scores decreasing.

Although the finding that children improved on the Inference task after 8 weeks of mindfulness training lends support to the hypothesis that mindfulness training improves social understanding in children with FASD, a major limitation of this study is that it didn't include a control group. Thus, it is impossible to know whether changes in perspective taking are attributable to the program or to the passage of time. Alternatively, improvements in perspective taking may be a result of practice effects. In other words, participants may be improving on the measures simply because they have become familiar with the task through previous exposure. Indeed, when administering the SLDT, children were exposed to the same images at baseline and post-test. Thus, it is possible that their previous exposure made them more prepared. Whether scores on the Inference subtest of the SLDT are subject to practice effects is unknown; however, practice effects have been demonstrated for executive function (EF) measures that demand similar higher order processing skills (Kuntsi et al., 2001). The literature examining practice effects in EF tasks is inconsistent, however, and findings suggest that retest effects may be most evident on tasks requiring significant instruction and training (Müller, Kerns, Konkin, 2012). Furthermore, research investigating the occurrence of practice effects on the Wechsler Intelligence Scale for Children (WISC) shows that performance-based measures (i.e., timed tasks primarily requiring visual motor integration) are more

sensitive to practice effects compared to verbal measures (Tuma & Appelbaum, 1980). Given that the Inference task required very brief instruction and was largely a verbal-based measure, it is reasonable to infer that practice effects would be minimal for this particular task.

A second interesting finding was that change from time 1 to time 2 differed between group 1 and 2 on Bosacki and Astington's Social Understanding Task. Furthermore, when examined separately, it was found that group 1 significantly improved on the task whereas group 2 showed no change in performance. There are several reasons why this may have occurred. First, differences in verbal comprehension and verbal expression between the two groups could have influenced their success on the task. The Social Understanding Test involves two steps; first, participants listen to a short story and second, they answer series of questions that address the story's contents. To score high on the task, participants need to provide answers that demonstrate an understanding of other's mental states. The more complex the answer is, the higher the score will be. Children who provide more information tend to score higher on this task. Group 2's performance on the Verbal Reasoning composite was significantly lower in comparison to group 1 which may explain why they didn't show improvement on this task. In addition based on naturalistic observations of both groups, it was evident that group 1 had more advanced verbal and communicative skills compared to group 2. This was made clear in both the complexity of their language and the extent of their sharing. Thus, it is possible that, because group 2 was limited by the language requirements of the task, only group 1 improved on this measure.

The finding that group 1 showed a different pattern of change on the social understanding task in comparison to group 2 could also be attributed to gender differences between the groups. Although the historical view that females are more empathic than males has been proven more complicated than once believed, there is some evidence to suggest that females are more empathetic than males (Lennon & Eisenberg, 1987). Indeed, one study found that female adolescents aged 10- to 14-years scored significantly higher in empathy and prosocial behaviour in comparison to age-matched males (Garaigordobil, 2009). Similarly, in a study assessing empathy and perspective taking in children with attention deficit hyperactivity disorder (ADHD), Marton and colleagues (2008) found that girls diagnosed with ADHD scored higher overall in both perspective taking and empathy. The Social Understanding Task used in the current study taps into both empathic concern and perspective taking. For example, a subset of questions on the task titled 'Empathic Responding' required children to infer what a character was feeling in difficult social situations. Thus, it is possible that the discrepancy in findings between the two groups reflected the fact that male participants (which group 2 consisted of entirely) had greater difficulty with this task in comparison to females. In line with this idea, a closer examination of the data revealed that female participants received the highest scores on the Social Understanding task at time 1 and time 2 in comparison to all other group members. It is important to note that gender differences in perspective taking and empathy have primarily been found in studies using self-report measures. Indeed, in Garaigordobil's (2009) and Marton et al.'s (2008) study, children answered a series of self-report questions that were designed to tap into a variety of social understanding domains. For example one statement read "*when I see someone is ill, I feel*

*sad*'. It is less likely that gender differences will be observed on measures that utilize picture or story indices or physiological measures (Lennon & Eisenberg, 1987). This suggests that observed gender differences in empathy and perspective taking are more likely a product of socialization processes rather than intrinsic biological differences.

In summary, this study suggests that mindfulness training may be useful for improving aspects of perspective taking and social understanding in children with FASD. However, improvements in this area were only observed on the Inferences task of the SLDT and the Social Understanding task for Group 1. The interesting pattern of findings may be due to the fact that children with FASD are skilled at providing appropriate social responses but are lacking when it comes to interpreting more complex and subtle social cues. Thus, there was considerable room for improvement on the Social Understanding and Inferences task but not the Social Interaction task. Additionally, analyses of scaled scores did not reveal the same results, suggesting that overall change in perspective taking on the SLDT was small. Furthermore, it is unclear whether the observed change can be attributed to the intervention or other factors. Despite the uncertainty regarding the cause of the effect, it is still reasonable to suggest that 8 weeks of mindfulness training could lead to improvements in a child's ability to adopt the perspective of others. However, more research using a control group needs to be conducted in order to further validate this possibility.

### **Hypothesis #3: Emotion Reactivity and Mindfulness**

It has been argued that a primary mechanism of mindfulness training is emotion regulation. In support of this view, research demonstrates that mindfulness-based treatments lead to a diverse range of improvements in emotion regulation (e.g., decreases

in negative reactivity, improvements in mood-related symptoms) (Arche & Craske, 2006; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010). Therefore, it was predicted that eight weeks of mindfulness training would lead to improvements in parent-reported emotion reactivity. Analyses of the imputed data revealed that parents reported no improvement in their children's ability to regulate their emotions after the mindfulness training. A failure to demonstrate improvements is surprising when considering the well-documented relation between mindfulness meditation and emotion regulation (Chambers, Gullone, & Allen, 2009; Goldin & Gross, 2010). One possibility, discussed in detail above, is that children were not able to generalize the skills they learned in the group to new situations. Children with FASD may require more direct instruction in instances where they cannot control their own emotions. It is possible that applying mindfulness concepts and strategies in these instances requires a degree of awareness and executive control that many children with FASD do not possess. This explanation is plausible given the difficulty children with FASD have with abstraction and metacognition (McGee et al., 2008). A failure to transfer learned concepts to real-life situations would help explain why parents did not observe differences in their children's ability to calm themselves down and regulate their emotions.

It is important to note that children's scores on the dysregulation scale did decline at time 2; however, the change was not significant. This finding suggests that parents did notice slight improvements in children's emotion regulation skills. It is possible that with more participants, a treatment effect may be observed; however, further research with larger samples is needed to support this claim.

There are two previous intervention studies with children with FASD that reported significant treatment effects for emotion regulation (Nash, 2010; Chasnoff et al., 2007). Both studies implemented the Alert Program for Self Regulation (Williams & Shellenberg, 1996) which targets self regulation and executive functioning through cognitive processing and sensory integration. The program has many similarities to the mindfulness training program implemented in the current study. First, the Alert program uses an analogy to help children learn about and relate to the concept of self-regulation. The engine analogy used in the Alert program teaches children to be aware of their different physical and emotional states. For example, an engine performs differently at high, low or ‘just right’ gears. By learning to change the gears of their engines, children are simultaneously learning to self-regulate. The mindfulness training program also used several different analogies to guide children’s awareness of their bodily states, emotions and thoughts. For example, children were taught to ‘widen’ and ‘narrow’ their flashlights of attention to help them adjust their focus. Similarly, a different exercise titled “Thought Parade” trained children to pay attention to their thoughts as if they were a stream of parade floats. Children were encouraged to see if they could step out of the thought parade and watch the parade go by. The use of analogies in these programs appears to help children relate to concepts that are otherwise abstract and difficult grasp. This seems to be especially important for children with FASD who struggle with abstract concepts (McGee et al., 2009).

A second similarity between the Alert program and mindfulness training is that they both teach children practical tools and strategies that can be used to alter their state of alertness or awareness. Additionally, both programs encourage children to practice the

strategies outside of therapy. Mindfulness training in particular strongly emphasizes the importance of practicing the tools in different contexts to help consolidate the information.

One difference between the programs is that the Alert program individualizes the treatment program for each child. Whereas participants in the mindfulness group continue to proceed throughout the program at an equivalent rate, participants in the Alert program cannot proceed to the next learning stage if they have not mastered the concepts of the previous stage. This approach is beneficial as it ensures that the individual needs of each child are met. In addition, it allows for further practice and instruction for children who need extra help with the concepts. An individualized intervention program not only attends to individual challenges but it also attends to the strengths of an individual (Popova et al., 2013). Thus, children who are successful in the Alert program move through the program steps at a faster rate.

In sum, mindfulness training did not appear to improve parent reports of emotion regulation and reactivity. However, mean ratings of emotion dysregulation from time 1 to time 2 did show decreases, just not at a significant level. Given that a comparable intervention program targeting self-regulation behaviours in children with FASD showed significant treatment effects in emotion regulation, it suggests that mindfulness training may still be a promising therapy for improving emotion regulation. In future studies, it would be important to include an experimental measure of emotion regulation that directly assesses children's ability to self-regulate (e.g., a frustration task). This would shed light on whether the children were even able to learn and retain the self-regulation

skills taught in mindfulness training. Currently, it is unclear whether the skills learned were simply not noticeable by parents or whether children failed to learn the skills.

#### **Hypothesis #4: Relations among Changes in Outcome Measures**

Given that perspective taking and emotion regulation are shown to be strongly related to social functioning and are thought to be underlying mechanisms of mindfulness, it was hypothesized that change in either of the two constructs would be significantly correlated with change in social functioning. Analyses of difference correlations revealed significant negative correlations between changes in perspective taking and social functioning, as well as changes in mindfulness and prosocial goals. This finding suggests that as children become more skilled at adopting the perspective of another, parent reports of social functioning decrease. In addition, the finding indicates that an increase in self-reported mindfulness is associated with a decrease in the likelihood of choosing prosocial goals in social conflict scenarios. Both of these results are counterintuitive and fail to support the hypothesis that increases in perspective taking will be related to increases in social functioning. The contradictory findings were most likely related to the significant variability observed across individuals and the presence of a small sample size. Indeed, a closer examination of the raw data and difference correlations showed that even one or two data points that were inconsistent with the hypothesis significantly influenced the outcome. This finding highlights the fact that the results of this study must be interpreted with caution.

In addition to the significant negative correlations, analyses of the data showed positive correlations between problem behaviour and emotion regulation. This finding indicates that decreases in parent-reported problem behaviour were associated with

decreases in emotion dysregulation. Therefore, it supports the hypothesis that certain aspects of social functioning are linked to children's capacity to self-regulate their emotions. This is not surprising given that the literature has clearly shown a strong relation between behaviour problems and emotion-regulation in both typically developing children and children with developmental disabilities (Morris et al., 2010; Zalewski et al., 2011). The finding also supports the idea that mindfulness training influences aspects of social functioning via mechanisms of emotion regulation. However, by simply looking at difference correlations it is impossible to deduce the direction of the relationship. For example, although it seems less intuitive, it is possible that declines in externalizing symptoms led to an overall decrease in emotion dysregulation. Thus, in this case, changes in behaviour may have led to changes in internal processing mechanisms.

The lack of significant correlations between the sets of variables may be attributable to the type of measures selected. Indeed, only a small number of the baseline correlations between the social measures and the perspective taking and emotion regulation measures were found to be significant. This suggests that the tasks were not highly related to begin with. Thus, it is less likely that change on one measure would be related to change on a different measure. This is particularly true for the perspective taking tasks and the parent and student SSRS measures as there is little overlap between the constructs assessed by the two different types of measures. Furthermore, other studies have shown that correlations between performance-based measures and naturalistic or parent-report measures are often low and not significant (Liebermann, Giesbrecht, Müller, 2007; Ozonoff & Miller, 1995; Vriezen & Pigott, 2002). This highlights the fact that many performance-based measures have low ecological validity. Alternatively, it

could also suggest that parent-report measures and performance-based measures tap into different domains of social functioning. Indeed, in relation to parental ratings and performance-based measures of executive functioning, Libermann et al. (2007) suggest that parent ratings may reflect more general impressions of behaviour whereas performance measures reflect more specific processes. In sum, the failure to demonstrate relations among difference scores between social functioning, perspective taking and emotion regulation may, in part, suggest that the social functioning tasks were not sensitive enough measures of the cognitive constructs investigated in this study.

#### Feasibility of Mindfulness Training for Children with FASD

A number of factors related to the feasibility of mindfulness training for children with FASD were revealed in the current study. In general, this study demonstrated that mindfulness training is a feasible intervention for children with FASD. Out of the 13 children recruited to participate in the study, 10 completed the training, demonstrating a 77% completion rate. Based on anecdotal reports from children and parents, mindfulness training appeared to be a positive experience for the majority of children and no significant adverse events were reported throughout the study. Children and parents who reported less success with the program appeared to demonstrate some common factors. For one, children with severe inattentiveness and hyperactivity did not appear to be a good fit for the group as it was difficult for them participate in the mindfulness exercises. In addition, children who sensed they were too old for the group seemed less satisfied with their experience. Strategies to engage older children may be helpful for future studies (e.g., give them more leadership within the group). Alternatively, a more limited age range may be more ideal.

## **Limitations and Directions for Future Research**

The most critical limitation in the current study is the small sample size. Studies in this area are often faced with the same challenge due to a number of issues related to recruitment of children with a diagnosis of FASD (Rasmussen et al., 2006). Although the prevalence of children with FASD is high (i.e., approximately 9 children for every 1000 births, Health Canada, 2006), the prevalence of children with a confirmed diagnosis is significantly reduced. Many children with FASD live in foster care or adopted homes, thus, it is difficult to obtain valid documentation of prenatal alcohol exposure (PAE). Since valid documentation of PAE is typically a necessary step towards receiving a confirmed diagnosis, many children are not diagnosed and, thus, not eligible for the study. Given the small sample size, the results of the present study must be interpreted with caution until further research examining the effects of mindfulness training with this population is conducted. Until then, it is still unclear whether mindfulness training was helpful for improving social skills in children with FASD.

A second significant limitation is the type of research design used in the present study. The study utilized a pre- post-design with no control group. Thus, it was impossible to deduce whether the observed treatment effects were a consequence of the 8-week training program or a result of the passage of time. Similarly, retest effects may have been accounting for the observed differences from time 1 to time 2. Currently, there is a paucity of systematic, randomized control trial (RCT) evidence for the efficacy of interventions for children with FASD. Additionally, a vast majority of intervention research has limited the data collection to pre- and post-test. Therefore, the long-term efficacy of the majority of interventions for children with FASD is largely unknown.

Issues regarding study design and the development of a scientifically sound evidence-base have been highlighted as major concerns for experts in the field of FASD research (Premji et al., 2006). The lack of RCT and follow-up data is likely due to a number of different factors including difficulty recruiting children with FASD and participant drop-out. Given the prolonged nature of intervention research, participant adherence is a significant challenge. It will be important for future studies to generate effective recruitment strategies that reduce dropout rates and enhance children's motivation to participate.

In relation to the issue of adherence, a third important factor to consider is both the instructor's adherence to the proper implementation of the intervention and the participant's adherence to the requirements of the training. Although no fidelity data was collected, children's anecdotal reports during the group sessions suggest that not all participants were engaging in mindfulness practice outside of the group. Given that home practice comprises a major component of the training program, failure to practice could have a significant impact on the effectiveness of the intervention. To corroborate this view, research has shown that time spent engaging in home practice significantly predicts the degree of improvement in a number of different areas including mindfulness, psychological symptoms and well-being (Carmody & Baer, 2008). Although the current study implemented several techniques to increase home practice (e.g., weekly incentives, parent involvement, daily reminder messages), future studies may want integrate additional strategies to enhance home practice. One strategy may be to have children document their practice each day. This will help elucidate whether children are truly

engaging in practice every day. Additionally, practice reports will provide useful data that may shed light on the variability observed in individual outcomes following treatment.

An additional issue is whether or not children were exposed to an adequate “dose” of the mindfulness treatment. There are a number of studies suggesting that the time spent practicing mindfulness is directly related to the amount of benefit obtained from the program (Gross et al., 2012; Saltzman & Goldin, 2008). For example, as previously mentioned, children who spent more time engaging in the formal practices of the Still Quiet Place program tended to have greater improvement in attentional control (Saltzman & Goldin, 2008). Based on anecdotal reports, the degree to which children were engaging in home practice each week appeared to differ across individuals as well as within individuals. These group- and individual-based differences may have accounted for the large degree of variability among participants’ scores at time 2. Children with FASD may also require a stronger “dose” of the treatment program given their specific learning challenges. For example, given the reported deficits in attention among individuals with FASD, they may require more repetition of mindfulness exercises over a larger span of time in order for change to occur. Increased repetition and practice in different contexts may also be important given their difficulties generalizing newly learned information to different contexts.

Finally, a further limitation of the current study pertains to the challenge of measuring social functioning as it represents a multi-faceted construct. Indeed, social competence encompasses cognitive and emotional capacities in addition to experience-based, or learned practical knowledge. Social functioning can be accessed through both verbal and nonverbal tasks, as well as informant reports and naturalistic observation. The

goal of the present study was to focus on aspects of social functioning (i.e., perspective taking and emotion reactivity) that were proposed to relate to general social behaviour. Consequently, other related aspects of social functioning may have been omitted. For example, one aspect of social functioning that may be altered by mindfulness training is emotion recognition (i.e., recognizing emotions in others using verbal and nonverbal cues). Future studies may also want to include teacher reports of social functioning as teachers consistently observe children in a variety of social contexts and can provide highly accurate reports of social behaviour (Stanger & Lewis, 1993; Verhulst, Koot, & Van der Ende, 1994).

In sum, intervention research with children with FASD has historically been limited by small sample sizes, pre- and post-test designs, and a paucity of follow-up data. Unfortunately, due to the difficulties in recruitment, the present study suffered many of the same issues. Although this ultimately limits the analysis and interpretation of the data, the present study still provides important information related to appropriate measurement, therapy implementation and treatment trends. Future studies with children with FASD should aim to address issues relating to recruitment and adherence to the mindfulness program. Additionally, it is recommended that future research collect qualitative and quantitative data in order to assess factors that could potentially add to our knowledge of program feasibility and fidelity. For example, some factors may include hours of home practice, extent of parent involvement, and parent and child-satisfaction. This would allow for a more in depth look at dose-response effects and experiential factors that may influence the post-test outcomes.

A further direction that needs to be considered for future studies is using alternative study designs. Given the difficulties around recruitment and finding appropriate controls, group-based intervention designs prove to be a considerable challenge when working with children with FASD. In addition, there are limitations associated with using a pre- and post-test comparison design, particularly when working with small sample sizes. For one, valid statements about treatment effects cannot typically be made due to the fact that the assumptions for parametric statistical analysis are often not adequately met (Todman & Dugard, 2001). In addition, when using such designs, the research question tends to focus on the effectiveness of the treatment for the group as a whole. Subsequently, there is a loss of rich clinical data that sheds light on the individual factors that may be influencing the outcomes. Adopting an idiographic approach would allow for a more in-depth look at individual characteristics that may be critical for understanding the effectiveness of the intervention.

One alternative approach to take is a single subject research design. Single subject designs are quantitative methods where the participant serves as his or her own control and is measured multiple times over a period of time (Gast, 2009). In this approach, the participant is introduced to the control condition (A) and the intervention condition (B). This pattern can then be repeated to further tease out the influence of the independent variable (i.e., the intervention) on the targeted behaviours. The intervention can also be time lagged in that new components of the intervention can be added over time. This will allow for an analysis of the “active ingredients” or components of the intervention that are responsible for changing the behaviour. The single subject design is highly regarded in terms of its experimental control (Horner et al., 2005). It also allows for a comparison

in measurement across other single samples. This will allow for an analysis of key individual factors that may moderate the effects of the treatment.

### **Conclusions**

The present study was the first to assess the efficacy of mindfulness training on social functioning in children with FASD. This study was unique in that it targeted cognitive processes (i.e., attention, self-regulation, and awareness) as well as affective processes (e.g., emotion reactivity, emotion understanding) that are thought to underlie social behaviours. The results of this study did not provide support for the effectiveness of mindfulness training for improving social skills. In addition, the intervention had no significant effect on improving emotion regulation. However, a closer examination of the data revealed that mindfulness training was effective for improving children's social understanding skills and their ability to take the perspective of another person.

Given the significant limitations of this study, there is not enough evidence to make judgements about the usefulness of mindfulness training for improving social functioning in children with FASD. However, the present study is helpful in that it brings attention to the importance of targeting underlying cognitive mechanisms of social functioning in intervention research with children with FASD. Additionally, this study highlighted important feasibility and implementation factors to consider when conducting a training program with this population.

To conclude, given the paucity of available treatment programs for children with FASD, it is critical that research is conducted in this area. To date, the majority of intervention studies are limited by a variety of methodological factors. Thus, it is important that the findings from the present study and other intervention studies are

replicated with larger sample sizes and improved study designs. Ultimately, future research needs to move in the direction of building a strong evidence-base for interventions so that children with FASD and their families can receive the highest standards of treatment.

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## Appendix A

## Examples of Social Conflict Vignettes

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## Watching TV

You and two classmates are watching TV at your house one afternoon. The three of you are watching a show you really like a lot. In the middle of the show, one classmate says he doesn't like it anymore and he wants to watch something different. You tell this classmate that you and the other classmate like the show a lot and the two of you want to watch it. This classmate says he is getting bored and then changes the TV to a different channel.

Imagine that this has really happened.

1. What would be your goal?

	Really disagree				Really agree
___ Trying to watch the TV show I want. -----	1	2	3	4	5
___ Trying <u>not</u> to let him boss me around. -----	1	2	3	4	5
___ Trying to get along with this classmate. -----	1	2	3	4	5
___ Trying to make sure that we all get to watch what we want. -----	1	2	3	4	5
___ Trying <u>not</u> to get in trouble with my mom or dad. -----	1	2	3	4	5
___ Trying <u>not</u> to get hurt. -----	1	2	3	4	5
___ Trying to get back at him for what he just did. -----	1	2	3	4	5
___ Trying to make sure that things are done fairly. -----	1	2	3	4	5

2. Put a check mark (✓) next to your top goal.

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Imagine that this has really happened.

1. What would you do?

	I definitely would not do this				I definitely would do this
___ Ask him nicely to turn the channel back.-----1	2	3	4	5	
___ Punch him or slap his hands off the TV. -----1	2	3	4	5	
___ Let him watch whatever he wants. -----1	2	3	4	5	
___ Tell him I will kick him out of my house if he doesn't turn the channel back.-----1	2	3	4	5	
___ Ask the other classmate for help.-----1	2	3	4	5	
___ Push him away from the TV. -----1	2	3	4	5	
___ Tell him we were watching the show and I want to watch it until it is over.-----1	2	3	4	5	
___ Call him a name. -----1	2	3	4	5	
___ Ask my mom or dad to help out.-----1	2	3	4	5	
___ Tell him we'll finish the show and then watch a show he wants. -----1	2	3	4	5	
___ Turn the TV channel back. -----1	2	3	4	5	

2. Put a check mark (✓) next to the thing you would do first..

## Appendix B

## The Emotion Questionnaire

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## Appendix

## The Emotion Questionnaire

*Anger**My child becomes angry.* Long and short versions.

1. My child often becomes angry and falls in a bad mood. (EM)
2. When angry or in a bad mood, my child reacts strongly and intensely. (EM)
3. It is easy for others, for instance a parent, to calm him/her down. (ER)
4. He/she has difficulties calming down on his/her own.-R (ER)

*My child is forbidden to do something he/she wants to do.* Long version.

5. When my child is forbidden to do something he/she wants to do, he/she reacts strongly and intensely. (EM)
6. It is easy for others, for instance a parent, to calm him/her down. (ER)
7. He/she has difficulties calming down on his/her own.-R (ER)

*My child gets into a conflict with a peer.* Long version.

8. When my child gets in conflict with a peer, he/she reacts strongly and intensely. (EM)
9. It is easy for others, for instance a parent, to calm him/her down. (ER)
10. He/she has difficulties calming down on his/her own.-R (ER)

*Fear**My child gets frightened and worried.* Long and short versions.

11. My child often gets frightened and worried. (EM)
12. When frightened and worried, he/she reacts strongly and intensely. (EM)

13. It is easy for others, for instance a parent, to make him/her calm down. (ER)

14. He/she has difficulties making him/herself calm down.-R (ER)

*My child sees or hears something scary.* Long version.

15. If my child sees or hears something scary, he/she reacts strongly and intensely. (EM)
16. It is easy for others, for instance a parent, to make him/her calm down. (ER)
17. He/she has difficulties making him/herself calm down.-R (ER)

*My child becomes scared of the dark.* Long version.

18. If my child becomes scared of the dark, he/she reacts strongly and intensely. (EM)
19. It is easy for others, for instance a parent, to make him/her calm down. (ER)
20. He/she has difficulties making him/herself calm down.-R (ER)

*Positive Emotions and Exuberance**My child gets happy and excited.* Long and short versions.

21. My child often gets happy, excited and in an exuberant mood. (EM)
22. When in an exuberant mood, my child reacts strongly. (EM)
23. It is easy for others, for instance a parent, to make her/him quiet down. (ER)
24. He/she has difficulties quieting down on his/her own.-R (ER)

*My child wins a game or a contest.* Long version.

25. When my child wins a contest or a game, he/she reacts strongly and intensely. (EM)
26. It is easy for others, for instance a parent, to make him/her quiet down. (ER)

27. He/she has difficulties quieting down on his/her own.-R (ER)

*My child is playing a game that he/she enjoys very much.*  
Long version.

28. When playing a game that he/she enjoys a lot, he/she reacts strongly and intensely. (EM)
29. It is easy for others, for instance a parent, to make him/her quiet down. (ER)
30. He/she has difficulties quieting down on his/her own.-R (ER)

#### *Sadness*

*My child becomes sad.* Long and short versions.

31. My child often becomes sad. (EM)
32. When sad, my child reacts strongly and intensely (e.g., cries, screams). (EM)
33. It is easy for others, for instance a parent, to make him/her feel better (e.g., by comforting, distracting or talking things through). (ER)

34. He/she has difficulties finding something to make him/herself feel better.-R (ER)

*A toy is lost or broken.* Long version.

35. He/she reacts strongly and intensely. (EM)
36. It is easy for others, for instance a parent, to make him/her feel better. (ER)
37. He/she has difficulties finding something to make him/herself feel better.-R (ER)
- My child has fallen and hurt him/herself.* Long version.
38. He/she reacts strongly and intensely. (EM)
39. It is easy for others, for instance a parent, to make him/her feel better. (ER)
40. He/she has difficulties finding something to make him/herself feel better.-R (ER)

EM = emotionality item; ER = emotion regulation item; R = item is reversed in scoring.

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## Appendix C

## Social Understanding Task

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Table 1

Interpersonal Understanding Interview: Social Understanding Story 1

Nancy and Margie are watching the children in the playground. Without saying a word, Nancy nudges Margie and looks across the playground at the new girl swinging on the swingset. Then Nancy looks back at Margie and smiles. Margie nods, and the two of them start off toward the girl at the swingset. The new girl sees the strange girls walk towards her. She'd seen them nudging and smiling at each other. Although they are in her class, she has never spoken to them before. The new girl wonders what they could want.

Comprehension Questions

1. Does the new girl see Nancy and Margie nudging and smiling at each other? Yes/No
2. Has the new girl ever spoken to Nancy and Margie before? Yes/No

If response to either comprehension question is incorrect, re-read the story to S.  
S must respond correctly to both Comprehension questions before continuing with the interview.

General prompt guide (applies to all questions): if response is "I don't know," or the child does not answer, repeat the question. If S responds with a second "I don't know," or still refuses to answer, go on to the next question.

A. Third Order Conceptual Role-Taking

1. Why did Nancy smile at Margie?
2. Why did Margie nod?
3.
  - a) Why did Nancy and Margie move off together in the direction of the new girl?
  - b) Why do you think this/ How do you know this?
4.
  - a) Does the new girl have any idea of why Nancy and Margie are walking towards her?  
Yes No
  - b) How do you know that the new girl has or [doesn't have] any idea of why Nancy and Margie are walking towards her?

The phrasing of 4b is contingent upon the response to 4a. Specifically, if response to 4a is "yes," ask "How do you know the new girl has an idea of why Nancy and Margie are walking towards her?" If response to 4a is "no" ask "How do you know the new girl doesn't have any idea of why Nancy and Margie are walking towards her?" If response to 4a is "I don't know" repeat question. If S responds to the second asking of question 4a with an "I don't know," go on to next section.

B. Empathetic Sensitivity

5.
  - a) How do you think the new girl feels
  - b) Why? Does she feel anything else? Why?

Keep repeating until no answer.

Table 1 (Cont.)

If response includes an ambiguous or bizarre feeling such as "different" or "wondering", ask for further clarification - "What do you mean by feeling different?" ; "Is wondering a feeling?"; Continue to prompt for valence if response is still ambiguous - "Is it a good/bad or in between feeling?"

C. Person Perception

6. Choose a character in the story and describe her.  
 What kind of things can you think of to describe her?  
 What kind of person do you think she is?

If S describes something the character does or some aspect of the story without mentioning any kind of trait, prompt with "What kind of a person do you think she is?"

Also, if response includes an ambiguous term with no explanation (e.g., she's nice) prompt with "What do you mean by nice?"; "What makes her nice?"

D. Alternative Explanations

7. Is there another way that you can think about this story? Yes No

If so, how?

If response is: "No," "I don't know," or if S asks "What do you mean?"  
 continue with "Could there be another reason why Nancy and Margie are nudging and smiling at each other?"

If response is still no, ask, "So is this the only way to think about the story?"

Note. For the purposes of the present study, this measure was designed by the author (Bosacki).