Parenting Under Stress: The Role of a Home-Based Intervention in Enhancing Efficacy and Reducing Stress in Families

by

Buse N. Bedir

Bachelor of Arts, University of Victoria, 2017
Master of Science, University of Victoria, 2019

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We acknowledge and respect the Lək̓ʷəŋən (Songhees and Xʷsepsəm/Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

Supervisory Committee

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Supervisory Committee

Dr. Sarah Macoun, Department of Psychology
Supervisor

Dr. Catherine Costigan, Department of Psychology
Departmental Member

Dr. Gina Harrison, Department of Educational Psychology and Leadership Studies
Outside Member

Abstract

Low socioeconomic status (SES) is associated with heightened stress, reduced access to resources, and diminished parenting efficacy, all of which can negatively impact child development. This study examines the effectiveness of a novel, parent-delivered intervention, Dino Island (DI), in enhancing parental efficacy and reducing parenting stress in families from diverse socioeconomic backgrounds. DI, which is a tablet-based attention and executive functioning (EF) training program, integrates process-specific and compensatory approaches to improve children's attention and EF skills. Additionally, it incorporates a parent training component to empower caregivers with strategies to support their children's cognitive and behavioral development. Grounded in the Family Stress Model, this dissertation explores the intersection of SES, parenting efficacy, and child outcomes, with a focus on families facing socioeconomic adversity. A mixed-methods design was used to evaluate DI's impact on parents' level of stress, perceived efficacy, and parent-reported child cognitive outcomes (attention and EF). Pre- and post-intervention assessments measured changes in parental stress and parental efficacy and whether these changes were related to family SES levels as measured by family income. Additionally, this dissertation investigated whether parent-reported child outcomes changed after participating in DI, and whether these changes were related to family SES levels. Findings indicate that DI improved parents' self-reported efficacy by providing structured strategies for addressing challenges, enhancing communication, and promoting positive parent-child interactions. Parents also reported reduced stress and a strengthened sense of empowerment in their caregiving role. Child specific outcomes also indicated some improvements across attention and some EF skills as reported by parents which indicates that DI intervention was effective for parents and children. These findings suggest that home-based cognitive

interventions, when paired with parent training, can provide parents with tools that improve feelings of parenting efficacy and lowered stress which over time may be associated with better child cognitive, social, and emotional outcomes. Future research should explore the sustainability of these effects and the potential for scaling interventions like DI to benefit broader populations.

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Acknowledgments

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Introduction

According to the 2016 Statistics Canada census data, over 1 million Canadian children are living in economically disadvantaged households (Statistics Canada, 2016). Low socioeconomic status (SES) is associated with a number of negative life outcomes for children including poor overall physical and emotional well-being, school failure, and reduced quality of relationships (Mistry, Biesanz, Chien, Howes & Berner, 2008). Low SES is often associated with increased stress and limited resources, which can also impact a parent's perceived ability to support and guide their children effectively. Research suggests that parents in low-SES households may face more financial and emotional stressors, potentially diminishing their confidence in managing parenting demands and fostering a positive environment (Conger et al., 2010). Additionally, limited access to resources and support networks can further impede parents' sense of control and effectiveness in addressing their children's needs (Gershoff & Bitensky, 2007). Such factors together may lower parents' perceptions of their parental efficacy, affecting the overall family environment and children's outcomes. In addition to poor life outcomes and lower parental efficacy, family SES has been associated with slower development of cognitive abilities in children, including the development of attention (Brydges, Reid, Fox, & Anderson, 2012; Morgan, Farkas, Hillemeier, & Maczuga, 2009) and executive functioning (EF) abilities (Lawson & Farah, 2017; Sarsour et al., 2011; Ursache & Noble, 2016). Attention refers to selectively concentrating on one aspect of information or stimuli while ignoring other stimuli (Posner, 2011). Executive functions refer to set of higher-level cognitive processes that allow for controlled and purposeful allocation of attention and goal-directed behaviour

(Friedman & Miyake, 2017). In addition to differences in attention and EF skills, childhood SES has also been shown to be a strong predictor of school achievement (Best, Miller, & Naglieri, 2011; Lawson & Farah, 2017; Reardon, 2011). Given the strong relationship between SES, parenting efficacy levels, and attention and EF skills in children, parent-delivered attention and EF interventions hold promise to both improve parental efficacy levels and child-related outcomes.

Family Stress Model

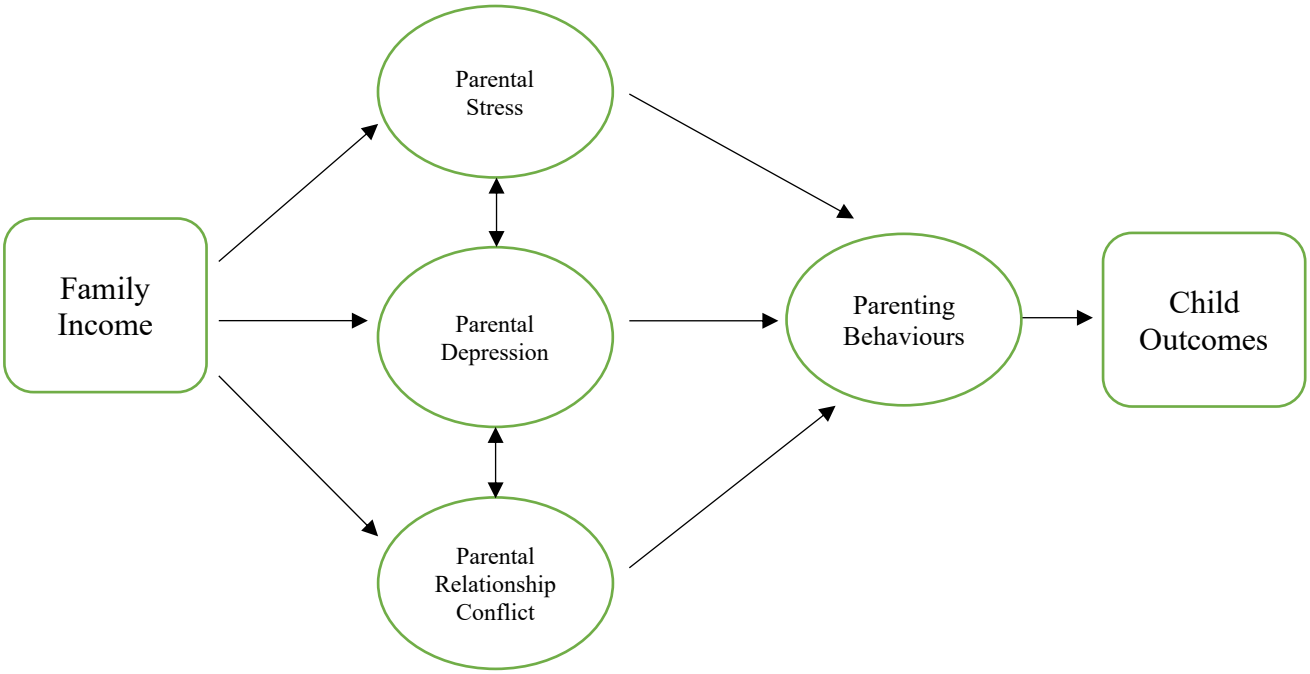
The Family Stress Model (FSM) offers an important framework for understanding how financial strain and related stressors affect parenting efficacy. According to FSM, financial hardship is a source of chronic stress that affects multiple aspects of life, which then impacts parents' emotional well-being, mental health, and parenting practices. Parents experiencing financial difficulties often face a multitude of stressors, including job insecurity, limited access to resources, and increased conflict, which can strain their emotional resilience and impact their sense of efficacy in their parenting (Conger et al., 2010).

The FSM suggests that financial strain leads to increased emotional distress, which often shows up as anxiety, depressive symptoms, or feelings of inadequacy in parents. This emotional strain can reduce energy, patience, and emotional availability in parents, which are essential for effective parenting. Conger and colleagues (2010) suggest that economic hardship is often linked to psychological stressors which can make it difficult for parents to maintain a consistent, nurturing, and supportive environment for their children. In this way, economic hardship indirectly impacts parents' efficacy by reducing parents' psychological health and their confidence in handling family

challenges. Parents who have lower levels of efficacy may be more likely to engage in harsh, inconsistent, or less responsive parenting behaviors. Studies show that low parent efficacy is often associated with lower levels of warmth and more punitive disciplinary practices, which can negatively affect children's emotional and behavioral development (Masarik & Conger, 2017). Parents who feel less effective may also be less inclined to seek support or access resources that could benefit their family, which may create a cycle in which low efficacy perpetuates stress and limits resilience.

Figure 1.

Family Stress Conceptual Model



Socioeconomic Status

SES refers to the standing of an individual's or family's economic and social position in relation to other people (APA, 2017). SES combines economic factors such as income and social factors such as education and social position (Adler & Rehkopf, 2008).

Since SES is a multifaceted construct, it usually encompasses a variety of factors including an individual's income, educational attainment, financial security and their subjective perceptions of social status to provide an accurate estimate of a complex term (Conger & Donnellan, 2007). For children, this term becomes even more complex as children are assigned SES indirectly by way of their parents, such as based on parents' income, education level and their social status. The social and economic factors of SES correlate highly with other characteristics, such as parental care, school quality, frequency of stressful life events, and possible exposure to toxins in early development (Evans, 2004; Lawson, Hook, Hackman & Farah, 2016). The most commonly measured factor when discussing SES is income (Farah, 2017). The location and number of people living in a household matter when discussing income; thus, an income-to-needs ratio is used instead of simply discussing income. For example, in the United States, the poverty-line for a family of four is an income of $31,200 (Department of Health and Human Services, 2024). In Canada, Market Basket Measure (MBM) is used to express low-income and it defines the cost of purchasing basic basket of goods and services to enjoy a standard way of living. In 2023, MBM was established at $58,163 in Vancouver. In addition to income, other social factors such as educational attainment or occupational status can be used to define SES (Farah, 2017). In addition, neighbourhood factors such as the percentage of people living below the poverty line in a particular neighbourhood or school can be used to estimate SES. While these factors are different ways to estimate SES, researchers have found moderate correlations (around .5) between measures of income, educational attainment, occupational status and neighbourhood factors

(Braveman et al., 2005; Chen & Patterson, 2006). Thus, one or more of these factors can be used to estimate SES of a family in research (Braveman et al., 2005).

SES has been consistently linked to a number of outcomes in the literature including physical and mental health, educational attainment and overall well-being across the lifespan, particularly in childhood and adolescence (Evans & Schamberg, 2009; Hackman & Farah, 2009; Last et al., 2018; Lawson & Farah, 2017; Noble, McCandliss & Farah, 2007). Additionally, SES significantly impacts cognitive development of children including intelligence, attention and EF skills and academic performance (Lawson, Hook, Hackman & Farah, 2016).

Researchers have tried many different ways to conceptualize and measure SES in the literature given that it is a multifaceted construct. SES is commonly described using indicators such as income, education, and wealth, which refer to material and educational resources available to individuals or families (Diemer et al., 2023). Additionally, prestige-based indicators, such as occupational status, are frequently used to assess the social value and relative ranking associated with a person's role in society (Williams et al., 2010). In intervention studies, socioeconomic status (SES) is frequently operationalized through objective indicators to better understand its role in outcomes. Many studies use resource-based measures, such as income, parental education, and occupational status, as proxies for SES. For example, interventions targeting early childhood often consider household income and parental education to identify participants from low-income families (RAND Corporation, 2023). Cognitive intervention studies frequently operationalize socioeconomic status (SES) using household income as a proxy (Brontman et al., 2016; Poon, Ho, Chu, & Chou, 2020).

Other studies use eligibility for welfare programs, such as free school meals or Medicaid, as indirect indicators of income (Wang, 2023). Given that SES is a multidimensional construct, there are multiple different ways to operationalize it. Even within British Columbia (BC) there are different ways of defining low income or low SES. For example, BC Housing sets the low-income limit as $84,780 per household for 2024. On the other hand, Market Basket Measure (MBM), which is a measure of poverty based on the cost of a specific basket of goods and services, sets the cost-of-living threshold for families in Vancouver at $58,163 for 2023. Other organizations in BC that provide support and services to low-income families set their annual family income threshold at $75,000 for eligibility of services (Variety, Children's Charity of BC). On the other end of the spectrum, for high income, most recent data from 2022 indicates that the threshold to be among the top 5% of earners in Canada was approximately $147,100. While this figure is national, it is reasonable to infer that the threshold in BC would be comparable or slightly higher given the province's economic landscape. As such, given the guidelines in BC and across Canada, this study conceptualizes any income below $75,000 as low, any income between $75,000-150,000 as middle, and any income above $150,000 as high, particularly for qualitative analyses which require categorization. However, as there is no universal cut-off for defining low SES in the literature, this study takes a continuous approach to SES for quantitative analyses with many different income levels instead of categorizing families into 'low' or 'high' SES groups (Darin-Mattsson, Fors, & Kareholt, 2017; Nutakor et al., 2023).

Parent Stress and Efficacy

Self-efficacy refers to an individual's belief that they can achieve different goals or tasks (Bandura, 1997). Parenting efficacy refers to a parent's belief in their capacity to effectively manage their parenting and positively impact their child's development and behavior (Liu, Liu, & Ding, 2024). High levels of parent efficacy have been associated with adaptive parenting behaviors in the literature which include parental warmth, high levels of structure at home, and emotional responsiveness, which are essential for children's development (Jones et al., 2015). On the other hand, low efficacy in parents is often linked to increased stress and less effective parenting practices which can impact children's behavioral and emotional well-being (Rowe et al., 2013).

A parent's confidence in their ability to parent effectively can influence not only their behavior but also the parent-child relationship. Research indicates that parents with high efficacy are more likely to use positive discipline strategies, support their child's autonomy, and respond sensitively to their child's needs, which fosters a secure attachment and promotes social, emotional, and cognitive growth in children (Albanese et al., 2019). By contrast, parents with low efficacy may feel overwhelmed by parenting challenges which can lead to higher stress levels and, at times, less responsive or consistent parenting behaviors (Huver et al., 2010).

There are many factors that impact parenting efficacy levels including family SES levels, social support and community resources, parental mental and emotional well-being, parenting knowledge, children's temperament, and cultural and environmental contexts. SES is a critical factor influencing parenting efficacy. Families with lower SES often experience higher levels of financial and environmental stressors, including

economic instability, housing insecurity, and limited access to resources like childcare and educational programs (Masarik & Conger, 2017). These stressors can increase parental mental health difficulties including anxiety and depressive symptoms, which may lower parents' sense of efficacy (Kuppens et al., 2020).

Parenting stress is closely linked to perceived parent efficacy, in which high stress levels often reduce a parent's sense of competence and control in their parenting role. Research highlights that parents who experience significant stress are more likely to struggle with feelings of low efficacy, which can impair their ability to manage their child's behavior effectively and respond to their needs in a positive way (Sevigny & Loutzenhiser, 2009). On the other hand, when parents feel more confident in their abilities, they tend to experience lower levels of stress and engage in more positive parenting behaviors, which in turn can support child development outcomes (Leerkes et al., 2017). Interventions aimed at reducing parenting stress and increasing self-efficacy, such as parenting programs, have shown promise in improving both parent and child outcomes. In particular, these programs help parents develop coping strategies, set realistic expectations, and feel more empowered in their roles, which can alleviate stress and improve their confidence (Mikolajczak & Roskam, 2018; Sevigny & Loutzenhiser, 2009).

Within the Family Stress Model (FSM), parental efficacy plays a central role in mediating the effects of socioeconomic stressors on parenting behaviors and child outcomes. FSM posits that financial strain and related adversities contribute to elevated parental stress, which can undermine parenting practices and negatively influence child development. Parental efficacy, defined as a parent's belief in their ability to manage the

demands of parenting, acts as a psychological buffer, enhancing resilience and supporting more consistent, nurturing caregiving, even under stress. Crucially, the relationship between efficacy, stress, and child behavior is bidirectional. High levels of parenting stress can erode parents' sense of efficacy, while low efficacy can increase feelings of helplessness and exacerbate stress in response to daily parenting challenges. At the same time, child behavior, particularly behavioral difficulties or emotional dysregulation, can further elevate parental stress and challenge parents' perceived competence. In turn, lower efficacy and increased stress may contribute to less effective parenting strategies, which can intensify child behavior problems. This dynamic creates a feedback loop in which stress, efficacy, and child behavior continuously influence one another. Interventions that strengthen parental efficacy may help disrupt this cycle, not only by improving parents' sense of control and reducing stress but also by promoting more adaptive parenting responses that support positive child behavior and emotional regulation.

In particular, parent levels of stress have been found to be heightened in parents of children with neurodevelopmental disorders (NDDs), which can significantly impact their well-being and the child's development. This stress is exacerbated by the child's behavioral challenges, communication difficulties, ensuring access to services, and the need for specialized care (Hohlfeld et al., 2022). Children with NDDs like autism spectrum disorder (ASD), attention-deficit hyperactivity disorder (ADHD), and intellectual disabilities (ID) frequently display disruptive behaviors, social-communication difficulties, and delays in adaptive functioning, which contribute to higher levels of caregiver strain (Davis & Carter, 2008; Hartley et al., 2012). Notably,

studies have found that the severity of a child's symptoms is often directly linked to greater parent stress and mental health issues such as anxiety and depression (Ingersoll & Hambrick, 2011; Nikmat et al., 2008). Additionally, behavioral challenges like emotional dysregulation and repetitive behaviors are strong predictors of increased caregiver strain (Mercier et al., 2000; Lecavalier et al., 2006), which suggests that parents' stress is closely tied to the intensity of their child's symptoms. The stress experienced by these parents not only impacts their wellbeing but can also affect their children's development. High levels of caregiver strain are linked to maladaptive parenting practices, which may in turn exacerbate difficulties in child behavior regulation (Gulsrud et al., 2010). Parental stress has been shown to impair parenting practices, which can lead to a cycle of increased difficulty for both parents and children (Jones et al., 2021). Research suggests that higher levels of parent efficacy are associated with better mental health outcomes for parents and improved child outcomes including greater emotional and behavioral regulation (Lecavalier et al., 2006). Parents with a strong sense of efficacy are more likely to engage in positive parenting behaviors, such as effective communication and consistent discipline, which can mitigate the behavioral difficulties associated with NDDs (Hohlfeld et al., 2022).

For parents of children with autism spectrum disorder (ASD) and other neurodevelopmental conditions, high levels of parent efficacy can buffer the negative effects of stress, which can help to prevent burnout and emotional exhaustion (Smith et al., 2008). Conversely, low efficacy is linked to increased stress and maladaptive parenting strategies, which can worsen the child's behavioral issues and delay their development (Gulsrud et al., 2010). These findings highlight the importance of fostering

parental self-efficacy and confidence in managing their child's needs through support programs, training, and interventions (Baker et al., 2010).

Social support, from family, friends, and community programs, has been shown to significantly enhance parenting efficacy. Support networks provide practical help, emotional support, and information, all of which can alleviate parental stress and reinforce parents' confidence in their abilities (Anderson et al., 2016). Community resources, such as parenting programs or family centers, offer guidance and resources that equip parents with knowledge and tools for effective parenting, which can strengthen their self-efficacy (Pinquart & Teubert, 2010).

Parental mental health is closely linked to parents' sense of efficacy. Studies show that parents experiencing depression, anxiety, or chronic stress often report lower efficacy, as these conditions can lead to feelings of doubt, irritability, and emotional exhaustion (Crnic & Ross, 2017). On the other hand, parents with stable mental health tend to feel more capable and resilient, which enhances their confidence in navigating the complexities of parenting. Interventions that support parental mental health have been associated with improved parent efficacy, as mental well-being can restore parents' emotional resources and patience (Smith et al., 2014). Similarly, knowledge about child development and effective parenting strategies strongly influences parents' efficacy. Parents who understand developmental stages and appropriate behavioral expectations for their child's age tend to feel more competent and capable in addressing behavior or developmental challenges (Jones et al., 2015). Access to parenting classes or workshops has been shown to increase parenting efficacy by providing parents with practical skills,

strategies, and realistic expectations for different developmental stages (Anderson et al., 2016).

Children's temperament and behavior also impact parents' sense of efficacy. Parents of children with challenging temperaments or behavioral difficulties often experience increased stress and may feel less confident in their parenting abilities (Le & Impett, 2020). Addressing behavioral challenges and learning strategies for managing these behaviors can help parents regain confidence and enhance their efficacy. For example, behavioral training programs for parents of children with ADHD and other NDDs have shown to increase parenting efficacy by equipping parents with targeted tools and techniques (Huang et al., 2018; Li et al., 2024; Morgan & O'Keefe, 2021; Yamanaka et al., 2023). As seen from this example, attention and EF difficulties and associated behavioural problems may impact parents' feelings of their efficacy. Previous research found that children's EF skills partially mediated the relationship between parenting stress and parenting quality (Qian et al., 2024). Behavioral issues arising from EF difficulties, such as oppositional behaviors, poor impulse control, or emotional outbursts, may lead to challenges in setting clear boundaries and consistently implementing discipline for parents. Parents may feel that commonly known methods of parenting (i.e., boundary setting, establishing consequences) are ineffective, which can negatively impact their belief in their ability to manage their child's behavior and decrease their sense of efficacy.

Cultural beliefs and societal expectations about parenting can influence parents' sense of efficacy. For example, parents in collectivist cultures, where extended family involvement and community support are normative, may feel more supported in their

parenting role, which may enhance their efficacy (Ardelt et al., 2019). In addition, research shows that perceived social support (i.e., supports at home, school and broadly within communities such as programs or interventions) strongly correlates with parent self-efficacy, as access to culturally relevant resources and community networks can enhance parents' confidence and coping strategies in raising children (BMC Public Health, 2024). Research underscores the importance of perceived social support in enhancing parenting efficacy. A study of parents of young children demonstrated that strong social support networks, whether through family, friends, or formal community services, are positively correlated with parents' sense of competence and resilience in managing child-rearing challenges (BMC Public Health, 2024). This highlights the critical role community structures play in reinforcing parenting confidence and adaptability. Environmental factors, such as neighborhood safety and access to quality schools, also play a role. Parents in safe, resource-rich environments may feel more empowered to raise their children effectively (Rowe et al., 2013).Relationship between SES and Parent Efficacy

The availability of social support and community resources can also play a protective role in moderating the effects of low SES on parenting efficacy. When families have access to supportive networks, such as extended family, community services, or mental health resources, parents may feel more empowered and equipped to handle stressors, which can protect against the adverse effects of economic challenges on parenting behaviours (Gershoff et al., 2007). FSM highlights that when these supports are unavailable or insufficient, parents’ stress levels and their perceived efficacy in managing family demands are likely to suffer.

The relationship between low SES, increased stress, reduced sense of efficacy in parents, and negative parenting behaviors have important implications for child outcomes. According to the FSM, children in low-SES households may face a higher risk of emotional and behavioral challenges, partly due to the stressors their parents face and their impact on parenting practices (Conger & Donnellan, 2007). As parents' stress levels increase, such as in low SES families due to stress related to financial instability, having limited access to resources, and housing instability, parents may start to have lower confidence in their parenting skills which in turn impact their parenting practices. Research suggests that children from low SES families may experience increased anxiety, lower self-esteem, and higher levels of aggression, as they are influenced by economic hardship and the associated parenting difficulties that emerge when parents feel less effective (Conger & Donnellan, 2007). Similarly, low parent efficacy impact children's cognitive development. Research indicates that children of parents who have lower efficacy may experience reduced language and cognitive skills due to a less stimulating home environment (Albanese et al., 2019). In addition, low parent efficacy may impact the development of attention and EF skills. Parents who have low efficacy may provide less structured and supportive environments, which can impact children's abilities to focus, self-regulate, and problem-solve effectively which are all crucial for academic success and successful social interactions (Albanese et al., 2019; Schroeder & Kelley, 2010). By addressing both financial stressors and parental support systems, interventions targeting low-SES families have the potential to foster resilience and potentially improve both parenting efficacy and child cognitive and emotional development and well-being.

The Relationship Between Home-Based Interventions and Parenting Efficacy

Parent-delivered interventions, which involve parents implementing specific strategies at home to support their child's development, offer numerous benefits for both parents and children, especially in the context of improving parents' sense of efficacy and confidence. Research has consistently shown that when parents are equipped with evidence-based strategies and supported in applying them consistently at home, they can support their children's development and well-being in meaningful ways (Kaminski et al., 2008; Smith & Jones, 2017). Programs like the Incredible Years and Parent-Child Interaction Therapy (PCIT) train parents to use positive reinforcement, set clear expectations, and manage challenging behaviors. These strategies often result in reduced parenting stress and greater self-efficacy (Kaminski et al., 2008). Following participation in these programs, parents generally report feeling more competent in managing their children's behaviors and improving family dynamics. Interventions that focus on improving parent-child interactions, especially through play and communication, have been found to enhance parents' confidence in their ability to support their child's development (Png et al., 2024). One study that focused on providing a home-based, parent-delivered intervention to toddlers with ASD found that parents benefitted significantly from coaching sessions (Png et al., 2024). In addition, parents reported greater confidence in managing child behaviours, which suggested greater levels of parent efficacy. Further research demonstrates that when parents participate in intervention programs, children show improvements in emotional regulation, social skills, and academic outcomes. A study by Webster-Stratton (2001) found that parents who received training on behavior management saw reductions in children's disruptive behaviors and improvements in social skills which may help to reduce parental levels of

stress associated with behavioural problems. These improvements were attributed to the parents' ability to implement structured behavioral techniques in real-world settings. This ability to implement techniques and strategies may improve family communication which may help to increase parenting efficacy.

In addition, parent-delivered interventions can strengthen the parent-child relationship by improving communication and quality time spent together. Programs like Triple P (Positive Parenting Program) focus on improving communication and fostering positive interactions between parents and children (Sanders, 2012; Sanders, Kirby, Tellegen, & Day, 2014). Studies show that these parent programs help parents build stronger emotional bonds with their children and improve overall family harmony (Sanders et al., 2014). Research on parents' experiences with delivering the Triple P (Positive Parenting Program) has found several key themes that reflect both the challenges and positive outcomes associated with participating in the program, particularly for low-income and high-stress families. Triple P is a home-based parenting skills program designed for parents which can be completed face to face, via telephone, or online depending on the level of support needed (Sanders, 2012). While challenges such as initial resistance and the time commitment have been noted, parents' experiences have been largely supportive of the program's impact on increasing parent efficacy (Ainsworth & Bell, 2014; Sanders & Prinz, 2005). Parents frequently report increased confidence in managing their children's behavior after completing Triple P. The program's emphasis on clear, simple strategies for setting boundaries and reinforcing positive behaviors may help parents feel more capable in their parenting roles. Many parents feel empowered as they notice improvements in their children's behavior, which

may foster a more harmonious home environment (Ainsworth & Bell, 2014; Sanders & Prinz, 2005; Spoth, Guyll, & Day, 2022). While Triple P is an actual parenting program, other parent-delivered programs that do not focus on improving parenting practices could have similar impacts on improving family harmony and communication. Parents who deliver an intervention (i.e., cognitive, academic, or a psychosocial) may spend more quality time with their children which may help to improve parent-child relationships and in turn parents' feelings of efficacy. In addition, effective interventions target areas of difficulty such as cognitive skills, behaviours, or emotion regulation skills and aim to improve children's skills in these areas. This may help to reduce parental levels of stress and foster positive family relationships.

Parent-delivered interventions have been used in the literature to examine the impact of home-based interventions in families with low SES. For example, one study explored how parent training in language development can improve language outcomes for children from low-SES backgrounds (Weitzman & Greenberg, 2019). The researchers found that when parents were trained to use strategies like increased child-directed speech, their children showed significant improvements in language skills. This study aligns with the FSM by emphasizing how reducing stressors (such as a lack of parental knowledge) through training and support can improve parenting and, in turn, child outcomes.

The FSM has also been applied in studies examining parent-delivered interventions aimed at improving outcomes for children, particularly by addressing stress within families. For example, mindfulness-based programs for parents are frequently studied within the FSM framework. A systematic review found that mindfulness-based

interventions reduce parenting stress and improve child outcomes, which are consistent with overall FSM principles (Burgdorf et al., 2019).

Finally, parent-delivered interventions offer a sustainable approach to long-term behavioral change due to the fact that they provide tools and strategies for parents to use in their everyday lives. When parents are involved in the intervention process, they are better able to generalize learned strategies across various contexts, which often leads to more consistent outcomes. This also enables parents to adapt strategies to meet the unique needs of their child, which may in turn enhance the intervention's effectiveness (McMahon & Forehand, 2003). All these factors contribute to increase parents' sense of efficacy levels in their parenting skills which positively impact child-related outcomes.

While there are many benefits to home-based or parent-delivered interventions in low SES families, parents participating in such interventions may face challenges, such as time constraints and financial stress, which can limit their ability to fully engage in interventions (Pellecchio et al., 2018). However, strategies that promote collaboration, support networks, and culturally relevant content have been shown to increase participation and reduce dropout rates (Barth, 2009; Skowron et al., 2024). In addition, parent-delivered interventions often require parents to balance their caregiving responsibilities with the demands of the intervention. This can lead to feelings of both empowerment and stress. Research suggests that the quality of parent-child interactions, particularly when supported by trained facilitators or program staff, plays a key role in the outcomes of such interventions (Barth, 2009; Skowron et al., 2024). Effective programs often focus on improving parents' confidence in their ability to support their children's development, while also providing tools to manage the stressors that come with

low SES (Luo et al., 2016). While the importance and positive impact of parent-delivered interventions on child and parent outcomes are established in the literature, very few studies have investigated the role of child cognitive interventions on child (i.e., attention and EF) and parent outcomes (i.e., parent feelings of confidence, efficacy). As such, the current study aimed to address this gap in the literature by combining a parent delivered cognitive intervention (attention and EF intervention) with parent coaching sessions.

Interventions to Improve Attention/EF Skills in Children

Attention

Attention refers to selectively concentrating on one aspect of information or stimuli while ignoring other stimuli (Posner, 2011). It is widely accepted that attention and EF skills are closely related, and that attentional control is necessary for performance on EF tasks (Wiebe, Espy, & Charak, 2008). It has been suggested that basic attention skills, such as basic alertness and the ability to shift focus, are essential for EFs (Diamond, 2006). This perspective emphasizes that the capacity to regulate attention is essential for goal-directed actions and planning, which makes attention a crucial element for EFs. In this sense, attention is thought of as a precursor to strong performance on EF tasks, and at a conceptual level, attention is required for executive control. Similarly, Posner and DiGirolamo (1998) argue that executive attention is responsible for conflict resolution that may arise in EF-demanding situations and hence constitute it as a part of EFs. Evidence from confirmatory factor analysis (CFA) supports this notion and highlights shared variance across various EF tasks, which likely reflects the importance of attention control during EF tasks (McCabe, Roediger, McDaniel, Balota, & Hambrick,

2010). These findings suggest that attention control can be viewed as a distinct component of EF, which is very important for higher-order cognitive regulation.

Several terms are used to describe the attention required for EF tasks, including executive attention (Kane, Conway, Hambrick, & Engle, 2007; McCabe et al., 2010), attentional control (Anderson, 2002), and cognitive control (Depue, Banich, & Curran, 2006). Consistent with this view, Anderson (2002) identified attentional control as one of the four key elements in the "executive system model." Similarly, Posner and DiGirolamo (1998) argue that executive attention plays a critical role in resolving conflicts that arise in EF-related scenarios, establishing it as a unique aspect of executive functioning. Given the strong connection between attention and EF capabilities, the following sections will delve into attention in greater detail.

Theoretical Models of Attention. Attention has many component processes that are sub-served by different brain networks (Petersen & Posner, 2012), including orienting towards and selecting stimuli to attend to, maintaining a state of alertness, regulating thoughts, focus and responses (Pozuelos, Paz-Alonso, Castillo, Fuentes, & Rueda, 2014). While attention has been conceptualized in many different ways (Baddeley, 1996; Neumann, 1996; Sturm & Zimmermann, 2000), one of the most foundational theories of attention is based on the triadic model (Petersen & Posner, 1990). This model categorizes attention into three core systems including alerting, orienting, and executive control systems. Within this model, alerting refers to achieving and maintaining a state of readiness to respond to incoming stimuli. Areas of the frontal and parietal lobes and locus coeruleus are involved with the alerting network, as well the right hemisphere of the brain (Posner & Petersen, 1990). Orienting involves directing focus to specific spatial

locations, and frontal eye fields, superior parietal cortex, temporoparietal junction and subcortical structures such as the superior colliculus are involved in the orienting network (Peterson & Posner, 1990). Finally, executive control manages conflict resolution and decision-making processes (Posner & Petersen, 1990). The functions of the executive attention network include selecting the appropriate response to different situations, maintaining goal-relevant responses and suppressing goal-irrelevant information (Rueda, Posner, & Rothbart, 2005). The prefrontal cortex (PFC), anterior cingulate cortex, and basal ganglia play a central role in executive attention, overseeing higher-order processes such as goal setting and conflict resolution (Tang et al., 2023). Out of the three networks described, *executive attention* is considered as the entry to conscious state and is involved with conflict resolution in conflict tasks such as the Stroop or Flanker tasks (Petersen & Posner, 2012). Thus, this is the higher-order *executive attention* network that is most closely associated with EFs (Rueda et al., 2005). Given that Posner's model provides a valuable framework to understand the relationship between attention and EFs, it will be used as the main framework for attention in this dissertation.

Development of Attention in Children. It was shown that children start to develop the ability to sustain, shift and inhibit attention in the first year of life (Wiebe & Karbach, 2018). After this, the ability to pay attention develops rapidly during the preschool years (Mahone & Schneider, 2012). Children are constantly confronted with complex and novel environments that are full of distractions and stimulation; thus, they need to learn to attend to important stimuli and disengage from unimportant stimuli when necessary to function well. All of these abilities require attention (and EF) control, which makes the development of attention and EF a very important task in childhood years.

At the brain level, maturation of the brain occurs in a back-to-front direction, with a protracted development of the prefrontal cortex which is associated with higher cognitive level processes such as executive attention and EF (Best & Miller, 2010; Hoyer et al., 2021; Toga et al., 2006). In fact, the ability to inhibit pre-potent responses progresses from a total inability to inhibit these responses to accurate performance between the ages of 2 to 4 years (Gerardi-Caulton, 2000). Additionally, attention control and working memory go through important changes in middle childhood until ages 14-15 years (Conners, Epstein, Angold, & Klaric, 2003; Huizinga et al., 2006). Children learn to resist irrelevant and distracting stimuli during middle childhood years, and selective attention becomes stronger (Fisher, Godwin, & Seltman, 2014). This shows that executive attention starts to develop in the first year of life and continues to develop throughout childhood.

Dysregulation of attention and attention problems may have serious consequences of children and their families. Attention problems were found to be associated with lower performance on cognitive and IQ tests (Friedman et al., 2017). In addition, children with attention problems are shown to struggle more academically (Bledsoe et al., 2010) and may have a higher incidence rate of psychiatric problems (Tzang et al., 2018). Given that attention abilities start to develop and mature in early childhood, and that attention problems are closely related to cognition, academic achievement and emotional well-being, it is essential to support and promote healthy development of attention abilities in early childhood.

Executive Functions

As mentioned earlier, EF refer to a set of higher-level cognitive processes that allow for controlled and purposeful goal-directed behaviour (Friedman & Miyake, 2017). While there is no consensus on what clearly constitutes as EF, most researchers agree that inhibition, working memory and cognitive flexibility are core EFs that are needed for healthy cognitive development, success in all types of environments, and well-being/health across the lifespan (Alloway & Alloway, 2010; Bull, Espy & Wiebe, 2008; Miyake et al., 2000; Muller, Baker, & Yeung, 2013). Inhibition or inhibitory control is defined as the inhibition of a prepotent response, stopping of an ongoing response, or resisting distractions (Barkley, 1997; Zhou et al., 2021). Working memory refers to the systems that are involved in keeping information in mind and manipulating it while performing complex tasks (Baddeley, 2010). Working memory abilities are strongly correlated with other aspects of cognitive processes, including verbal comprehension, reasoning abilities and academic success (Kane & Engle, 2002). Finally, cognitive flexibility refers to the ability to switch between thinking about two different concepts or to think about multiple concepts simultaneously (Zelazo, 2015). Cognitive flexibility allows children to adapt flexibly to their constantly changing environment. This ability also allows children to override their automatic responses and thoughts to better adapt to their environments to obtain their goals (Neiworth et al., 2022). As discussed previously, while attention is not a core EF construct, basic attention is needed for EFs (Wiebe et al., 2008).

Theoretical Models of EFs. For decades, researchers have created models with the goal of defining and explaining the nature of EFs (Kirkham, Cruess, & Diamond, 2003; Miyake et al., 2000; Zacks & Hasher, 1994). Initially, Baddeley (1996)

conceptualized EF as a single, unitary construct for directing and regulating behaviours. On the other hand, others have conceptualized EFs as several distinct constructs that rely on each other for coordinating goal directed behaviours (Barkley, 1997).

Researchers in this field debate whether EFs are unitary or distinct constructs (Bull et al., 2008; Hughes & Ensor, 2007; Lerner & Lonigan, 2014; Miyake et al., 2000). One of the most prominent theories in the literature remains Miyake et al, (2000)'s theoretical approach that defines EFs as a multi-component system that include both independent and interrelated processes (Miyake et al., 2000; Stuss & Alexander, 2000). In this model, Miyake et al. (2000) proposed that there are three core components of executive functions (e.g., inhibition, working memory and shifting) which are related but distinct constructs. This combines the unitary and distinct models which shows that distinct EFs tend to correlate highly with each other, which shows unity, but there is also evidence of diversity in that they tap into different abilities (Miyake & Friedman, 2012). In addition, confirmatory factor analysis (CFA) studies demonstrated that inhibition, shifting, and updating are distinct but interrelated components. For instance, Friedman et al. (2012) found a common EF factor that supports these specific abilities, aligning with the "unity and diversity" hypothesis in adults, adolescents, and school-aged children. However, CFA studies with preschool-aged children support a single latent EF construct in studies with preschoolers (Wiebe et al., 2011). These results suggest that EFs start as a unitary construct and start to differentiate during development.

More recent integrative models of EFs, such as Doebel's (2020) developmental framework, highlight the relationship between environmental and social influences on EF development such as differences in cultures and situations. In addition, Lipina (2023)

demonstrated the importance of early childhood environments and how EF capacities are shaped by complex interactions between biological predispositions and socio-cultural factors such as SES and parenting practices. These models reflect a shift toward understanding EFs as adaptive, context-sensitive constructs rather than static traits that people are born with.

Neural Correlates of Attention and EFs. Frontal lobes and functioning of the frontal lobes are strongly associated with attention and EF function. With respect to attention, the prefrontal cortex (PFC) plays a pivotal role in the top-down modulation of attention (Buschman & Miller, 2007; Yantis & Jonides, 1996). It helps maintain focus on goal-relevant information and suppresses distractions. Other key areas involved in attention include Dorsal Attention Network (DAN) which involves the intraparietal sulcus (IPS) and frontal eye fields (FEF), is primarily responsible for voluntary, goal-directed attention (Corbetta et al., 2005). It facilitates the orienting of attention to specific spatial locations and is crucial for tasks requiring sustained focus. On the other hand, the Ventral Attention Network (VAN), which is also known as the salience network, includes regions such as the insula, temporoparietal junction (TPJ) and ventral frontal cortex (Peters, Dunlop, & Downar, 2016). It is involved in detecting behaviorally relevant stimuli, particularly those that are unexpected or novel, thereby guiding attention to salient events (Menon & Toga, 2015). Finally, the parietal lobe, particularly the posterior parietal cortex, is involved in spatial attention and the integration of sensory information. It contributes to the allocation of attentional resources to different spatial locations (Behrmann, Geng, & Shomstein, 2004).

Similar to the attention networks, EFs involve a complex network of interconnected brain regions, with the prefrontal cortex (PFC) being highly involved during EF tasks. Specific regions within the PFC, such as the dorsolateral prefrontal cortex (DLPFC), ventromedial prefrontal cortex (VMPFC), and orbitofrontal cortex (OFC), are linked to distinct EF components. For example, the DLPFC is crucial for working memory and cognitive flexibility, while the OFC supports decision-making and social cognition (Tang et al., 2023). The anterior cingulate cortex (ACC) also plays a significant role, particularly in error detection and conflict monitoring. Studies using functional MRI (fMRI) and event-related potentials (ERPs) show heightened ACC activity during tasks requiring inhibition and shifting, such as the Stroop task (Botvinick et al., 2001). This indicates its role in managing competing demands and prioritizing responses.

In addition to the PFC, subcortical regions, such as the basal ganglia, contribute to task-switching and action initiation. The basal ganglia's loops with the PFC ensure efficient regulation of motor and cognitive processes. The thalamus acts as a relay center, filtering sensory inputs and modulating attention, a precursor to effective EF operations (Tang et al., 2023).

Longitudinal neuroimaging studies reveal that EF neural circuits undergo significant development during childhood and adolescence, marked by increased connectivity and gray matter pruning in the PFC. This maturation correlates with improvements in task performance which suggests a strong link between structural and functional brain changes and EF growth (Howard et al., 2023).

Development of EFs in Children. Research with preschool-age children suggests that a single, unitary EF factor may be present instead of the three-factor model, and that working memory and inhibitory control in this age group may be tapping into the same ability (Wiebe, Espy, & Charak, 2008). Consistent with this idea, Wiebe et al. (2011) reported that there was no distinction between working memory and inhibition skills at age three years. On the other hand, Schoemaker et al. (2012), in a sample of three to five-year-old children, found distinct but correlated working memory and inhibition abilities in this age group. Further, Wiebe, Espy, & Charak (2008) found that a simple, single executive control factor model was supported over multifactor executive control models in preschoolers. Similarly, Wiebe et al. (2011) found that in a group of 228 three-year-old children, the fit of a single latent EF construct was supported over a multifactor EF construct. This research suggests that EFs may start out as an undifferentiated unitary process when children are born, and become differentiated and distinct as children develop and mature. (Huizinga, Dolan, & Van der Molen, 2006; Wiebe, Epsy, & Charak, 2008).

As mentioned earlier, EF development happens in a protracted fashion following the maturation of the prefrontal cortex (Hoyer et al., 2021), and different EF abilities start to come online at different ages depending on their stage in development. The development trend is not linear; instead, there seems to be periods of acceleration, plateauing and deceleration in the development of EFs (Huizinga, Dolan, & van der Molen, 2006). Because of very slow maturation of frontal lobes and particularly prefrontal cortex, EF is one of the last cognitive functions to develop, not fully reaching

adult levels until the early 20s (Li et al., 2004). As prefrontal cortex continues to develop and mature into adulthood, EFs follow a similar path.

Early and middle childhood is considered to be one of the most important time periods for EF development as seen behaviourally in children's improved ability to resist impulses and follow social rules (Wiebe & Karbach, 2018). As children get older and their EF skills mature, they are better able to resist impulses, follow social rules and engage in goal-directed behaviour. By five years of age, children show improved ability to inhibit previously learned responses (Clark et al., 2013) and to delay gratification (Carlson, Moses, & Claxton, 2004). Overall, research shows that EFs start to develop in the first year of life and continue to develop through early childhood, with a spurt in preschool years (Zelazo & Müller, 2011). Early rudimentary EFs set the stage for the development of more complex EFs later on, highlighting importance of promoting healthy EF development in early childhood.

Core EFs such as inhibition and working memory start to develop in the first year of life and go through important changes in preschool years, while more complex EFs such as planning and problem solving take a longer time to develop and reach maturity into early adulthood (Espy, 1997; Espy, Kaufmann, McDiarmid & Glisky, 2001). Studies that have examined the development of inhibition skills in preschoolers have found that prefrontal cortex was involved in inhibitory control activities in preschoolers, and that age contributed to the variability in inhibitory control with older children performing better on inhibitory control tasks (Liu et al., 2015; Watson & Bell, 2013; Zhou et al, 2021). Similarly, working memory abilities go through important changes in early and middle childhood, and do not reach adult levels until the age of 15 years (Huizinga et al.,

2006). Studies have shown substantial development of working memory and capacity of working memory storage between the ages of 4 and 7 (Applin & Kibbe, 2020; Cheng & Kibbe, 2022; Pailian et al., 2016), which highlights the importance of targeting these skills in early childhood while they are more malleable to change. In terms of cognitive flexibility, studies have shown that while 4-year-old children can successfully switch the rules on the Dimensional Card Sorting Task (DCST), 3-year-olds typically perseverate and keep applying the first rule they have learned instead of applying the new rule (Doebel & Zelazo, 2015; Zelazo, 2006). In addition to better performance, 4-year-olds showed increased activation in the left inferior prefrontal cortex on DCST task compared to 3-year-olds (Morton et al., 2009), which demonstrates the importance of the prefrontal cortex in task-switching and cognitive flexibility tasks. Performance on cognitive flexibility tasks improves with age, and children are shown to be able to handle more complex tasks and rules with older age (Diamond, 2013). Taken together, the behavioural and neuroimaging studies demonstrate that EF skills mature rapidly during early and middle childhood, suggesting that this may be a period of high plasticity and malleability to change and improvement.

Attention and EF Development and SES

The impact of SES on child development, particularly attention and EF development, is widely documented in the literature. Children from low-SES families consistently face challenges such as lower cognitive abilities, poorer academic performance, and increased mental health issues like anxiety, depression, and ADHD (Evans & Schamberg, 2009; Hackman & Farah, 2009; Last et al., 2018; Lawson & Farah, 2017; Noble, McCandliss & Farah, 2007). These disparities are mediated by factors

including environmental stress, limited access to enriching resources, and parental challenges.

As described previously, attention and EFs are closely linked to the prefrontal cortex (PFC) and frontal regions of the brain, which goes through rapid changes shortly after birth, and particularly in early childhood and in preschool years (Best & Miller, 2010). PFC development is driven partly by to genetics; however, it also depends on the transactions with the environment (Raver, McCoy, Lowenstein, & Pess, 2013). Thus, children who have fewer experiences that allow for healthy attention and EF development will have different developmental trajectories compared to children who have more opportunities. These adverse conditions may be due to lack of opportunities such as access to enriched preschool environments and books, chaotic living conditions, or poverty (Sasser, Bierman, Heinrichs, & Nix, 2017). As a result, attention and EF development is susceptible to the disparities in opportunities and experiences between lower and higher SES environments. Indeed, research suggests that attention and EF are strongly and significantly associated with SES (Hackman & Farah, 2009), with children from high-SES families consistently outperforming those from low-SES families on attention and EF tasks (Hughes & Ensor, 2009; Ming et al., 2019; Noble, Norman, & Farah, 2005). Children from lower SES backgrounds perform more poorly on multiple components of attention and EF tasks, including working memory, attention, inhibition and flexibility tasks starting from early childhood (Noble, McCandliss & Farah, 2007). This negative relationship between SES and attention/ EF is seen across the lifespan starting from early childhood into adulthood and appears to be chronic/long term

(Biederman et al., 2023; Calhoun et al., 2021; Evans & Schamberg, 2009; Wu, Wang, Cao, & He, 2021).

One theory that may explain the mechanism of action between SES and attention/EF development is that the chronic stress experienced by children who live in economically disadvantaged backgrounds may cause disruptions in the development of the brain, and particularly the PFC, which is strongly associated with the development of attention and EFs in children (Blair & Raver, 2012). Prenatal or early-life exposure to stress impairs the hypothalamic-pituitary-adrenal (HPA) axis development and activity, which is responsible for regulating response to stressors in the environment, and regulating bodily functions such as the immune system, digestion and mood and emotions (Maniam, Antoniadis, & Morris, 2014). It was shown that early life exposure to prolonged or extreme stress, such as in families living in poverty, can cause the HPA-axis to be hyper-reactive and lead to a lifelong vulnerability to stress (Flinn, Nepomnaschy, Muehlenbein & Ponzi, 2011). Chronic stress indicated by the activation of the HPA-axis is known to affect cognitive performance and may cause cognitive dysfunction in adults and children, particularly on tasks related to memory (Wolf, 2009).

Finally, neural models suggest that brain development is a complex process influenced by many factors, including genetic, environmental, and experience-dependent factors. Maturation of the brain regions that are responsible for attention and EFs start in infancy and continue in childhood and adolescence (Moriguchi, Zelazo, & Chevalier, 2016; Sowell, Thompson, Leonard, Welcome, Kan & Toga, 2004; Toga, Thompson & Sowell, 2006) and is influenced by early childhood experiences including family life and SES. In a study by Hanson and colleagues (2013), the researchers examined the

development of brain structure using children aged between 5 months and 4 years and found that the development of frontal gray matter, which has associations with EF abilities, was faster in children from higher SES families (Hanson et al., 2013). In another study, Raizada, Richards, Meltzoff, and Kuhl (2008) found a positive relationship between SES and gray matter volume in the left inferior frontal gyrus. Other researchers have found differences in cortical thickness and smaller PFC volumes in children from low SES backgrounds (Brain Development Cooperative Group, 2012; Jednoróg et al., 2012). Taken together, these studies demonstrate that SES influences neural development, particularly within prefrontal regions of the brain that are responsible for higher level cognitive abilities such as attention and EFs.

SES-related EF differences have been found in 3-to-5-year olds on goal-setting, flexibility, and working memory tasks (Lipina, Martelli, Vuelta, Injoque-Ricle, & Colombo, 2004) and on attention measures in 4-to-7 year olds (Mezzacappa, 2004). A similar pattern has been found for older children, which suggests that these EF-related difficulties that result from SES disparities persist into adolescence and adulthood. For example, Hackman et al., (2014), found that there are SES-related disparities on a working memory task in children and adolescents aged between 10 to 18 years old. It is also shown that the length exposure to poverty between birth and age 13 predicted the working memory abilities as an adult. That is, children who had longer exposure to poverty had worse working memory outcomes compared to children who did not experience poverty (Evans, Schamberg, & McEwen, 2009). As working memory and other core EFs, such as inhibitory control and attention shifting, are the basis for higher-order cognitive processes such as planning, problem solving and goal--directed behaviour

(Miyake et al. 2000), these early EF deficits may result in long term problems with higher order EFs (Blair & Razza, 2007). These studies suggest that the relationship between SES and EF is mediated by differences in the environment associated with SES-related factors such as parental stress and care, malnutrition or poor psychosocial environment in childhood. Thus, this suggests that differences in cognitive or social outcomes due to SES are amenable to environmental modifications and may be preventable (Diamond. Barnett, Thomas & Munro, 2007; Noble et al., 2007).

Low SES is closely tied to higher risks of attention and EF disorders, including ADHD, due to a range of factors. Chronic stress experienced by families from low SES backgrounds has been shown to disrupt the development of the prefrontal cortex, impairing attention and EFs like self-regulation, impulse control, and working memory (Bernier, Carlson, & Whipple, 2010; DeGruyter, 2023; Frontiers in Psychology, 2024; Hackman, Gallop, Evans, & Farah, 2015). Limited access to cognitive stimulation, early learning resources, and healthcare further exacerbates these deficits, leaving children from low-SES families particularly vulnerable to cognitive and behavioral challenges (Carrasco et al., 2021; Springer, 2023). Children from low-SES families are more likely to show delays in cognitive development and to face challenges in school, peer relationships, and later occupational difficulties (Carrasco et al., 2021), which can lead to further difficulties.

Research highlights that attention issues and executive dysfunction in these populations are associated with poor academic outcomes, such as lower performance in reading, writing, and mathematics (Last et al., 2018). Deficits in attention, working memory, and self-regulation can impair learning and task completion, leading to lower

academic performance. Furthermore, environmental factors such as inadequate educational resources, less parental involvement, and higher rates of absenteeism contribute to widening achievement gaps between low-SES children and their higher-SES peers (Bierman et al., 2008; Last et al., 2018). The negative effects of low SES on academic performance extend beyond cognitive deficits. Chronic stress, which is common in low-SES households, has been linked to both physiological changes in the brain and emotional difficulties, such as higher rates of anxiety or depression, which can further impact academic work and progress (Bernier, Carlson, & Whipple, 2010; Tonkin, 2001). Social challenges, such as limited access to peer networks and extracurricular activities, also contribute to the academic achievement gap, as these students often lack the supportive environments that are essential for educational success (Bierman et al., 2008).

In addition, the effects of these cognitive difficulties extend to social and peer-relationship related outcomes as well. Children with weaker attention and EF skills often struggle with peer relationships, which can lead to higher risk of social exclusion or bullying (Bierman et al., 2008). This lack of social support, coupled with academic challenges, can result in poor long-term outcomes, such as underachievement, poor mental health, and higher rates of behavioral disorders (Tonkin, 2001).

Deficits in attention and EFs that result from SES-related disparities put children at risk for differences in school readiness and may lead to negative life trajectories including serious and lifelong academic, behavioural, and social problems (Chung et al., 2016). Due to this, early intervention (in childhood years as opposed to later years of life) typically leads to better results (Dias & Seabra, 2017) because early intervention may

improve brain development and person-environment interactions, provide enriched learning opportunities and may reduce chronic stress experienced by families (Landa, 2018; Wass, Scerif, & Johnson, 2012). Thus, it is important to remedy the early attention and EF deficits in children who are at an increased risk of experiencing these problems to avoid possible negative life trajectories. Given the fact that children who come from low SES backgrounds have more difficulties with attention and EFs, early interventions that target these skills are crucial for long-term academic, interpersonal and occupational success.

These findings underscore that SES-related attention and EF disparities are rooted in environmental factors such as malnutrition, psychosocial stress, and inadequate parental care. However, research highlights that these differences are modifiable through targeted interventions (Brock et al., 2018; Giovanetti et al., 2020; Neville et al.; Schubert, 2018). Programs focused on early childhood education, parental support, and reducing environmental stress have demonstrated success in improving attention and EF outcomes in children from low-SES backgrounds, which suggests that these cognitive and social disparities are preventable (Diamond. Barnett, Thomas & Munro, 2007; Noble et al., 2007).

Cognitive Interventions for Attention and EF

Given the importance of attention and EFs for healthy development, promoting and strengthening these skills has been a focus of research in the early childhood development field (Diamond, 2012; Diamond & Lee, 2011). There are different types of intervention approaches for remediating attention and EFs including pharmacological treatments, behavioural interventions and cognitive interventions (Diamond, 2012;

Diamond & Lee, 2011). Cognitive interventions will be the focus of this study. The importance of attention and EFs for healthy development has led researchers to develop programs for improving attention and EFs. Cognitive interventions for attention and EF problems, such as direct interventions aimed at improving cognitive functions, are one method of improving such skills. There are different approaches to cognitive intervention in the literature, including include compensatory, process specific and combined approaches (Mateer & Sohlberg, 1987; Mateer, Kerns & Eso, 1996).

One form of attention and EF training is the 'compensatory approach' (Conners, Rosenquist, Arnett, Moore, & Hume, 2008; Loomes, Rasmussen, Pei, Manji, & Andrew, 2008; Ylvisaker et al., 2003). When using the compensatory approach for remediating attention and EFs, the individual is taught techniques and strategies to help 'compensate for' or 'work around' cognitive difficulties (Sohlberg & Powell, 2011). Specific techniques may involve learning to follow a checklist to engage in certain behavioural routines, learning metacognitive strategies or using technology such as memory aids, navigation devices and flow charts to help a person reflect on their behavior and use strategies to improve functioning in real-life situations. These skills or strategies do not improve in individual's cognitive abilities but teach them to work around their challenges and improve their functional abilities (Mateer, Kerns & Eso, 1996). While this works for some individuals, at other times, when working with children, interventionists may wish to use approaches that have the potential to remediate the weakness or problem instead of working around the weaknesses. Research indicates that when working with children, it may be appropriate to strengthen brain systems as much as possible (process-specific

approach), then use compensatory approaches to support challenging areas (Cicerrone et al., 2011; Lannin et al., 2014; Ylsaviker et al., 2001).

A second approach to cognitive training is the direct training of these skills, also known as the process-specific approach (Sohlberg & Mateer, 1987). This approach utilizes repeated exercises in targeted areas to help an individual improve their cognitive abilities through mass practice (Sohlberg & Mateer, 1987). The process-specific model of attention and EF training involves targeting one specific cognitive ability through repeated exercises to reorganize the neural pathways in the brain and improve cognitive abilities (Sohlberg et al., 2003). This approach capitalizes on properties of neuroplasticity, in the sense that repetition and consistent use of one ability can lead to neural change and improve the functioning of that specific skill (Feuerstein, Falik, & Feuerstein, 2013; Kleim & Jones, 2008). Kleim and Jones (2008) provided core principles of experience-dependent plasticity that are relevant for this type of cognitive remediation. The core principles of "intensity", "salience", and "repetition" means that long-lasting neural change requires repetition of a salient behaviour at a high intensity. The activities also need to be hierarchically graded and adaptive, that is self-adjusting based on individual's performance. One of other the principles "use it and improve it" refers to the principle of targeting one specific ability leading to improvement of that ability through the engagement and change of underlying neural systems (Kleim & Jones, 2008). Process-specific training has been shown to be associated with improvements in attention, EF and reasoning abilities after intervention (Johnstone et al., 2010; MacSween et al., 2011; Macoun et al., 2020; Kerns, Macoun, MacSween, Pei, & Hutchison, 2017; Rueda et al., 2012, 2005).

While process-specific and compensatory approaches are empirically validated but distinct approaches, they can be delivered in combination to maximize an intervention's success in terms of better cognitive outcomes and generalization to other situations. While there is support for process-specific training, the main criticism is problems with generalizability of effects and far transfer. An important component of enhancing outcomes from the process-specific approach is the inclusion of metacognitive strategy instruction for the individual, which refers to teaching an individual to monitor their own thinking to improve their performance on cognitive tasks (Kerns, Macoun, MacSween, Pei, & Hutchison, 2017). Researchers have found that teaching and using metacognitive strategies improves the generalization of learned abilities to other real-life tasks and increase the self-directed use of the strategies (Cicerone et al., 2011; Sohlberg et al., 2003; Tamm, Epstein, Peugh, Nakonezny, & Hughes, 2013; Ylvisaker, 1998). Previous studies have found that combining attention training with metacognitive strategies led to generalizable effects including improvements in day-to-day attention and adaptive skills, including social skills, communication, and daily living (Frontiers in Psychology, 2020; Galbiati et al., 2009; Veloso et al., 2020; Wischgoll, 2016). The findings support the claim that process-specific attention and EF training methods should be used with compensatory approaches to maximize training outcomes and generalizability effects. The brain-related changes that are promoted by process-specific training, such as improved attention and EF skills, are then better generalized to other contexts and lead to real-life behaviour changes such as improved ability to pay attention in the classroom or improved self- and emotion-regulation. Thus, the combination of process-specific and compensatory approaches is thought to promote generalization of

skills and strategies to real-world tasks and other non-trained environments and generate positive outcomes for children.

The use of a computerized or video game format may improve engagement and motivation in children when process-specific interventions are delivered (Hardy, Willard, & Bonner, 2011; Jaeggi, Buschkuehl, Jonides, & Shah, 2011). It was shown that WM training in a game format was more engaging for children; children spent more time on the training program, had better training performance, and performed better on WM measures at the end of the intervention (Ko et al., 2020; Prins, Dovis, Ponsioen, ten Brink, & van der Oord, 2011). In addition, computerized or tablet-based interventions can automatically adjust the difficulty level based on the individual's performance, which is the adaptive process-specific approach. The adaptive approach helps children work at their optimal performance or level of engagement as the level of difficulty is neither too easy nor too hard for the individual. The process-specific approach has been used with preschoolers and older children in the past, in the form of targeting attention and specific EF skills to improve them using computerized and non-computerized training procedures (Lee et al., 2016; Howard, Powell, Johnstone, & Melhuish, 2016; Re, Capodieci, & Cornoldi, 2015; Thorell et al., 2009). These studies reported promising results and found that attention and EF training in preschoolers have the potential to improve these very important abilities.

Even though many studies have shown that attention and EF training can be effective for children, others have found that these programs do not improve attention and EFs in children and does not necessarily transfer effects out of the training environment to real-world situations. For example, a meta-analysis by Melby-Lervag, Redick, &

Hulme (2016) reviewed the effectiveness of working memory training programs. They reported that the effectiveness of WM training did not transfer to non-trained abilities and to real-word cognitive skills. Similarly, another article by Shipstead, Hicks, & Engle (2012) reviewed the effectiveness of a working memory training program (Cogmed). They concluded that while this WM program showed marginal improvements in working memory capacity, the effectiveness was not maintained in the long term, and there were no transfer effects to other skills. However, while group studies don't show globally positive results, these studies collapse different diagnoses, intervention times, types of interventions, outcome measures (and timing of delivery of outcome measures), and age ranges in the studies. Thus, it is not exactly known what types of problems or age ranges this type of training is going to be most effective or not effective for.

While there is controversy about the effectiveness of computerized attention and EF interventions (Chenault, Thomson, Abbott, & Berninger, 2006; Melby-Lervag et al., 2016; Shipstead, Hicks, & Engle, 2012), there is literature documenting the efficacy of attention and EF training in children and adults to promote attention, EF skills, behaviour/emotion regulation and, in turn, academic achievement (Blair & Diamond, 2008; Kerns, Eso, & Thomson, 1999; Kerns et al., 2010; Macoun et al., 2020; Morrison & Chein, 2011; Rueda, Checa & Cómbita, 2012; Shalev, Tsal, & Mevorach, 2007; Thorell et al., 2009). One study by Rueda, Checa, & Cómbita (2012) delivered computerized attention training to a group of typically developing 5-year-old children and compared them to a non-training group. They found that children in the training group were able to activate the attention network faster and more efficiently compared to the non-training group of children. This suggests that attention abilities were improved

after training, and this effect was maintained even after two months after the training. In a similar study by Thorell et al. (2009), preschool children received visuospatial working memory or inhibition training for five weeks, and they compared the active training group to a non-training control group. They found that working memory training improved the trained aspects of working memory, as well as gains in non-trained spatial and verbal working memory and attention. On the other hand, inhibition training showed improvement on trained inhibitory tasks, but there were no transfer effects to working memory or attention abilities. This suggests that working memory training shows significant effects among preschoolers and may potentially be more effective than inhibition training (Thorell et al., 2009).

The efficacy of attention and EF training in clinical groups has also been documented in the literature. A study by Re, Capodieci, & Cornoldi (2015), investigated the effectiveness of a non-computerized EF training program, delivered by a school psychologist to five-year-old children who showed ADHD symptoms. They found that the children who participated in the program showed improvements in tasks that measured attention control, working memory and impulsive behaviours. Similarly, in a pilot study by Salvaguardia et al., (2009) with first graders who showed ADHD symptoms, it was found that attention control and working memory training improved children's EFs and decreased the presence of ADHD symptoms. In a different study by Conesa et al. (2021) examined the effects of a game-based computerized EF training program on primary school children. Their findings indicated significant improvements in inhibition and working memory, as well as academic performance compared to a control group. Additionally, in a different study, a computerized attention and EF

training game was delivered to children between the ages of six to 12 years who had Autism Spectrum Disorders (ASD) (Macoun et al., 2020). Post-intervention results showed that children showed significant gains in attention and working memory abilities, as well as improved performance on academic measure of math fluency and in behavioural regulation. Finally, a meta-analysis reviewed technology-based interventions, such as computer-assisted programs, showing moderate effectiveness in improving inattention, executive functioning, and disruptive behaviors among children with ADHD (Wu et al., 2023).

Benefits of Attention and EF Interventions in Children from Low SES Families

In addition to typically developing children and clinical groups, previous studies have demonstrated the benefits of attention and EF interventions for children from low SES backgrounds. A study by Brock and colleagues (2018) found that EF and visual-spatial training improved EF skills in children from low-income communities. In a different study, Neville and colleagues (2013) found that following a small group self-regulation and attention training, lower SES preschoolers enrolled in a Head Start program benefitted from a selective attention intervention program. They found that electrophysiological measures, standardized testing measures and parent reported attention skills in children all improved in the active training group compared to children in the control condition. Giovannetti and colleagues (2020) explored the effectiveness of a novel computerized cognitive intervention in preschoolers from low SES backgrounds. They adapted the computerized intervention based on children's performance at baseline. They found that while both control and intervention group benefitted from training in their executive attention network, children in the intervention group had greater gains. In

addition, they found that children in the intervention group had significant improvements in their working memory and inhibition skills post-intervention (Giovanetti et al., 2020). Similarly, Poon and colleagues (2020) found that following a tablet-based task-switching intervention program, children from low SES backgrounds showed significant improvements on untrained cognitive flexibility task. This effect was maintained even after a year at follow-up. Studies suggest that these interventions can lead to improvements in working memory, impulse control, and problem-solving skills, which are critical for academic and social success (Stephenson, 2022; Shinn, 2019). For example, training programs designed to enhance cognitive flexibility and inhibitory control have been particularly effective in this demographic, which helps children better manage school tasks and regulate their behavior in complex environments (Goldstein & Naglieri, 2020) and improve children's feelings of efficacy and self-concept (MacSween, Macoun, & Kerns, 2017).

While these studies demonstrate the efficacy of such interventions for children from low SES families, there are some limitations as well. While such studies implement cognitive interventions, not many programs incorporate families into the intervention process (Blakey et al., 2020; Lo et al., 2021; Poon, Ho, Chu, & Chou, 2020). As discussed previously, families from low SES backgrounds may not have the resources to access parenting supports or interventions in their community easily. For these families, combining cognitive training with other strategies, such as parent training, parent-delivered interventions, and community support, can lead to more sustainable improvements. As such, the current study aimed to address this gap in the literature by incorporating families into the direct intervention process. On the other hand, it is

important to recognize that it may be more challenging for low SES families to deliver home-based interventions due to time limits or lack of resources including technology or modes of transportation (Al-Dhahir et al., 2022; Berry et al., 2022). Other barriers may include awareness of the availability of such programs in families' communities (Berry et al., 2022). In fact, one study found that low SES was associated with reduced attendance at parenting programs (Berry et al., 2022). Facilitators of engagement for low SES families included the importance of personal contact with families (i.e., face to face or virtually), reminders for participation, and resonating intervention content that fit with parents' and families' goals (Al-Dhahir et al., 2022). Given these unique barriers and facilitators, an intervention approach that is accessible (i.e., that does not require frequent traveling or many resources), personal (i.e., connection with research team), that targets key areas or difficulties for children and parents (i.e., child struggles, cognitive or behavioural difficulties, parenting stress) and incorporates approaches that teach parents skills hold particular promise in this population. These integrated approaches may address the broader environmental factors that influence children's development and provide a more well-rounded support system for parents (Barch & Dowd, 2020). The evidence suggests that when these programs are tailored to meet the specific needs of children from disadvantaged backgrounds, they are more likely to have a positive impact on long-term outcomes, including academic achievement and social functioning (Brady et al., 2019).

A Novel Attention and EF Training Program: Dino Island

Dino Island (DI) is a hybrid intervention designed to be delivered by nonexperts in the community (i.e., parents, caregivers) that combines process specific and

compensatory approaches. DI is a tablet-based cognitive intervention which targets attention and EF in children that can be played on Android or IOS tablets. DI consists of five hierarchically graded and self-adjusting therapeutic computer 'games'. The self-adjusting and adaptive nature of the games increase the effectiveness of the intervention and make it more motivating for children.

DI is a therapeutic game based on a process specific approach, which systematically targets and trains specific EF skills through repetitive practice on self-adjusting and hierarchically graded exercises (Sohlberg & Mateer, 1987). This approach is supported by neuroscience as process-specific attention and EF interventions are shown to promote brain plasticity and cognitive gains (Feuerstein, Falik, & Feuerstein, 2013; Kelly, Foxe, & Garavan, 2006). Additionally, to maximize salience, DI includes internal motivators associated with each task; the player collects coins throughout the games and can use them to customize their character or to buy trophies in the DI store to enhance motivation. The presence of such motivators in the game makes the intervention more engaging for children and may improve effectiveness.

As explained previously, The DI intervention is a hybrid approach to cognitive interventions, and incorporates compensatory approaches with the process-specific approach. Compensatory approaches teach individuals to 'work around' their area of difficulty. As such, DI trains parents to teach their children to work around their difficulties (i.e., attention or EF) through using metacognitive strategies. This training is completed online using a laptop or a computer. Metacognition refers to the awareness and control of one's own cognitive processes, including the ability to monitor, regulate, and evaluate one's learning, thinking, and problem-solving strategies (Flavell, 1979). In DI,

parents teach child participants to monitor their own thinking and performance to maximize performance. As mentioned earlier, process-specific interventions which combine direct intervention with an active metacognition component show better efficacy and greater transfer effects to other areas as well as maintenance over time (Cicerone et al., 2011; Sohlberg et al., 2003); thus, the metacognitive component of this intervention helps to address concerns about transfer effects associated with EF training. DI is designed to be delivered with an interventionist present to teach metacognitive strategies to participants as they play the 'games' and therefore combines both compensatory and process-specific approaches. While DI is focused on improving child attention and EF skills, it also has a component that involves actively working with parents or caregivers. to support their child. While it was not designed as an intervention to improve parenting efficacy, it may have a positive impact on improving parenting efficacy and reducing parenting stress based on the literature that shows the positive impact of home-based interventions that are delivered by caregivers. (Png et al., 2024, Sanders, 2012). Additionally, as discussed previously, attention and EF difficulties may lead to behavioural difficulties that may be particularly stressful for parents (Mak et al., 2020). Since DI teaches parents and children strategies to help with attention and EF difficulties, the focus of the intervention may also reduce these attention and EF related difficulties which may reduce parenting stress and help parents feel more capable and effective. In a previous study, Caribbean Quest which is a predecessor of DI, was used to evaluate the effectiveness of a cognitive intervention (CQ) on improving children's cognitive and social self-concept and efficacy. It was found that participating in CQ led to significant improvements in cognitive and social self-concept and efficacy in young boys (younger

than 8) (MacSween, Macoun, & Kerns, 2017). This shows that cognitive interventions can be successfully used to improve feelings of efficacy.

In a study that investigated the effectiveness of an earlier iteration of DI (titled the Caribbean Quest/CQ), research assistants were trained to deliver the CQ to school-aged children with FASD in the school setting (Kerns, MacSween, Vander Wekken, & Gruppuso, 2010). Post-intervention results showed significant improvements in sustained and selective attention, working memory, and academic fluency. Similarly, Kerns and colleagues trained Educational Assistants (EAs) within the school setting to deliver the CQ intervention to children with ASD and FASD (Kerns, Macoun, MacSween, Pei, & Hutchison, 2016). There were significant improvements on measures of attention, working memory and reading fluency. In a different study, EAs were trained to deliver CQ to school-age children with attention problems resulting from a variety of different causes. Results indicated that participants made significant gains in EFs, reading fluency, academic engagement, and emotional and behavioural regulation (Macoun, Kerns, Sheehan & MacSween, 2017). More recently, the CQ intervention was delivered to a sample of children with attention and executive functioning difficulties at school by trained EAs (Macoun, Pyne, MacSween, Lewis, & Sheehan, 2020). Post-assessment measures showed improvements in attention, working memory, metacognitive awareness, and metacognitive regulation. Finally, another study that delivered the CQ intervention to children with ASD within the school setting found improvements in attention, visual working memory, and math fluency (Macoun, Schneider, Bedir, Sheehan, & Sung, 2020). The DI intervention, which is a more updated version of the CQ intervention, is a broad-based EF intervention that incorporates both process specific and compensatory

approaches. In addition, it is built in a hierarchical and adaptive manner in which exercises and games adjust themselves according to the player's performance and get more difficult as a child progresses. Studies using DI showed near-transfer and far-transfer effects in many different populations. In a study that investigated the effectiveness of DI in typically developing preschoolers, it was found that DI led to improvements in working memory (Bedir & Macoun, 2019). Other studies have found effectiveness of DI with preschoolers who were born pre-term (Guo et al., 2023) and school-aged children with EF deficits (Lewis et al., 2023). In addition, DI was assessed to be feasible for school delivery by trained EAs (Kim et al., 2023). These characteristics, and results from previous studies, show that DI can be used with children who have or who are at risk of experiencing attention and/or EF related difficulties.

The DI intervention in particular has many advantages for use in families from low SES backgrounds. As discussed previously, children from low SES families are at higher risk of experiencing attention and EF difficulties. As such, the DI intervention is well-suited to these children as it aims to improve such skills. While other studies have shown some efficacy of attention and EF training in this population (Brock et al., 2018; Neville et al., 2013; Stephenson, 2022; Shinn, 2019), many interventions that are designed to improve such skills in children from low SES families do not incorporate parents directly into the intervention process (Blakey et al., 2020; Lo et al., 2021; Poon, Ho, Chu, & Chou, 2020). The DI intervention aims to fill this gap as DI is a parent-delivered intervention that has an active parent training component to support parents in delivering a high-quality intervention to their children. This training involves teaching families the stages of child cognitive development including attention and EF skills, what

is expected during an intervention process, positive parenting strategies (e.g., active listening, movement breaks, language to talk about difficulties), and how to facilitate use of metacognitive strategies to support their children. Parents who know about their child's cognitive development and who have the tools to help their child work through difficult or frustrating tasks may feel more empowered and in-control to address any challenges that may come up in their day-to-day lives.

In addition to these benefits, DI offers weekly parent coaching groups via Teleroo (a digital healthcare tool that provides virtual meeting opportunities) that are facilitated by a DI Research Team member, which provide extra support to parents when working through the intervention and ongoing training which is not typically present in other interventions. As such, this time and direct consultation with professionals during parent groups may particularly benefit parents from low SES backgrounds and help them feel more supported and confident in their parenting practices through learning metacognitive strategies. These sessions also include discussing any challenges that arise in parents' interactions with their children, challenges that arose during the intervention tasks and how to mitigate these while doing the intervention. Then, parents are encouraged to take these strategies and apply them to other challenging or frustrating day-to-day tasks which help with transfer effects. As parents and children learn to apply these strategies to frustrating or challenging day-to-day tasks, they may experience successes or less frustration which may reduce behavioural difficulties and subsequent parent stress levels that arise from behavioural challenges. In addition, given that DI is a cognitive intervention, children directly exercise attention and EF skills which may lead to improvements in these areas and reduced behavioural challenges that rise from attention

and EF difficulties. Based on the FSM, parenting stress is directly linked to parenting behaviours and child outcomes. By participating in the DI intervention, parents learn strategies that they can use with their children which may reduce stress, which may then lead to positive parenting behaviours and child outcomes. Experiencing this change through reduced stress, greater positive parenting strategies, and potentially improved child outcomes (through attention and EF training and teaching of metacognitive strategies), parents may start to feel more confident in their parenting as well which may be associated with higher efficacy.

Current Study and Research Questions

This study aims to deliver a novel attention and EF training program, DI, to children (ages 5-12) with attention and EF difficulties as reported by their families. The main aim of the study is to determine whether delivering a home-based attention and EF intervention that includes targeted parent training influences parents' perceptions of their efficacy and stress. Additionally, this study investigates whether changes in parent self-efficacy and stress are impacted by family SES. Finally, this study aims to determine whether DI leads to any changes in parent-reported attention and EF skills in children, and whether these changes are impacted by family SES levels. SES was conceptualized as family income levels as used in previous studies (Neville et al., 2013; Noble et al., 2021).

The Family Stress Model (FSM) highlights how family income influences parent' levels of stress, mental health, and family conflict, which influences their parenting behaviours and in turn child outcomes. Utilizing this model as a framework, it is expected that parents from low SES families will report higher levels of stress and lower levels of

parenting efficacy (due to their stress levels, conflict, parenting behaviours and child outcomes) at the start of the intervention. By participating in the DI, it is anticipated that parents will have improved perceptions of their parenting efficacy and stress. Based on the FSM, it is expected that parents from low SES groups (who are anticipated to experience higher stress and lower levels of support) will show greater changes in their levels of parent-related stress and perceptions of efficacy after the intervention. In addition, it is anticipated that parent-reported child skills (attention and EF skills) will show improvements after participating in the intervention. Given the literature that shows greater attention and EF-related behavioural challenges for children from low SES families, it is anticipated that the changes in attention and EF skills will vary depending on family SES, with children from lower income families showing greater improvement.

There has been recent research showing that cognitive interventions, such as computerized attention and EF training can be effective for many populations (Kerns et al., 2010; Macoun et al., 2019). When interventions are delivered in naturalistic settings and include adults in the child's circle of care (i.e., parents, caregivers) in the intervention process, they may lead to generalization of training effects to other settings (Mingebach, Kamp-Becker, Christiansen, & Weber, 2018). Studies indicate that parents actively involved in delivering structured interventions help enhance their children's cognitive skills, including language, problem-solving, and executive functioning (Shonkoff & Fisher, 2013). These interventions also often yield positive impacts on the parent-child relationship, as engaging in targeted activities can strengthen communication and mutual understanding (Zhou et al., 2020). These parent-delivered interventions have been linked to increased parental self-efficacy and confidence, as parents feel more capable of

positively influencing their child's development, which helps to foster a sense of accomplishment and empowerment (Kaminski & Valle, 2017). Such outcomes highlight how parent-led interventions serve as an effective method not only for advancing children's cognitive skills but also for enhancing parental satisfaction and family bonds.

This project aimed to deliver Dino Island (DI; a hybrid, parent-delivered tablet-based intervention that combines process specific and compensatory training) to children with reported attention and EF difficulties. DI involves parents in the intervention process and provides training to parents through online training and weekly support groups and focuses on behavioural targets (attention and EF skills) that are identified to be more challenging for children from low SES backgrounds. The main outcome of the current study involved investigating whether DI reduces parent stress and improves parents' perceptions of their efficacy, and whether these effects on stress and efficacy are different across SES levels. Second aim of the study involves investigating whether DI led to changes in parent-reported changes in child attention and EF skills and whether these changes are different across SES levels.

Research Questions and Hypotheses

1) Given the above factors and the research literature that links low family SES to lower attention and EF skills in children, it is hypothesized that children from low SES families will present with lower attention and EF skills at the start of the intervention.
2) Based on the FSM, it is hypothesized that parents from low SES families will report more stress.

3) Based on previous literature that found greater levels of intervention-related stress in low SES families, it is hypothesized that low SES families will have greater levels of intervention stress throughout the intervention.
4) Based on the Family Stress Model, it is hypothesized that parents from low SES families will report lower levels of parenting self-efficacy.
5) Given the FSM and previous research that found reduced stress after participating in a parent-child intervention, it is hypothesized that parents' level of stress will decrease after the intervention. It is also hypothesized that changes in parents' reported stress levels will vary for low- and high-income families and that there will greater reductions in stress for lower SES families.
6) Given previous research that found reduced stress and greater parental self-efficacy after participating in a range of different parent-child interventions, it is hypothesized that parent reports of self-efficacy will improve from pre- to post-intervention. It is also hypothesized that changes in parents' self-reports of efficacy will be greater for lower SES families.
7) Finally, it is investigated whether SES play a role in changes in parent-reported child outcomes (child attention and EF skills) from pre- to post-intervention. It is hypothesized that parents' observations and perceptions of child attention and EF skills will improve after the intervention and that child outcomes (changes in attention and EF skills) will vary for low- and high-income families. It is hypothesized that children from lower income families will show greater improvements in these skills.

Methods

Study Design

This mixed methods study used qualitative and quantitative information to investigate the impact of a parent/caregiver delivered attention and EF intervention on parents' reports of their self-efficacy, self-reported parenting and DI intervention stress, and whether these changes are influenced by family SES. It also aimed to measure changes in parent-reported child behavioural outcomes (attention and EF skills) and whether these changes are influenced by family SES. As explained earlier, SES was used as a continuous variable to determine the effect of family SES on parent and child outcomes instead of artificially categorizing SES into "low" or "high" categories which may miss nuances between different SES groups. As such, the 8 income groups as they were measured were used in the analyses. Small changes in these thresholds can significantly impact results which may reduce replicability (Royston et al., 2006). SES exists on a spectrum, with incremental changes affecting outcomes differently. Treating it as a continuous variable allows for modeling gradual relationships which may improve the accuracy of analyses (Frazier et al., 2004).

Spearman correlations were used to answer the first four hypotheses about associations between SES and parent stress, parent perceptions of efficacy, and parents' reports of their child's attention and EF skills. A Repeated Measure Analysis of Variance (RM-ANOVA) was used with SES (family income) as a between subject factor to address the fifth, sixth and seventh hypotheses.

Finally, qualitative information gathered from exit interviews were analyzed using MAXQDA software. These qualitative information and analyses provide extra information and a different prong to examine the effectiveness of interventions. Qualitative information may also provide researchers with rich and detailed insights into

families' experiences, help identify barriers and facilitators, and explain potential unexpected outcomes. Consistently, the exit interviews asked parents about their own experience delivering the intervention and whether they noticed any growth in themselves both personally and in their parenting skills. Transcribed exit interviews were uploaded to MAXQDA 24. This software allows researchers to code interviews and gather themes across interviews and notes. The coding process followed an inductive and deductive approach. Initially, an open coding scheme was developed based on parents' responses which allowed for the identification of emerging themes across interviews. This involved the writer carefully examining each exit interview to identify themes across interviews and create codes. A preliminary codebook was then created with codes that aligned with the current study's research questions (parent stress, efficacy, changes based on SES). Then, a second review of each interview was undertaken by the writer to ensure that no important information was missed which helped to create a finalized codebook for all interviews. The finalized coding framework was then applied to all interviews, with MAXQDA facilitating the organization and visualization of coded segments and providing the number of families that reported changes in each identified code.

Participants

This study was approved by the Human Ethics Review Board of the University of Victoria. The data in this study were extracted from a larger study that investigated the efficacy of DI intervention on child attention and EF skills as assessed through cognitive (performance-based), neurophysiological, and behavioural (questionnaires) assessments. Participants were recruited through targeted advertisements on social media including

Facebook and Instagram pages. Recruitment flyers and posts were posted on parent Facebook groups. Interested parents were directed to the Child Neuropsychology Lab website where they could fill out a form to express interest. Following this, trained Research Assistants (RAs) called interested families to explain the study and conduct a screening interview to ensure families met inclusion criteria (Please see Appendix A for the screening interview). Families who continued to show interest signed consent forms to participate in the study and were booked for an in-person pre-intervention testing appointment. Parents and caregivers also completed a sociodemographic questionnaire when they arrived at the testing appointments to provide key background information about their family structure, income, education, and occupation (Please see Appendix B for the sociodemographic questionnaire).

Inclusion criteria were families with a child between the ages of 5-13 years with attention and EF difficulties as identified by their families. Children had to have neurodevelopmental concerns in the areas of attention and EF based on clinical diagnoses known to lead to these difficulties (e.g., ADHD, ASD) or having identified difficulties in these areas without formal diagnoses as reported by their parents or caregivers on a screening call that asked about attention and EF difficulties in day-to-day life. This recruitment approach led to a mixed pediatric sample of children with a range of neurodevelopmental and behavioural concerns associated with attention and EF difficulties. In addition, due to the requirements of the DI intervention (i.e., navigating a tablet screen, listening to instructions), child participants needed to be able to have sufficient vision, hearing, and motor skills to participate in the current study. The current study and intervention require children to be able to understand and follow game

instructions at a beginner level, meaning that while they had to understand some simple instructions (i.e., collect X, Y, Z), they did not have to understand complex language. Other inclusion criteria included comfort in understanding and speaking English for child and parent participants, parent coaches having the time, availability, and sufficient technical comfort levels (e.g., to manage the tablet intervention) to deliver an intervention. Families were not required to have their own tablet or computer to participate in the intervention as the research team was able to print paper copies of the training materials for families and loan tablets as needed.

Exclusion criteria were children who have a diagnosis of moderate, severe or profound intellectual disability were excluded. Other exclusion criteria included children who cannot see, cannot hear, or do not have sufficient mobility to use a tablet.

Child and parent participants were pre-screened for the study through a telephone screening interview with the child's parent or guardian to ensure the child met inclusion criteria.

Overall, 204 parents reached out to the research team to express interest in the study. Out of the 204 families, 139 were screened. Other families were not accessible via phone or email for screening despite multiple attempts, or expressed that they were not interested in the study after hearing the details. Out of the 139 families that were screened, all were eligible to participate. Unfortunately, 47 families expressed that they were unable to participate in the intervention due to time demands or plans over the summer that would interrupt intervention availability. Overall, 92 participants signed up and completed pre-testing information and demographic data (with a child mean age of 8.89 years, range 5-13 years). Out of the 92 families, 78 families completed the

intervention and participated in post-intervention assessment. Data from the 92 families were used to answer questions about associations between SES and parent stress, efficacy, and parent-reported child attention and EF skills. Then, 78 families were included in the statistical analyses that looked at the comparison from pre- to post-intervention on parent stress, parent perceptions of efficacy, and parents' perceptions of change in their child's attention and EF skills. Participants were excluded from these analyses if they did not complete both pre-and post-intervention assessments. There was a significant difference between the number of boys and girls in the study with more boys participating (N= 67 boys), which is consistent with diagnostic rates of attention and EF difficulties in children (Assari, 2021).

Parents were asked to complete questionnaires pertaining to their child's behaviours and attention and EF skills before and after the intervention (e.g., attention, activity levels, working memory). They also completed two separate questionnaires that asked about their own levels of stress and their sense of efficacy. These questionnaires were completed in-person on a tablet during their child's pre-and post-intervention testing appointments.

Table 1.

Parent Participant Demographic Characteristics at Pre-intervention

Characteristic	N	%
Parent Age (years)		
Mean (SD)	43.22 (5.64)	
First Language		
English Only	86	93.5

English and French	3	3.3
English and Portuguese	1	1.1
French	1	1.1
Tagalog and English	1	1.1
Number of Children in the Family		
1	28	30.4
2	41	44.6
3	21	22.8
4	2	2.2
Parental Education Level		
Grade School	1	1.1
Some High School	3	3.3
High School Diploma	1	1.1
Some College	14	15.2
Associate Degree	13	14.1
Bachelor's Degree	35	38.0
Graduate Degree	21	22.8
Other	4	4.3
Family Income		
$ 0-25,000	1	1.1
$25,001-40,000	8	8.7
$40,001-75,000	12	13.0
$75,001-90,000	11	12.0

$90,001-100,000	6	6.5
$100,001-150,000	30	32.6
$150,001-200,000	11	12.0
Over $200,001	12	13.0
Prefer not to disclose	1	1.1
Parental Employment Status		
Full-time employment	57	62.0
Part-time employment	19	20.7
Home duties	7	7.6
Volunteer work	1	1.1
Looking for work	1	1.1
Retired/Not looking for work	5	5.4
Prefer not to disclose	2	2.2
Parent Relationship Status		
Married	65	70.7
Single	19	20.7
Living with partner	1	1.1
Divorced	7	7.6
Other	6	6.5
Prefer not to say	1	1.1

Regarding child participant characteristics, out of the 92 children who initially signed up for the study, 66 had official diagnoses of neurodevelopmental disorders (71%)

and 4 had diagnoses of mental health conditions (5%). Out of the 92 participants, 26% of them had two comorbid conditions, and 13% had three comorbid conditions. Out of the 92, 54 of them had ADHD (59%); 20 of them had ASD (22%); 13 had diagnosed anxiety disorders (14%); 8 had diagnosed Specific Learning Disorders (9%); three participants were gifted (3%); three had Developmental Coordination Disorder (3%); three had sensory processing disorder (3%); two had cerebral palsy (2%); two had Global Developmental Delay (2%); one had mild intellectual developmental disorder (1%); one had obsessive compulsive disorder (1%); one had Tourette's disorder (1%); one had Fetal Alcohol Syndrome Disorder (FASD; 1%); and one had Oppositional Defiance Disorder (ODD; 1%). 22 children did not have any official diagnoses.

Overall, the average intellectual functioning in the current study was in the Average range (FSIQ = 109.26), with scores ranging from 64 to 154 (standard score with a mean of 100, and standard deviation of 15). Based on parent-reported attention, hyperactivity, and EF symptoms at pre-intervention, all children had sufficient parent identified attention and EF difficulties. Based on parent ratings on the BRIEF-2, children in the sample demonstrated elevated levels of attention and executive functioning difficulties even prior to the intervention. These scores were consistently in the potentially clinically significant range across multiple subscales, suggesting that participants began the program with substantial EF-related challenges. As such, no child participants were excluded from the current study due to intellectual functioning or insufficient attention and EF difficulties.

Table 2.

Child Participant Characteristics at Pre-intervention

Demographic Variables	Participants (N=92)	T-score
Age in years (M[SD])	8.89 [1.82]	
Child Sex (N)	Male = 67 Female = 22 Other = 3	
Diagnosis (N)	ADHD = 54 ASD = 20 Anxiety = 13 Learning Disorder = 8 Other = 18 Comorbid = 37	
Race (N)	White = 69 White/First Nation mixed = 9 First Nation = 1 Asian = 1 Asian Indian = 1 Biracial = 11	
KBIT-2 FSIQ (M [SD]; range)	109.26 [17.49) 64-154	
BRIEF-2 Inhibition (M [SD])	18.51 [3.58]	64
BRIEF-2 Self-Monitoring (M [SD])	9.00 [1.93]	63
BRIEF-2 Shifting (M [SD])	17.82 [3.70]	69
BRIEF-2 Emotion Control (M [SD])	17.51 [4.41]	65
BRIEF-2 Initiation (M [SD])	11.09 [2.28]	63
BRIEF-2 Working Memory (M [SD])	19.08 [3.35]	66
BRIEF-2 Plan/Organize (M [SD])	18.83 [3.46]	63
BRIEF-2 Task Monitor (M [SD])	12.15 [2.41]	62
BRIEF-2 Organization of Material (M [SD])	13.88 [2.66]	60
BRIEF-2 Behaviour Regulation (M [SD])	27.51 [4.96]	64

BRIEF-2 Emotion Regulation (M [SD])	35.33 [7.48]	69
BRIEF-2 Cognitive Regulation (M [SD])	75.02 [12.02]	65
BRIEF-2 Global Executive Composite (M [SD])	137.86 [20.26]	71
ADHD Scale Hyperactivity (M [SD])	14.41 [6.84]	
ADHD Scale Inattention (M [SD])	16.59 [6.01]	
ADHD Scale Total (M [SD])	31.01 [11.21]	

Note: These scores are based on T-scores. The average population mean is T=50, with a SD=10. On the BRIEF-2 and the ADHD scale, higher scores indicate more difficulty.

Measures

Screening Measures

Child History Questionnaire. Parents completed a childhood history questionnaire on a tablet (REDCap) at their child's pre-intervention assessment appointment (Please see Appendix 1). This questionnaire was completed during the screening interview process on the phone with families. This questionnaire screens for parent and child demographic information, such as age, language, household income, parent education levels, parent occupational status, and parent relationship status as well as diagnoses and medication use in children. This measure was used to describe the demographic characteristics of the sample, for child and parent participants.

The Kaufman Brief Intelligence Test-Second Edition (KBIT-2). The Kaufman Brief Intelligence Test, Second Edition (KBIT-2), is a widely used measure of intelligence for individuals aged 4 to 90 years. The KBIT-2 assesses verbal and nonverbal intelligence through three tasks in approximately 20 minutes. Extensive research has demonstrated the validity and reliability of the KBIT-2 across diverse populations and

settings. Studies have consistently reported high internal consistency for both the Verbal and Nonverbal scales of the KBIT-2, indicating that the items within each scale reliably measure the intended constructs (Kaufman & Kaufman, 2004). Furthermore, the KBIT-2 demonstrates strong correlations with other established measures of intelligence, such as the Wechsler Intelligence Scale for Children-5th Edition (WISC-V) ($r = 0.722$), indicating that it effectively captures intellectual functioning across various age groups (Kaufman & Kaufman, 2004). Additionally, the KBIT-2 has been shown to have good discriminant validity, distinguishing between individuals with and without cognitive impairments (Kaufman & Kaufman, 2004). This measure was used to characterize the sample of the current study and to assess intellectual ability in the sample to ensure that the child participants had sufficient cognitive skills to participate in the study.

Outcome Measures

Parent Measures.

Carer Quality of Life Questionnaire (CarerQoL)-7 item. The CarerQoL is a 7-item questionnaire, widely used to assess the quality of life (QoL) of caregivers, providing valuable insights into their well-being and satisfaction with their caregiving roles (Please see Appendix E for a copy of this questionnaire). It has two dimensions, including negative (i.e., burden, physical and mental health, relationship stress, financial stress) and positive dimensions of care (i.e., fulfillment from care and support). Extensive research has demonstrated the reliability and validity of the CarerQoL measured across diverse caregiver populations and cultural contexts. Reliability studies have consistently reported high internal consistency for the CarerQoL scales, indicating that the items within each dimension reliably measure the intended constructs (Hoefman et al., 2013).

Furthermore, test-retest reliability analyses have shown stable scores, suggesting the questionnaire's consistency in assessing caregiver QoL (Hoefman et al., 2013). Additionally, validation studies have provided evidence of the CarerQoL's validity, including convergent validity, discriminant validity, and criterion validity. These studies have demonstrated significant correlations between CarerQoL scores and measures of caregiver burden, mental health, and social support, supporting the questionnaire's ability to accurately capture various aspects of caregiver QoL (Hoefman et al., 2013; Brouwer et al., 2006). Overall, the robust reliability and validity of the CarerQoL measure make it a valuable tool for assessing and monitoring caregiver QoL across different caregiving contexts and populations. In the current study, this measure was used as a proxy for assessing parenting stress. While it is not designed as a measure of parenting stress, the questions in the CarerQoL questionnaire assesses for areas that contribute to caregiver stress such as experiencing difficulties with parents' own mental health, financial difficulties, and relational challenges with the care receiver which are the areas covered in the FSM (Newland, Crnic, Cox, & Mills-Koonce, 2013; Reich et al., 2023). Based on the FSM, more difficulties across these areas are thought to contribute to higher levels of caregiver stress. As such, the CarerQoL indirectly addresses factors that relate to caregiver stress and may be appropriate to use as a measure of stress. The CarerQoL is a Likert scale and all questions are summed into an overall stress score, with lower scores meaning higher levels of stress. The raw summary score which includes answers from each of the seven questions was used as a measure of stress in the current study.

General Self Efficacy Scale (GSE). This is a widely used 10-item psychometric instrument developed by Schwarzer and Jerusalem in 1995. It measures optimistic self-

beliefs about one's ability to cope with challenging demands in life. The General Self Efficacy Scale consistently demonstrates high internal consistency, with Cronbach's alpha values typically ranging from 0.76 to 0.90 across various cultural contexts which suggests strong reliability (e.g., Cronbach's alpha = 0.88 in Canadian samples). The GSE has been positively correlated with favorable emotional states, optimism, and job satisfaction, and negatively correlated with anxiety, depression, stress, and burnout (Scholz et al., 2002). This was used as a measure of parents' sense of efficacy. Responses are rated on a 4-point Likert scale ranging from 1 ("Not at all true") to 4 ("Exactly true"), producing a raw total score from 10 to 40. Higher scores indicate greater self-efficacy.

Self-Efficacy and Stress as Reported on Tracking Forms. As mentioned above, parents were asked to submit weekly tracking forms to the research team (Please see Appendix D for fidelity forms). The tracking information that was recorded included 1) date and session length; 2) training games and levels achieved per session 3) type and outcome (successful or not) of any cognitive or metacognitive strategies used; 4) whether that strategy was taught to the child, prompted by the examiner, or spontaneously utilized by the child; 5) general observations from the sessions (such as motivation level, engagement in game play, and distractibility). In addition, these weekly tracking forms included questions about parental stress and efficacy levels during the week. These forms included questions about how much stress parents experience while delivering the intervention and outside of the intervention and parents' perceived efficacy levels while delivering the intervention (Please see Appendix D for fidelity forms). With regard to stress, parents were asked two questions about their stress levels including:

1. *How stressful has it been for you to deliver the DI intervention?*

2. *Outside of delivering DI, how much stress have you experienced this week?*

The answers from these two stress questions were used to look at intervention-related stress (Question 1) and general life stress (Question 2). While parents were asked to submit weekly forms, not all participants submitted their tracking forms regularly. As such, it was challenging to look at trends across weeks. To get around this difficulty, parents' and caregivers' answers to these questions across all weeks were averaged to get a mean DI intervention stress and life stress score.

The second piece of information collected via these tracking forms was around parents' sense of their efficacy while delivering the intervention. In particular, two efficacy questions included:

1. *How capable did you feel this week while delivering the DI intervention?*
2. *When a challenge arises while delivering DI, do you find you can cope with it and find solutions?*

Parents and caregivers answered these questions on a 4-point Likert scale (0= not at all, 1= a little, 2= moderately, 3= a lot) and this data was collected weekly during the intervention period. Similar to the stress question, parents' ratings to these questions across all weeks were averaged to get a mean DI intervention efficacy score. Parents' ratings of their efficacy during Week 1 were used to calculate associations between SES and parenting efficacy.

Child Measures.

BRIEF-2 Child Parent Questionnaire. Parents completed the Behaviour Rating Inventory of Executive Function-Second Edition - Child (ages 5 years to 18 years) to measure EF in our sample of children both pre- and post-intervention (Gioia, Isquith,

Guy & Kenworthy, 2015). The BRIEF-2 is a norm-referenced, standardized measure that consists of 9 EF subscales, including *Inhibit, Self-Monitor, Shift, Emotion Control, Working Memory, Plan/Organize, Initiate, Task-monitor and Organization of Materials.* The BRIEF-2 has high internal consistency reliability for both parents and teacher forms, with estimates ranging from .76 to .97 for a parent sample (Hendrickson & McCrimmon, 2019). Similarly, test-retest reliability is in the moderate range for parents (.67-.92 for the parent sample). The 9 EF subscales of this measure were used as a parent-reported child outcome measure to answer research questions one and seven. BRIEF-2 was used to provide a pre-intervention estimate of EF skills in child participants as well as to look at change in this area after the intervention. On this measure, parents are asked to rate their children's behaviour (EF skills) on a scale of 1 to 3 (1: Never; 2: Sometimes; 3: Often). Higher scores on this measure are associated with poorer executive functioning. This measure takes about 10 minutes to complete for parents. While the BRIEF-2 yields scaled and composite scores for children (T-score with a mean of 50 and SD of 10), raw scores were used to determine whether there are improvements in BRIEF-2 scores as these are more sensitive to any changes that may occur.

ADHD Rating Scale-5 for Children and Adolescents. Parents completed the ADHD Rating Scale-5 for Children and Adolescents to provide information about inattention and hyperactivity symptoms in children (DuPaul et al., 2016). This measure has two forms; one for children between the ages of 5-10, and other version for teens between the ages of 11-17. The ADHD Rating Scale-5 shows excellent internal consistency for the behaviour scales for parent forms (range from .89 to .96). Similarly, test-retest reliability is high and ranges from .80 to 0.87 (DuPaul et al., 2016).

Convergent and divergent validity have been demonstrated in that scales that theoretically measured the same constructs are moderately to strongly related to one another. For example, concurrent validity was demonstrated by similar scores between the ADHD Rating Scale-5 and Conners-3 rating scales (DuPaul et al., 2016). Similar to the BRIEF-2, this measure was used as a parent-reported child outcome measure to answer research questions one and seven. It provides a pre-intervention parent-reported estimate of EF skills in child participants as well as to look at change in this area after the intervention. There are a total of 18 questions with the answers provided on a Likert scale (0 to 3; Never a problem, sometimes a problem, often a problem, and very often a problem). This questionnaire yields three scales, with hyperactivity concerns, attention concerns and total amount of concerns with higher scores meaning higher levels of difficulty. Similar to the BRIEF-2, this measure was used as distal child outcome measure to answer research questions four and five. While this questionnaire provides T-scores based on the sum of items (with a mean of 50 and SD of 10), raw scores were used to determine changes from pre- to post-intervention as these are more sensitive to changes.

Qualitative Data. In addition to standardized questionnaire, qualitative data was collected about caregiver involvement, stress levels, and efficacy throughout the intervention. First, qualitative data from exit interviews were used to generate themes around parenting efficacy levels, stress, and intervention related changes that parents have observed at the end of the intervention (Please see Appendix C for exit interviews). Parents answers to the following questions were matched with their SES status to gather themes around how SES plays a role in changes in parents and child outcomes. In

particular, the following questions were used to generate themes about parents' experiences:

1. *What are the positives and negatives of doing the intervention for you and your child?*
2. *Has the program improved your communication with your child? What about their communication with others?*
3. *Have you seen any areas of growth for yourself after completing the intervention personally, as a parent, and as a coach?*

These questions were selected as they were likely to lead to conversations or comments about parents' experiences throughout the intervention that may relate to stress, parent confidence levels, efficacy, or other factors that may be related to parent-child relationships. These questions were selected to supplement and augment the data already collected on these factors through questionnaires (quantitative data).

Procedures

All participants completed pre- and post-intervention assessments, which were conducted at the Child Neuropsychology Lab at the University of Victoria.

Both at pre- and post-intervention, parents completed standardized rating scales while their children completed cognitive testing as part of the larger study. While IQ scores are reported in the current dissertation as they were used as a cognitive screening measure, other attention and EF cognitive measures are not reported as they are not relevant to the current study. The completed questionnaires provided data on their child's EF and attention in day-to-day life as well as questionnaires that assess parents' parenting efficacy and quality of life. Tracking forms which included questions about intervention

stress were completed weekly. In addition to collecting these data, an exit interview with the parents was conducted at the end of the study to gather qualitative information about families' experience during the intervention. The exit interview included a series of open and close-ended questions focused on caregiver's experiences while delivering the intervention (positives and negatives to participating), determine whether caregivers noticed any changes in their child post-intervention, and to gather data about how well the procedures of the study worked.

After parents and child participants completed pre-intervention assessment and questionnaires, they were given access to the online training program. As they completed the online training, they started attending the DI parent coaching groups to get oriented to the intervention (i.e., downloading the games, taking a look before they start the intervention with their child). The parent coaching groups were held via Teleroo (a digital healthcare communication platform that allowed researchers and participants communicate) or Zoom. After they completed online training, downloaded the game, and completed the first orientation meeting in parent coaching groups, they were instructed to start the intervention. Throughout the intervention, parents were asked to submit their completed tracking forms to the research team via Teleroo, email, or mail. If parents chose to digitally submit their tracking forms, they were asked to take photos of the tracking forms and send it to the research team via Teleroo. If this was too challenging, parents had the option to mail all of the completed tracking forms at the end of the intervention to the research team (mail labels were provided).

Intervention: Dino Island

The DI game is comprised of five independent 'mini-games' that aim to strengthen different components of attention and EF (sustained attention, focused attention, shifting attention, inhibitory control, working memory/WM, cognitive flexibility) through mass practice (Kerns et al., 2016). The five mini-games are hierarchically graded and self-adjusting, meaning that each level within a task is more difficulty and complex than the level before. Self-adjusting nature of DI means that the five mini-games automatically adjust the level of difficulty based on a child's performance. If a child is performing well, the games self-adjust themselves to be more challenging. On the other hand, if a child has difficulty at a level within a game, the game automatically adjusts the difficulty level to be easier. The self-adjusting nature of DI ensures that children always work at their optimum level of difficulty based on their own performance. Across attention games, 90% success rate is required to pass. On other games, 5 correct sequences within a level are required to move on to the next difficulty level.

The five mini-games that were used in the current study involve Wave, Santorini, Mining Cave, Shell Machine, and Volcano. Wave starts as a sustained attention task, with game duration increasing with each level. Early levels of the Wave game are shorter and do not have visual or auditory distractions. As the levels increase, the game progressively gets longer and there are distracting stimuli (e.g. animals swimming in the sea). Approximately halfway through the game, Wave becomes a sustained attention and WM game (n-back task). On the n-back task the player is instructed to collect items if they are same as the one that came before. Mining Cave is also a sustained attention and WM game which requires the child to attend to dinosaurs on the screen and to choose a

specific type of dinosaur from amongst a group of various dinosaurs. Mining Cave initially starts as a sustained attention task with game duration slowly increasing. Visual and auditory distractions are added to the game with each new level (e.g., dripping water, mechanical sounds, etc.). Mining Cave exercises WM skills through n-back task later on in the game. Santorini is a visual and auditory WM game through use of a forward and backward span task. While this starts out as a visual WM game, children are then asked to complete auditory WM tasks as they progress through the levels. Complexity of the Santorini game increases in terms of span length, increased complexity of instruction sets (visual and verbal), and presence of distractor and non-target items. Shell Machine is another visual and auditory WM game through use of a span task. While Shell starts out as a simple visual WM task, game difficulty increases by increasing span, adding distractors and non-target items, and by having the items move around on the screen. As the task progresses, the game alternates between visual and verbal WM tasks. Complexity of Shell Machine increases in terms of span length, instruction sets (visual vs verbal), and presence of distractor and non-target items. Finally, while Volcano game starts out as a simple shifting task that requires going back and forth between items with simple instructions. These shifting tasks also require attention and inhibition skills. As children progress, the flexibility difficulty increases by increasing the duration of the game, adding distractors or non-target items, and complexity of instructions. These added levels increases the complexity of the flexibility game. This model follows Posner and Petersen's (1990) approach to attention skills which build from basic orientation to executive attention. In addition, Miyake and colleagues' (2001) approach to EF was followed by rolling out a phased approach in which basic EF skills such as inhibition start

to develop earliest in the development, followed by working memory, and more complex EF skills such as flexibility, planning, and problem-solving.

The DI program was delivered via tablet 1:1 from parents to their children. Parents were asked to deliver DI in a quiet location during a time set aside by participants' parents or caregivers. The delivery method was three to four 45-60 minute sessions per week for 6 weeks total. Core components of the program included consistent game play (i.e., no breaks for more than a week, continuing to play throughout the intervention), one-on-one caregiver-child environment where the caregiver is with the child throughout the entire intervention session, and active teaching of metacognitive strategies to children as struggles come up during game play.

Prior to the start of the intervention, parent coaches completed online web-based training that provided psychoeducation about attention and EF difficulties, intervention, and behavioural and metacognitive strategies to teach their child. This training took about two to three hours to complete. This was a key component of the intervention as parents had the opportunity to learn about their child's development and different phases of development, and how they can support their child during this process. While this process started with the online training first, it continued into the first group meeting with the research team to answer questions and learn more about the intervention. As such, this component was considered to be essential to improve parents' perceptions of their efficacy during DI intervention as well as outside of the intervention to manage their child's behaviour and have strategies that they can use.

As a part of the intervention, parents attended weekly parent coaching groups with each session lasting for an hour. These groups were run by a senior graduate student

and a trained research assistant as a notetaker. The groups were held virtually, and parents and caregivers were not required to have their camera on to participate. The research team was flexible on parent coaching group sizes in order to accommodate schedules, with this number ranging from 4 to 12 parents. There were 7 parent coaching meetings in total for each group. While parents were not required to attend every week, they were encouraged to do so. If they were not able to attend their usual group time due to conflicts, they were encouraged to share updates with the research team via writing or attend another parent coaching group that week. As such, there was flexibility for parents. The parent meetings generally coincided with intervention phases. For example, the first phase and group meeting involved meeting the parents, providing psychoeducation, and onboarding them to the intervention such as helping them download the intervention, create avatars, and navigate different mini-games within the intervention. The structure of groups for phases 2 to 6 included 5-minute updates from the research team, 15 minutes of content presented by the research team, then 40 minutes of updates and questions from parents and caregivers. Parent and caregiver updates included expressing any struggles they experienced during the week, asking questions, and having interaction between participants. Within this 5-phase approach (from phase 2 to 6), parents were instructed to go from simple tasks and DI mini-games (i.e., basic orientation and attention games) to more complex tasks and mini-games (inhibition, shifting, and visual working memory, then auditory working memory with distractions, and finally cognitive flexibility).

The intervention was separated into six phases to help parents with initial parent psychoeducation, set up, getting themselves and their child oriented, and to support them through game play during intervention. During the intervention sessions, the trained

parent coaches were asked to provide support to their children 100% of the time during their game play where they taught and scaffolded their child's use of metacognitive strategies. The parent coaches first introduced the metacognitive strategy using a five-step script and then taught the child how to apply the strategy. This included helping their child identify the difficulty, generating ideas on what they can do to support, picking a strategy, trying the strategy and monitoring success, and problem-solving as needed. As children learned metacognitive strategies and started to become more independent in their use, parent coaches were instructed to slowly diminish the level of support.

Parent coaches were instructed to start with the simple, general metacognitive strategies and move to the more complex and game-specific strategies as they progress through the intervention. During the early phases, parent coaches were instructed to introduce sensory or body-based strategies to their children during game play, such as deep breathing, careful listening and movement breaks that can be applied to all of the mini games and form the foundation for being able to tolerate the intervention. In addition, the importance of generalizing these strategies to other situations and environments were emphasized to parent coaches. They were given tips and strategies on how to apply these strategies in the real world. This included thinking about how to prompt metacognitive strategy use in different situations for their child and actively implementing it during their life outside of the intervention. As children gain experience and success with the simple and general strategies, they were instructed to move to strategies that were more specific to the areas of attention and EF being practiced such as rehearsal, elaboration, chunking, and tracing. Game specific strategies included sensory

and motor strategies for all games (including attention and EF), and rehearsal, tracing, chunking and elaboration strategies for WM games.

Not all participants progressed through all the phases and parent coaches were encouraged to monitor their own child's progress. For example, some children stayed earlier in the phases at the attention and inhibition level throughout the entire intervention because they needed to build such skills before more complex EFs. Some other children progressed through all the phases. The last phase (phase 6) included highlighting the importance of maintenance of gains and generalization to other environments, and discussing what this would look like for each family that participated in the intervention. This included general strategies such as body and sensory strategies (i.e., movement breaks, deep breathing, good listening, calming body down)

Intervention Fidelity

Intervention fidelity was assessed using the following metrics: 1) weekly meetings with the research team through parent coaching groups, and 2) tracking forms that were turned in weekly.

One aspect of intervention fidelity involved parents' attendance and participation parent coaching groups. As explained previously, parents attended weekly coaching groups throughout the intervention. In these meetings, the research staff kept track of attendance to meetings and whether parents participated (i.e., verbally or in the chat) in these meetings. This information allowed research staff to determine whether parents and families were engaged with the groups. In addition, through discussion in these coaching groups, researchers were able to determine whether parents were delivering the

intervention as intended (i.e., both game-based and metacognitive portions) and identify any areas of challenge to improve the fidelity of the intervention.

Another source of intervention fidelity was related to tracking sheets completed weekly by the parent coaches (parents or caregivers) to provide a record of intervention progress for each training session. The collected information allowed researchers to ensure that the intervention was delivered as intended. Since the tracking forms covered both the game-based portion of the intervention and the metacognitive strategies, intervention fidelity across all areas was ensured. As discussed previously, this data was used to answer research questions about DI related stress in parents.

Results

Intervention Attrition and Fidelity

As previously mentioned, while 92 families initially enrolled and completed the pre-intervention questionnaires, only 78 families completed the intervention (85%), resulting in a total of 14 families withdrawing from the study (15%). At the start, 21 families (22.8%) who signed up for the study were from low SES backgrounds (income < $75,000 annually). Of these, six families (28.5%) withdrew from the study. On the other hand, 47 families who signed up (51%) were from middle SES backgrounds (income between $75,000 and $150,000), with 7 of these families withdrawing from the study (15%). Finally, 23 families at the start were from high SES background (income > $150,000). Of these, only one family (4.3%) withdrew from the study and did not complete the intervention. This indicates that families from lower SES backgrounds were disproportionately represented in the attrition rates, which suggests that factors related to socioeconomic status may have influenced study retention. However, a chi-square test of independence was conducted to examine the relationship between socioeconomic status

(SES) and attrition rates. The results were not statistically significant, χ^2 (2, N = 91) = 4.97, p = .083, indicating that attrition rates did not significantly differ across SES groups. Unfortunately, the research team was not able to reach some participants to collect data about their attrition reasons. As such, it is challenging to draw conclusions about attrition reasons for these participants.

Intervention fidelity was assessed through weekly parent coaching group attendance and participation, and submission of tracking forms. In the weekly parent coaching groups, most parents attended weekly and informed the research team when they had to miss a group. Missed sessions were all followed up with make-up sessions (i.e., attending a different group at a different time that week) or through written communication with the research team (via Teleroo or email). Majority of parents had their cameras on throughout the parenting groups, while some chose to keep their camera off unless they were talking. Similarly, parents contributed to group discussions verbally or through chat, indicating that they were paying attention and engaging with the content in the groups.

With regards to tracking forms, fewer parents returned completed tracking forms to the research team. Overall, 40 families submitted Week 1 completed tracking forms (51%), with only five families from lower SES families submitting tracking forms (12.5%). Out of 78 participating families, only 29 families submitted completed Week 1, 3, and 6 tracking forms (37%), and were included in analyses that relied on the average of these forms. Out of the 29, only four families belonged to lower SES groups (14%). Given that lower SES families made up 23% of the overall sample (92 participants at pre-

intervention) but only 14% of the group submitting complete tracking forms, they were somewhat underrepresented in this aspect of data collection.

Out of the 78 families who participated in the intervention, 53 families (68%) completed exit interviews. Among those who participated, 14 families (27%) were from the low SES bracket (income <$75,000), 24 families (45%) were from the middle SES bracket ($75,000–$150,000), and 15 families (28%) were from the high SES bracket (income >$150,000). Notably, the proportion of low SES families who completed exit interviews (27%) aligns with their representation in the overall sample (23% of participating families), suggesting that low SES families were appropriately represented in this aspect of data collection.

Statistical Analyses

Results are discussed in eight separate parts organized by hypotheses. First, associations between SES and child attention and EF skills are presented. Second, associations between SES and parents' perceptions of parenting stress are discussed. Third, associations between SES and intervention-related stress are presented. Fourth, associations between SES and parenting efficacy are discussed. Fifth, changes in parents' level of stress from pre- to post-intervention are discussed. Sixth, changes in parents' perceptions of their parenting efficacy from pre-to-post intervention are discussed. Seventh, results pertaining to the relationship between SES and intervention gains on child outcomes (attention and EF skills) are discussed. Finally, qualitative information and themes gathered across training sessions and from exit interviews are presented.

Analyses used SPSS package 27.0. An alpha significance level of .05 (two-way) was used for all statistical tests were used unless otherwise indicated. When an

underlying assumption of a statistical test was not met, the details of the violation and rationale for using that test (or alternate tests) were provided. Power analyses showed that to achieve a power of 0.80 for a repeated measures ANOVA with two measurement times, a medium effect size and a significance level of 0.05, 65 participants were needed. Overall, 92 participants signed up and completed pre-testing questionnaires and assessment. Out of the 92 families, 78 families completed the intervention and participated in post-intervention assessment. As such, 78 families were included in the statistical analyses that looked at the comparison from pre- to post-intervention.

Part 1. Associations Between SES and Child Attention and EF Skills

A set of Spearman's correlation analyses were used to examine the relationship between family SES (as measured by family income) and child attention and EF skills at pre-intervention to determine whether low SES was associated with lower attention and EF skills. Spearman's correlations were used since family income was measured on an ordinal scale (1 to 8 scale) and attention and EF ratings were on an interval scale.

Results revealed no significant correlations between SES and parent ratings of their child's hyperactivity (r = -.037, p = .724) or inattention (r = -.18, p = .087) on the ADHD Rating Scale. Similarly, SES was not significantly correlated with overall ADHD symptoms (r = -.11, p = .302).

For specific EF domains as assessed by the BRIEF-2, SES was not significantly associated with parent ratings of their child's inhibition (r =-.13, p = .745), self-monitoring monitoring (r = -.236, p = .342), shifting (r = -.134, p = .532), emotion control (r = -.342, p = .223), or initiation (r = -.323, p = .078). Similarly, no significant correlations were found between SES and working memory (r = -.149, p =

.094), planning/organization (r = -.171, p = .103), or task monitoring (r = -.161, p = .125).

However, SES was significantly negatively correlated with organization of materials (r = -.217, p = .030) and the BRIEF-2 Cognitive Regulation composite (r = -.200, p = .049), indicating that higher SES (family income) was associated with fewer difficulties in organizational skills. Additionally, the correlation between SES and the BRIEF-2 Global Executive Composite, which measures overall EF ability, approached significance (r = -.211, p = .057).

Overall, these findings indicate that lower SES is associated with poorer parent-rated organization of materials and cognitive regulation skills (which takes organization of materials into account), with trends suggesting broader difficulties in global executive functioning. No significant associations were observed between SES and other ADHD symptom domains or executive functioning components which suggests that there is little relation between SES and child attention and EF skills.

Part 2. Association Between SES and Parenting Stress

A Spearman's rank-order correlation was conducted to examine the relationship between socioeconomic status (SES) and parents' stress levels as measured by the Carer QoL Scale. Results indicated a small, nonsignificant positive correlation, r = .127, p = .230, which suggests no meaningful association between SES and parental stress.

Similarly, parents' perceptions of their overall stress levels on their DI tracking forms from week 1 was used as another measure of relationship between parental stress and SES at intervention start. Overall, 40 parents submitted their Week 1 tracking forms with completed stress-related questions, with only five families from low SES groups

completing Week 1 tracking forms. Spearman's rank-order correlation revealed a negative, nonsignificant correlation between SES and parents' ratings of their stress on week 1 tracking forms, r = -.123, p = .456. Similarly, an average of Week 1, 3, and 6 overall stress was taken to get an overall stress score for all families. Overall, 29 families completed week 1, 3, and 6 tracking forms and were included in this analysis. However, only four families in the low SES group submitted completed tracking forms. Spearman's rank order correlation revealed a negative, nonsignificant correlation between SES and parents' average ratings on their tracking forms, r = .-103, p = .243. However, given that parents from low SES backgrounds were less likely to submit their tracking forms, this may be an under-estimation of stress levels.

These results imply that parental stress, as assessed by the Carer Quality of Life Scale and weekly tracking forms, do not significantly vary with SES in this sample.

Part 3. Association Between SES and Intervention-Related Stress

Parents' ratings of their stress when delivering the DI intervention (weekly tracking forms) were used to determine the relationship between SES and intervention related stress. Overall, 40 parents submitted their Week 1 tracking forms with completed intervention stress-related questions, with only five families from low SES groups completing Week 1 tracking forms. Spearman's rank-order correlation revealed a negative, nonsignificant correlation between SES and parents' ratings of their stress on week 1 tracking forms, r = -.083, p = .615. Additionally, the average of parents' ratings of Week 1, 3, and 6 intervention stress was taken to get an overall DI-intervention stress score throughout the intervention. Overall, 29 families submitted their completed week 1, 3, and 6 tracking forms and were included in this analysis. Out of the 29 families who

had completed forms, only four families were in the low SES group. Spearman's rank-order correlation revealed a negative, significant correlation between SES and parents' average ratings of their intervention stress on tracking forms, $r = -.203$, $p = .041$. These results suggest that there was a significant relationship between SES and overall intervention stress, which means that intervention stress was higher for families from low SES groups. However, it is important to note that parents from lower SES families were less likely to submit their tracking forms. As such, these analyses may be an under-estimation of stress levels in those families.

Part 4. Association between SES and Parents' Perceptions of Self-Efficacy

A Spearman's rank-order correlation was conducted to examine the relationship between socioeconomic status (SES) and parents' ratings on the General Self-Efficacy Scale as completed at the start of the intervention. Results revealed a small, nonsignificant positive correlation, $r = .070$, $p = .509$, indicating no meaningful association between SES and parents' perceived self-efficacy at the start of the intervention.

Similarly, parents' perceptions of their efficacy ratings on their DI tracking forms from week 1 was used to examine the relationship between parental efficacy and SES at the start of the intervention. Overall, 40 parents submitted their Week 1 tracking forms with completed efficacy questions. Spearman's rank-order correlation revealed a nonsignificant positive correlation between SES and parents' ratings of their efficacy on week 1 tracking forms, $r = .204$, $p = .212$.

These findings suggests that variations in SES were not significantly related to parents' confidence in their ability to manage and solve difficult situations, and succeed

in goals, as measured by the General Self-Efficacy Scale and parents' ratings on their DI tracking forms at pre-intervention.

Part 5. DI Intervention Efficacy

DI intervention efficacy for parent and child outcomes was measured by a set of repeated measures ANOVAS. The assumption of normality for the SES variable was not met according to the Shapiro-Wilk test, which indicated a significant departure from normality ($p < .01$). However, when assessed through skewness and kurtosis, the values fell within acceptable thresholds, suggesting normal univariate distribution. Specifically, skewness and kurtosis values within the range of -2 to +2 are considered acceptable for proving normal univariate distribution, as suggested by George and Mallery (2010). Similarly, Hair et al. (2010) and Byrne (2010) have argued that data can be considered normal if skewness values lie between -2 to +2 and kurtosis values between -7 to +7. Additionally, Kline (2011) reinforces these thresholds, while Curran et al. (1996) also endorses the moderate normality thresholds of 2.0 for skewness and 7.0 for kurtosis, particularly for assessing multivariate normality in techniques like factor analyses and ANOVA. Based on these guidelines, the current study meets assumption of normality as skewness (at -.28) and kurtosis (-.832) were all within the acceptable guidelines. Similarly, it is known that ANOVA is fairly robust to violations of assumptions (Field, 2005). Nevertheless, this was taken into account as a limitation when results were interpreted.

Parent Outcomes.

Parental Stress. A set of mixed factorial repeated measures ANOVAs was performed on the parent stress scores (Carer QoL Questionnaire) with the within-subject factor of time (pre- and post-intervention) and between-subject factor of SES.

Parent stress levels did not significantly differ as a function of SES [$F(7, 70) = .986$, $p = 448$] or between pre- and post-intervention [$F(1, 70) = .416$, $p = .521$], nor was the interaction significant [$F(7,70) = .325$, $p = .94$].

Parents' Self-Efficacy. A set of mixed factorial repeated measures ANOVAs was performed on the parents' self-efficacy scores (General Self-Efficacy Scale) with the within subject factor of time (pre- and post-intervention) and between subject factor of SES.

There was a significant main effect of time for parents' reports of their self-efficacy on the General Self Efficacy Scale scores [$F(1, 70) = 8.22$, $p = .005$, partial $\eta^2 = .105$], indicating significantly higher post-test scores ($M = 33.65$) compared to pre-test scores ($M = 32.62$). No significant effect was found as a function of SES [$F(7, 70) = 1.89$, $p = .084$], nor was the interaction between time and SES (as measured through income) significant [$F(7, 70) = 1.04$, $p = .409$].

Child Outcomes. Changes in child cognitive and behavioural skills were assessed through parent-report questionnaires. A set of mixed factorial repeated measures ANOVAs was performed on child outcomes (executive function (BRIEF-2), attention (ADHD Rating Scale-5), and hyperactivity (ADHD Rating Scale-5) scores) with the within subject factor of time (pre- and post-intervention) and between subject factor of SES levels.

BRIEF-2. There were no significant changes in inhibition skills between pre-and post-intervention as assessed by the BRIEF-2, [$F(1, 70) = 1.150$, $p = .287$]. Similarly, there was not a significant difference in child inhibition levels as a function of SES [$F(7, 70) = 1.704$, $p = .122$] nor was the interaction significant [$F(7,70) = 1.587$, $p = .154$]. Similarly, there was not a significant difference in child self-monitoring levels as a function of income [$F(7, 70) = 1.106$, $p = .369$] or between pre- and post-intervention [$F(1, 70) = 1.464$, $p = .230$], nor was the interaction significant [$F(7,70) = 1.707$, $p = .121$]. Additionally, there was not a significant difference in child shifting skills as a function of income [$F(7, 70) = .813$, $p = .580$] or between pre- and post-intervention [$F(1, 70) = .126$ $p = 847$], nor was the interaction significant [$F(7,70) = .564$, $p = .783$]. On the emotional control subscale, there was no main effect of income [$F(7, 70) = 1.249$, $p = .288$] or time [$F(1, 70) = 1.125$, $p = .292$], or the interaction between the two [$F(7, 70) = .809$, $p = .583$]. On the task monitoring scale, there was not a significant difference in child monitoring skills as a function of income [$F(7, 70) = 1.58$ $p = .155$] or between pre- and post-intervention [$F(1, 70) = 2.75$ $p = .102$], nor was the interaction significant [$F(7,70) = 1.105$, $p = .370$]. Finally, there was not a significant difference in child planning and organization skills as a function of income [$F(7, 70) = .709$ $p = .665$] or between pre- and post-intervention [$F(1, 70) = .348$ $p = .557$], nor was the interaction significant [$F(7,70) = 1.01$, $p = .431$].

On the working memory subscale, there was a significant main effect of time for parents' reports of their child's working memory skills which was reverse coded [$F(1, 70) = 10.23$, $p = .002$, partial $\eta^2 = .127$]. This indicates that parents reported significantly fewer problems with WM post-intervention ($M = 18.38$) as opposed to pre-intervention

(M = 19.41). No significant effect was found as a function of income [F (7, 70) = 1.47, p = .193], nor was the interaction between time and income significant [F (7, 70) = 1.408, p = .216].

In addition, a set of mixed factorial ANOVAs was performed on BRIEF-2 composite scores of Cognitive Regulation, Emotional Regulation, and Behavioural Regulation. There was no main effect of income [F(7, 70) = 1.21, p = .311] or time [F(1, 70) = 1.63, p = .205] or interaction effect [F(7, 70) = .97, p = .460] on the cognitive regulation composite. Similarly, no main effect of income [F(7, 70) = .991, p = .445] or time [F(1, 70) = .520, p = .473] or the interaction effect [F(7, 70) = .764, p = .619] on the emotion regulation composite. On the behaviour regulation composite, while the main effect for income [F(7, 70) = 1.26, p = .112] or time [F(1, 70) = 2.05, p = .156] were not significant, the interaction was significant [F(7, 70) = 2.37, p = .03, partial η^2 = .191. The partial eta squared value of .191 represents a large effect size (Cohen, 1988), which suggests that the interaction accounted for 19.1% of the variance in the dependent variable, demonstrating a meaningful influence of SES on changes in behavioural regulation skills over time. A pairwise comparison of behavior regulation scores across time revealed significant decreases for some SES levels ($40,001-75,000) (M=3.556,SE=0.911,p<.001, 95% CI [1.739,5.372] and ($100,001-150,000) (M=1.538, SE=0.536, p=.005, 95%CI [0.470,2.607]. These results suggest that participants in these income groups showed significant improvements in behavior regulation from time 1 to time 2. No significant differences were observed in other income groups (p>.05). Finally, there was no main effect of income [F(7, 70) = 231, p = .121] or time [F(1, 70) = 1.87, p

= .176] or interaction effect [$F(7, 70) = 1.36$, $p = .237$] on the General Executive composite.

ADHD Rating Scale-5. Similarly, a set of mixed factorial ANOVAs were performed on the ADHD Rating Scale to examine changes in attention skills and hyperactivity levels from pre- to post-intervention. On the hyperactivity scale, no significant effect was found as a function of income [$F(7, 70) = 1.18$, $p = .327$], or time [$F(1, 70) = .06$, $p = .801$], nor was the interaction between time and income significant [$F(7, 70) = .700$, $p = .672$]. On the attention scale, there was a significant main effect of time for parents' reports of their child's attention skills [$F(1, 70) = 1.04$, $p = .03$, partial $\eta^2 = .03$], which is reverse coded. This indicates that parents reported fewer concerns with attention skills post-test ($M = 15.47$) compared to pre-test ($M = 16.38$) indicating fewer problems with attention difficulties after the intervention. No significant effect was found as a function of income [$F(7, 70) = 1.67$, $p = .130$], nor was the interaction between time and income significant [$F(7, 70) = 1.01$, $p = .751$].

Qualitative Information

The demands of parenting, particularly in managing complex behavioral and emotional needs of children, underscore the importance of targeted interventions. Programs such as DI aim to empower parents with tools and strategies to foster stronger relationships, improve communication, and better manage challenging situations as they come up which may help to foster parents' perceptions of their efficacy and lower feelings of stress. While quantitative information is important, qualitative information and analyses are very informative to understand families' experiences and observations of change, particularly in intervention studies. In these studies, such as the current

dissertation, qualitative analyses provide extra information and a different prong to examine the effectiveness of interventions. Qualitative information may also provide researchers with rich and detailed insights into families' experiences, help identify barriers and facilitators, and explain potential unexpected outcomes. Given the importance of qualitative data, information from 53 exit interviews were analyzed to create themes around parents' experiences of delivering DI, their perceptions of change and growth in their own skills as well as parent-child communication. The remaining (25) parents were not available for exit interviews despite attempts from the research team. Participation was not related to SES as some parents from all SES levels across the sample completed the exit interviews.

All interviews were conducted verbally by phone by trained RAs and transcribed into a Microsoft Word document during the phone call with the parents. To analyze these interviews, all interviews were uploaded to MAXQDA 24. Then, all interviews were explored carefully which involved reading through all of them. Interviews were used as guides to develop initial analysis categories, and codes were created by the writer. The codes included themes around parent levels of stress, changes in their sense of efficacy or growth, and changes in parents' interactions with their children. Only one person (the writer) completed the coding in the current study. The findings from interviews were categorized into three key themes, with quantified reporting with numbers (i.e., number of parents reporting changes in that particular area) to highlight different themes and direct quotes from the interviews. After the first round of coding was completed, a second round of coding and analyses was used to look at SES-related differences between parents' reports and experiences to ensure that no information was missed or overlooked.

While SES was used as a continuous variable in quantitative analyses, it was not possible to look at differences in themes between SES levels. As such, for the purposes of qualitative analyses, SES was used as a categorical variable and was clustered into low, medium, and high categories based on family income. While there are different guidelines around defining SES levels based on income, many organizations in British Columbia that provide support and services to low-income families set their family income threshold for low-income classification at $75,000 for eligibility of services (Variety, Children's Charity of BC). Given this, and recent Statistics Canada reports from 2022 which are discussed above, a family income of $75,000 or lower was used for classification of "low income" in qualitative analyses. An income of $75,000 to $150,000 was used for "middle income", and an income above $150,000 was classified as "high income" (Variety, Children's Charity of BC; Statistics Canada, 2022). Out of the 53 families who completed exit interviews, 14 families were in the low SES bracket (income <$75,000), 24 were in the middle SES bracket ($75,000-$150,000) and 15 were in the high SES bracket (>$150,000). The following sections include a write up of broad changes parents reported which are followed by specific examples and SES level analyses.

Theme 1: Communication Changes

Out of 53 participating families who completed exit interviews, 47 (89%) of parents reported positive changes in communication with their child. 32 participants (60%) explicitly mentioned improved conversations with their children including getting to spend focused one-on-one time with their children without disruptions or distractors. This one-on-one time with their children helped to improve communication between

parent coach- child pairs. Many parents highlighted that their child became more willing to talk about feelings and challenges, which helped to foster deeper parent-child connections. In addition, parents reported that doing the DI intervention and learning about metacognitive strategies gave a common language to use between child and parent coaches which helped to improve their communication. Parents highlighted how the program equipped them with language to discuss goals and challenges constructively as challenges arose. In fact, 11 parents (21%) directly mentioned the importance of having shared vocabulary or framework for discussing challenges which led to improvements in communication. Many parents emphasized improved communication dynamics, which led to stronger bonds between parent coach- child dyads. Finally, 15 parents (28%) observed that their child showed improved emotional articulation and self-regulation skills. Participants frequently described their child using strategies to express needs and manage emotions during the DI intervention as well as in other situations such as at school which helps to foster communication skills and clear communication between parents and child participants.

Some examples of improved communication included no longer needing to yell due to increased patience and improved understanding of the skills for parents and child participants. Other parents reported that neutral vocabulary introduced by the program (i.e., strategy names) helped reframe challenges and foster collaborative problem-solving. This allowed parents and children to address frustration and engage in productive discussions during emotionally challenging moments.

SES and Communication Changes. While all SES groups reported improvements in communication, the nature of these improvements varied based on family SES.

Overall, 12 of the 14 parents from low SES groups reported improvements in communication with their child (85%). In their interviews, these parents focused on structured strategies (i.e., goal setting, behaviour management, scripts for difficult conversations) that they found helpful throughout the intervention. In fact, parents from low SES families reported that this intervention gave them a shared language for problem solving. These structured strategies and communication shifts focused on reducing conflict and improving their child's responsiveness to their ideas or suggestions. Some examples from parents included:

"*This program gave me the right words to use with my child. That alone has reduced so much tension at hone".*

"We now have a way to talk about frustrations without it turning into a fight"

In the middle SES bracket, 19 out of 24 parents reported improvements in communication with their child (79%). These parents focused on discussing emotional awareness and using communication to regulate emotions in their interviews. They focused on understanding their child, their child's personality and needs better and adjusting their approaches based on their child's needs. Some examples from parents included:

(when child is getting angry and frustrated) "we now sit down and talk through our frustrations instead of reacting in the moment"

Finally, in the high SES group, 12 out of 15 parents (80%) reflected on improved communication with their child. While these parents also commented on structured strategies and emotional awareness, they also focused on enhanced reflective listening skills and using neutral language in communication. These parents reported that after doing the intervention and weekly parenting groups, they learned to step back and listen more before responding to their child which helped them to deepen their communication with each other. Some examples included:

"We use neutral language now- and it's helped my child be more open with us"

These results show that while parents from all SES groups reported improvements in communication, the types of strategies that they found to be helpful differed across SES groups. While parents from low SES families highlighted structured strategies such as scripts, parents from the middle SES group focused on emotional regulation skills during times of tension to improve communication. Finally, parents from the high SES group focused on reflective listening skills as using neutral language in communication.

Theme 2: Parents' Personal Efficacy

Overall, 38 out of the 53 parents (72%) reported significant personal growth and increased efficacy after engaging in the DI intervention through learning of metacognitive strategies, attending weekly coaching groups, and spending one-on-one time with their children. In particular, 29 parent participants (55%) highlighted improvements in their own emotional regulation skills. Parent participants frequently described adopting strategies that paralleled their child's own strategies, which led to calmer responses during emotionally heightened or challenging situations. Many parent coaches reported increased self-awareness after the intervention. This self-awareness

included gaining insights into their own emotional patterns and responses during times of stress, which led to adjusting their behaviors to create more positive and productive interactions with their children. Finally, 9 participants (17%) described a newfound empathy or shift in perspective toward their child's challenges. These parents reported that by spending one-on-one time with their children, they had the opportunity to see their children's strengths and challenges in a controlled environment which led to feelings of empathy and understanding of their children's challenging behaviour and why that occurs.

Some examples of personal growth reported by parents included parents using strategies such as body breaks to regulate their emotions in their own lives. In fact, one participant specifically noted that the program felt more like an intervention for parents than solely for children. Other parents directly noted that "understanding their child's triggers and struggles allowed them [parents] to stay patient and avoid escalating conflicts unnecessarily". Other parents commented on improved self-awareness, indicating that they became aware of their tendency to communicate ineffectively when stressed which led to using self-regulatory strategies before addressing their children. Parents reported that these newly learned or practiced skills helped to improve their relationship with their children.

SES and Parents' Self Efficacy. Similar to the first theme, the majority of parents from all SES groups reported improvements in their own efficacy and growth. However, themes and reflections of parents' personal growth differed by SES.

For the low SES group, 10 of the 14 parents (71%) commented on changes in efficacy and growth in the exit interview. Parents in this group focused on improvements

in their self-confidence as parents and their problem-solving abilities in their interactions with their children. In particular, parents in this group commented on how they realized they have more control on their child's development and behaviour than they initially realized, which helped them feel effective and valued as parents. Some examples from parents included:

"I now understand my child's behaviour and perspective better, and I feel more confident as a parent"

"I realized I learned more tools than I thought. That alone helped lower my stress".

In the middle SES group, 17 of the 24 families (70%) commented on their efficacy and growth. Parents in this group reflected on how they saw improvements in their own stress management and emotion regulation skills. They commented that they became more patient and self-aware throughout the duration of the intervention, and their growth centered on staying calm and managing emotional reactions during times of tension or stress. Some examples from parents include:

"I take breaks now when I notice my temper rising. That's something I never did before"

"I now realize my child's behaviour is not just misbehaviour. That mindset alone changed everything".

Finally, in the high SES group, 10 of the 15 parents (66%) reported experiencing personal growth after the intervention. For these parents, most of them focused on deeper reflection rather than gaining new skills. For example, parents focused less on what

strategies to use or "what to do in the moment" and focused more on how to think differently about parenting. Some examples included:

"This was more about my own self-reflection and growth than my child's"

"Reflecting on my behaviours helped me parent with more patience"

Overall, while parents across all SES levels reported improvements in their self-growth, trends and themes differed slightly across groups.

Theme 3: Changes in Efficacy for Parenting and Coaching Skills

Overall, 44 participants (83%) reported learning practical skills that improved their parenting or coaching abilities. In total, 66% (35 participants) specifically mentioned learning new parenting strategies. These included using task breakdowns, visual cues, and calming techniques with their children to address behavioral challenges as they came up during DI and outside of DI. Parents reported they started to use such strategies more frequently after participating in DI, which helped to reduce the frequency of challenging behaviours in their children. A key takeaway for many participants was the importance of involving children in the problem-solving and decision-making process. Parents reported that through metacognitive strategies, children started to learn what worked for them during stressful and challenging moments. This led to greater independence as children did not feel the need to immediately go to their parents when a challenge arose. Finally, parent participants in teaching or coaching roles often translated these strategies into their work environments. Specifically, 17% (9 participants) applied these strategies in professional roles, such as teaching or mentoring.

Some examples of changes in efficacy as a parent or as a coach included parents commenting on how structured communication, such as breaking instructions into

smaller tasks, helped their children focus and succeed during DI tasks. Other parents shared that proactively addressing challenges rather than reacting in the moment made her parenting more "constructive and empathetic". Finally, some participants noted that they developed a toolbox of strategies that improved their teaching practice and provided them with increased confidence as a parent.

SES and Changes in Efficacy in Parenting and Coaching Skills. In the low SES group, 12 of the 14 parents (85%) reported improvements in their parenting and coaching skills. These parents reported that learning different strategies was very helpful, and step by step guidance benefitted these families. Parents from low SES families showed stronger reliance on intervention-provided strategies (i.e., goal setting, breaking tasks down into smaller parts) which increased their confidence in their ability to guide their child's behaviour and in their parenting skills. An example included:

"I now have concrete strategies to keep my child on task. Before, I wasn't sure how to help".

In the middle SES group, 19 of the 24 parents (79%) reported improvements in their parenting and coaching skills. Parents in this group focused on greater patience towards their children and understanding child's needs, self-regulation skills, and understanding what their child needs in a given moment. These parents focused on trying to understand when their child needs independence to problem-solve versus when they need direct help, which helps them feel more in tune with their child and improve their confidence in parenting skills. Some examples included:

"I've learned to slow down and observe when my child needs guidance versus when they need space"

"This program made me realize I needed to adjust my reactions to help my child in difficult moments".

Finally, 11 of the 15 parents (73%) in the high SES group reported some improvements in their parenting and coaching skills. Compared to the low SES group which benefitted from learning structured tools and strategies, parents in the high SES group focused less on strategy learning for effective parenting. Instead, they focused on understanding and practicing strategies that made them more effective and empathic parents and using those strategies in their parenting practice. These included learning to model calm behaviour and reduced perfectionism in parenting, which led to a more positive mindset. Some examples include:

"I've stopped expecting myself to have answers immediately. That's been a huge relief".

These findings demonstrate that while all parents reported some improvements in their parenting and coaching skills, and learned some new skills, there were differences in what parents found more helpful across different SES groups.

Table 3.

Summary of Themes from Exit Interviews.

Communication Changes	Parent Efficacy	Parenting and Coaching Skills

Common Themes	1)Parents reported improvements in parent child communication across all SES groups. 2)Parents report building positive relationship with their child through having a dedicated time & structured activity. 3)DI provides parents and children with a common language to talk about successes and challenges. 4)Many child participants started sharing personal information (i.e., what happened at school, friends) with parents through improved communication channels. 5)Parents and children developed their own "language" (i.e., neutral language) to talk about difficulties which helped to reduce tension.	1)Most parents reported changes in their efficacy and personal growth after completing the intervention. 2)Subthemes included parents noticing unhelpful behaviours/strategies they were using with their child. 3)Some parents noted that this sometimes felt more like a parent personal development intervention which they found helpful. 4)Other parents discussed gaining perspective and awareness as a result of spending uninterrupted, structured time with their children. 5)This self-awareness and perspective helped parents understand their own response patterns, and gave them some tools to regulate their emotions in moments of stress.	1)Most parents reported seeing changes in their parenting and coaching skills after the intervention. 2)In their interviews, parents noted that they learned important parenting skills through training and weekly coaching meetings which helped them feel more effective in their parenting skills. 3)Parents highlighted the importance of metacognitive skills, including involving their children in problem-solving (i.e., asking them what went well and what was challenging, what they can do next time) which helped to foster independence and stronger coaching skills. 4)Parents and children also came up with their own metacognitive strategies that worked for them. Parents shared that this helped them feel more effective (through successful implementation).
Low SES	1)Many parents commented on improved communication following DI intervention. 2)Most parents preferred structured strategies (i.e., scripts) which provided strategies for parents to use.	1)While most parents reported personal growth across all SES groups, some parents in this group discussed improved self-confidence as a result of gaining knowledge.	1)While most parents reported growth in their parenting skills, some parents in this group emphasized the benefit of step-by-step instructions when learning new strategies.

Middle SES	1)Many parents commented on improved communication. 2)While parents commented on broader communication patterns, some parents focused on improved emotional awareness and regulation as a result of direct communication.	1)While parents from all SES groups discussed changes in emotional awareness, this group reflected on parents' own stress management and emotional regulation skills which helped them stay calm during times of tension.	1)Similarly, while there were changes reported in overall parenting skills, parents in this group focused on finding balance between direct help and problem-solving support. In particular, parents reported that they felt more effective as a coach/parent when they were able to understand what their child needed in a given moment.
High SES	1)Many parents commented on improved communication. 2)In addition to common themes, some parents focused on the importance of listening skills (i.e., active listening while they are working with their child).	1)Parents in this group focused on self-reflection and what "parenting" and "parent skills" meant to them. 2)While some parents noted concrete strategies, there was less emphasis on what to do in the moment.	1)Similar to the personal growth theme, these parents reflected on what made them effective parents, and applying those same principles to different aspects of parenting and coaching. 2)Examples of this include removing pressure or expectations to have all answers at all times.

Do the Findings Suggest Greater Parent Efficacy and Lower Stress?

The themes identified in these analyses, including improved communication, improvements in self-efficacy and growth, and enhanced parenting and coaching skills, align closely with predicted findings of greater parental self-efficacy and lower levels of stress post-intervention as per the FSM.

First, one of the main findings from analyses was improvements in communication patterns between parents and children. Improved parent-child communication equips parents with tools to better understand their children's emotions and behaviors. By having improved communication and fostering open dialogue, parents

feel more capable of addressing challenges before they escalate and feel more confident in their own skills as parents. Most parents reported that having shared vocabulary and a common language helped to improve communication, which may help to reduce ambiguity and frustration often associated with parenting. This may suggest higher levels of efficacy and lower levels of stress for parents. Similarly, parents reported that they do not have to yell as much which directly decreased feelings of powerlessness, a core component of low self-efficacy. As such, these findings suggest that as communication improves, parents feel more in control of interactions, which increases self-efficacy and lowers levels of stress related to misunderstanding and conflicts.

Second, parents reported growth and feelings of improved efficacy in their own personal skills including their own emotion regulation, often in the form of better emotional regulation, which directly reduces parenting stress and feelings of overwhelm. In addition, many parents mentioned gaining a new perspective on their child's behaviors which helped them shift from viewing them as "misbehavior" to understanding the underlying triggers. This shift reduces stress by reframing challenges as opportunities for support rather than conflicts. As parents succeed in reframing challenges and helping their child in moments of difficulty, their feelings of efficacy in their own parenting skills improve which translates to feeling more efficacious as a parent. As such, personal growth empowers parents with emotional tools to stay calm under pressure and reduces stress and enhances their confidence in managing challenging situations.

Third, learning practical, effective and evidence-based parenting and coaching strategies benefitted parents to feel more confident in their own skills. Practical tools such as breaking tasks into smaller steps, using visual cues, and incorporating calming

techniques were observed to give parents a sense of preparedness and control. Parents often commented on perceived increase in their confidence in managing their children's needs after participating in the intervention which may translate to higher levels of efficacy and lower stress. Many participants learned to involve their children in problem-solving, which not only improved outcomes but also gave parents the satisfaction of seeing their strategies succeed. Parents noted that proactively addressing challenges with their children felt more constructive and reduced the stress of reactive parenting. As such, the acquisition and practice of concrete skills reduce the uncertainty and frustration often associated with parenting, which helps to bolster self-efficacy and alleviate stress.

While many parents reported improvements in one or more areas, a minority of parent participants (2 parents) reported no changes in communication or personal or parenting skills. Similarly, while many parents reported improvements, there were also additional stressors associated with DI that made the intervention delivery more challenging for parents such as time restraints, busy schedules for parents while juggling their child's school, extracurricular activities, and new responsibilities such as DI, and their child's resistance to playing DI on some days.

Overall, many parent participants reflected improvements in communication and personal and parenting skills. Improvements in communication, emotional regulation, and skill application reinforce each other and create a positive feedback loop. As parents see the results of their efforts, their confidence grows, which further reduces stress. Many participants mentioned feeling validated by the program, as it provided strategies that work in real-life scenarios. This validation helps counter feelings of inadequacy, a common source of parental stress. In conclusion, the themes of communication

improvements, personal growth, and enhanced parenting skills strongly suggest that the DI program fosters greater parent self-efficacy by equipping participants with effective tools and strategies. These gains, in turn, reduce parenting stress by promoting emotional regulation, proactive problem-solving, and a sense of control.

Are There Any Differences in Parenting Efficacy and Stress Across SES Groups?

Across all SES levels, parenting stress may arise from feeling unequipped to manage behavioral challenges. The development of effective parenting and coaching skills through this intervention helped parents feel more confident and in control, which led to stress reduction across SES levels.

While parents from all SES levels reported increased confidence in their skills and some amount of stress reduction, there were also differences in patterns. In the low SES group, many low-SES parents felt uncertain about how to manage behavioral challenges effectively before starting DI, and reported gaining confidence through structured strategies, such as goal setting, behavior reinforcement, and proactive communication techniques after the intervention. This may mean that on average, lower-SES parents had fewer pre-existing parenting resources, which may have led to greater gains when exposed to structured techniques. Given the FSM, parents from low SES families may not have the time, resources, or access to parenting sources as readily as families from middle or high SES brackets. As such, step-by-step, concrete strategies may have helped them the most to set the stage up for more complex tools in the future. Overall, 92% of parents from the low SES group reported stress reduction after the program. Their pre-intervention stressors included uncertainty about effective parenting strategies, time management, and frustration with managing behaviours. They reported that the strategies

from the DI and parenting groups provided them with approaches that made parenting feel less unpredictable. Given the FSM, lower-SES parents may be under greater financial and environmental stress (i.e., time, living conditions), which may have made clear, structured intervention tools particularly impactful**.** While these parents reported the highest stress reduction at the end of the intervention as structured tools gave them a sense of control over parenting challenges, they also reported the most significant challenges with logistics throughout the intervention. The main stressors that were reported throughout the intervention for low SES families was time (89%), and how challenging it was to find time to do the DI intervention regularly for an extended period of time.

In the middle and high SES group, while the majority of parents reported lower rates of stress after the intervention (68% and 56%, respectively), these rates were lower compared to the low SES group. While these parents reported lower stress, these changes were less likely due to learning new parenting strategies, which was the case for the low SES group, and more due to learning self-regulation strategies for themselves that helped them self-reflect and be less reactive in their parenting which reduced stress levels. Given the FSM, the middle and high SES families may be less likely to experience financial stress in their day to day lives, which may free up more time and resources (i.e., books, classes, working with professionals) to learn parenting skills. This may explain why they benefit from more self-reflection in their parenting as opposed to concrete strategies as they may already know them. The implications of these findings are discussed below.

Discussion

The current study examined the impact of a parent-delivered attention and EF cognitive intervention (Dino Island/DI) intervention on parental efficacy and stress levels in families from diverse socioeconomic (SES) backgrounds. Given the established link between low SES, increased parenting stress, and diminished parental efficacy (Conger et al., 2010; Gershoff & Bitensky, 2007), this study used the FSM framework (Conger et al., 2010; Masarik & Conger, 2017) to determine whether this parent-delivered attention and EF training program could enhance parents' reports of their self-efficacy and reduce stress levels. The second objective of this study was to determine whether this attention and EF intervention led to improvements in child attention and EF skills as reported by parents, and whether these effects differed across SES. The importance of this research lies in its potential to inform future intervention strategies designed to support families facing SES adversity and improve both parental and child outcomes. Qualitative analysis results indicated that while few aspects of attention and EF skills in children were associated with family SES status, this was not true for most aspects of EFs. Second, while family SES was significantly associated with intervention-related stress, SES was not significantly associated with overall parent stress and parenting efficacy. Third, DI intervention did not lead to significant changes in parenting stress. Similarly, while the DI intervention improved parents' perceptions of their efficacy, this change in parenting efficacy did not vary as a function of family SES. Fourth, post-intervention testing scores revealed significant improvements in child working memory, cognitive regulation, and attention scores as reported by their parents, but other EF skills did not show changes after the DI intervention. Similarly, these improvements did not vary as a function of family SES. Finally, qualitative analyses were used to examine themes on parental

perceptions of change and how these were related to SES. While all families reported improvements in communication, parental efficacy and stress levels after the intervention, what parents found helpful varied depending on their SES.

DI Intervention

Attrition and Fidelity

In the current study, 85% of participating families completed the intervention while 15% dropped out of the study throughout the intervention. Previous literature documents a wide range of attrition rates in intervention studies, with these numbers ranging from 0 to 54% of the sample (Karlson & Rapoff, 2009). In a previous systematic review that examined attrition rates in behavioural interventions for children, it was found that the mean attrition rate was 20% (Karlson & Rapoff, 2009). Similarly, in parenting interventions, the mean attrition rate was found to range from 30 to 69% (Ufford et al., 2022). This shows that the attrition rates in the current study are below the average rates across intervention studies.

While parents could deliver DI at home with success, attrition rates differed across SES groups throughout the intervention. While 85% of families who enrolled in the study completed the intervention, 15% withdrew, with families from lower SES backgrounds disproportionately represented in attrition (43% of those who withdrew were from low SES backgrounds, despite making up only a portion of the sample). This suggests that factors associated with SES, such as financial stress, time constraints, or other barriers, may have influenced study retention. Unfortunately, the reasons for attrition remain unclear for some participants, as the research team was unable to follow up with all families who withdrew. Without this information, it is

difficult to determine whether dropout was related to challenges specific to the intervention, logistical difficulties, or other external factors and whether this differed across SES groups. It is important to note that sample retention bias may have influenced the findings, as families who remained in the study may differ in important ways from those who withdrew. If lower SES families who remained in the study faced fewer barriers than those who dropped out, the results may not fully capture the experiences of the most vulnerable families.

In addition to attrition, parents were able to complete requirements of DI with fidelity. Fidelity was measured through attendance and participation in parent coaching groups and submission of weekly tracking forms throughout the intervention. Fidelity was high for parent coaching groups throughout the intervention. While parents consistently attended these groups and engaged with information, which demonstrated good engagement and fidelity of intervention delivery, tracking form completion was more challenging. While 51% of families submitted tracking forms in Week 1, only 37% (29 families) provided completed forms for Weeks 1, 3, and 6 combined, with lower SES families were underrepresented in this subset of data. Despite making up 23% of the overall sample at pre-intervention, they accounted for only 14% of those who consistently submitted tracking forms. This underrepresentation of lower SES families in tracking form submissions may have implications for the interpretation of intervention effects. This may indicate that families from lower SES backgrounds faced greater barriers to completing and returning tracking forms which may relate to time constraints or competing stressors. As a result, findings based on tracking form data may not be fully representative of all participants, particularly those from lower SES backgrounds.

Associations Between SES and Child Attention and EF

Previous research has documented a significant association between family SES and child attention and EF skills (Biederman et al., 2023; Calhoun et al., 2021; Hackman & Farah, 2009; Hughes & Ensor, 2009; Ming et al., 2019; Noble, Norman, & Farah, 2005). The findings of the current study partially supported this relationship between family SES and child attention and EF skills. Specifically, it was found that SES was significantly correlated with organization skills and overall cognitive regulation, which includes skills such as working memory, monitoring, and planning and organization skills. Within the current sample higher SES levels (income) was associated with stronger organization and cognitive regulation skills in children. These results align with several studies that have found a significant relationship between SES and child EF skills including organization, planning and working memory (Leonard et al., 2015; Lawson et al., 2018; Rakesh et al., 2024). While the exact mechanism that underlie this relationship is unknown, previous studies have started to identify potential factors that are important in this relationship. Consistent with the FSM, these factors can be classified into different categories such family stressors, cognitive stimulation, and family support levels. Family stressors refer to increased family conflict, financial hardship, or exposure to negative experiences such as violence which impact the cognitive and brain development of a child and increase risk for cognitive and mental health difficulties (Evans, Li, & Whipple, 2013; Grant et al., 2003; Grant, Compas, Thurm, McMahon, & Gipson, 2004; Rakesh et al., 2024). Cognitive stimulation refers to access and availability of enriching experiences and materials (i.e., books, extra supports, good schools) that increase curiosity and cognitive skills in children (Rakesh et al., 2024). Finally, family supports

include the availability of resources, environments, and relationships that provide emotional and practical assistance to families which may mitigate against the negative effects of stress in children and families (Chu, Saucier, & Hafner, 2010). As explained in the FSM, all these factors may contribute to child cognitive skills, and promote stronger attention and EF skills. As such, all these factors may explain the findings of the current study.

While some aspects of EF were significantly associated with SES in the current study and sample (organization, cognitive regulation), other aspects of attention and EF were not (attention, WM, inhibition, shifting). This may be due to a number of reasons. First, research shows that some aspects of EF (i.e. working memory and inhibition) are more closely associated with SES (Farah et al., 2006; John, Kibbe, & Tarullo, 2018). These skills may be more susceptible to cognitive stimulation and early experiences (McNeilly, Peverill, Jung, & McLaughlin, 2021). In addition, chronic stress experienced by families from low SES backgrounds impacts the development of the prefrontal cortex, which is essential for working memory and inhibition skills (Girotti et al., 2019). In the current study, while individual subscales for inhibition and working memory were not significantly associated with SES, the cognitive regulation index (a composite index that combines the inhibition, working memory, planning, organization, and task monitor scales) was significant. This means that while individual scales did not reach significance, a summary scale that combines all related skills was significantly associated with SES in this population. This may be due to the aggregation of small changes that may happen throughout the intervention. For example, given that the composite score combines multiple scales, small, non-significant improvements in individual scales can

add up to a statistically significant overall change. Another reason for the change in composite score as opposed to individual scales may be that DI may have generalized benefits across EF skills rather than dramatically improving specific subdomains. As such, we may be seeing the broad effects of DI on cognitive skills post-intervention. The second reason for the current findings could be due to the multifaceted nature and transactional development of EF skills. For example, as shown by the FSM and previous research, parenting styles and emotional factors such as warmth and emotional support are essential for healthy attention and EF development (Luby et al., 2013). While low SES families may be more at risk due to less time together as a family, less financial stability, and less access to education and materials to provide the emotional support and structured environments, it is likely that there is variation in these factors between families. The current study did not measure these factors (parenting style, warmth, time spent together). As such, it is challenging to determine whether these family-related factors contributed to the nonsignificant findings in the current study. Further, the current study recruited participants from a limited region (Vancouver Island in British Columbia). Given the importance of neighbourhood factors such as safety and access to quality education in child EF development, (MacKinnon et al., 2023) it is important to consider the location of the study. While safety and neighbourhood levels vary by community, Vancouver Island's safety and education factors are generally favorable when compared within Canada and globally. A report by Early Years in BC School Districts document programs and services across BC that connect children and families with early educational supports which are essential for child cognitive, emotional, and social development. These include programs such as StrongStart BC, Ready Set Learn,

and Primary Years across the province that provide enriching learning environments to children from birth until age 8 across the province. Given that these supports and enriching learning environments are available to many children and families in BC regardless of their SES or family income, children from low SES families may have stronger cognitive and EF skills in this region, as found in the current study, and the difference between children from low and higher SES families may be smaller. Finally, another explanation may be that most families (51.1%) in the current study fell within the middle SES range ($75,000-$150,000 family income), and most parents (90.1%) had minimum of some college education. While these may have impacted the results, family income levels in the current study were representative of Canadian and British Columbia family income levels. In fact, according to data from the Canada Mortgage and Housing Corporation in 2021, the average household income in BC is $108,600 before taxes. Another report by Statista in 2022 showed that the median household income in BC was $101,520. These reports show that the sample in the current study was a representative sample of BC family income levels. On the other hand, even though income was used appropriately, it may not be fully representative of the spectrum of SES. It is possible that income levels in the study's small region does not fully capture the spectrum of SES needed to detect differences. As such, higher income and parent education levels in the study may partly explain the non-significant findings between child EF skills and family SES as measured by family income. Results may look different if studies sampled across more communities which may create a more diverse sample.

Changes in Child Attention and EF Skills

While there is controversy, previous research demonstrates the efficacy of cognitive interventions in children to improve attention and EF skills (Blair & Diamond, 2008; Kerns, Eso, & Thomson, 1999; Kerns et al., 2010; Macoun et al., 2020; Morrison & Chein, 2011; Rueda, Checa & Cómbita, 2012; Shalev, Tsal, & Mevorach, 2007). These findings apply to typically developing children (Rueda, Checa, & Cómbita, 2012; Thorell et al., 2009) as well as clinical groups (Conesa et al., 2021; Re, Capodieci, & Cornoldi, 2015). As such, this study examined whether children showed improved attention and EF skills at the end of the intervention as reported on parent-rated questionnaires. While there was a larger study that looked into child outcomes on objective measures of attention and EF (performance based), this portion of the study focused on behavioural outcomes as observed by parents. This was chosen as the main focus of the study was parents' experiences of delivering a cognitive intervention, and whether it is a feasible and effective way of reducing stress and improving parent efficacy, particularly in parents from low SES backgrounds as they may be more susceptible to stress and lowered efficacy. As such, parents' perceptions of change in their children's skills were the main focus. The results partially supported improvements of skills as reported by parents, with working memory, behaviour regulation, and attention skills showing improvements after participating in the intervention. It should be noted that the bulk of tasks completed by children in the current study were attention and working memory tasks given the hierarchical nature of DI. As attention is seen as a precursor to more complex EF skills, most DI mini games start with sustained attention tasks. As children progress in the games, other skills such as working memory, inhibition, and flexibility get exercised more. Even past the sustained attention tasks, most DI mini games include

significant visual and auditory working memory tasks which may explain the significant improvements in attention and working memory skills. Similarly, children learn to regulate themselves throughout the intervention with the support of their parent or caregiver and through trying out different metacognitive strategies which may explain the improvements in behaviour regulation skills. The inclusion of metacognitive strategies in DI may have contributed to the intervention's effectiveness in behaviour regulation, as parents were encouraged to help their children reflect on their cognitive processes and problem-solving approaches. Given that children move at their own pace throughout the intervention, some of them do not reach more advanced levels that include flexibility tasks which may explain the lack of significant findings on other aspects of EF skills.

There are several possible explanations for the improvements observed following participation in DI intervention. These improvements may result from the development of better habits and strategies for monitoring performance on tasks or may stem from neural changes occurring due to repeated practice of these cognitive abilities (Pozuelos et al., 2019; Rueda et al., 2012). The DI intervention was designed to strengthen attention and EF through systematic and repetitive practice using self-adjusting and hierarchically structured exercises (Sohlberg & Mateer, 1987). The core mechanism underlying this approach is experience-dependent plasticity, in which neural circuits reorganize themselves in response to new learning experiences (Kleim & Jones, 2008). Repeated, targeted, and meaningful cognitive or behavioral experiences can drive neuroplasticity and foster neural adaptation. Throughout the intervention, children practice and develop their attention and EF skills through experience-dependent plasticity principles, which may explain gains in these skills.

A key component of DI is its integration of metacognitive strategy instruction, which supports children in monitoring their thinking and performance while enhancing their ability to apply learned skills throughout the intervention. Previous research has emphasized the importance of combining attention and EF training with metacognitive strategy instruction to promote the generalization of skills to real-world tasks and encourage independent strategy use (Cicerone et al., 2011). This study followed a similar approach which highlighted the role and importance of metacognitive strategies in maximizing intervention gains and facilitating skill transfer beyond trained tasks. These findings align with previous meta-analyses, which have shown that process-specific training is most effective when combined with metacognitive strategy instruction (Cicerone et al., 2011; Kennedy et al., 2008; Sohlberg et al., 2003). The structured teaching and increasing independent use of these strategies likely contributed to the overall effectiveness of the DI intervention which leads to improvements across cognitive domains. Similarly, the learning and teaching of metacognitive strategies may have given parents and children a common language to discuss difficulties and problem-solve effectively. This explains the improvements in parent-child communication as reported by parents. Finally, given that child outcomes were measured through parent-report questionnaires, parent bias may be a factor in the explanation of better attention and EF skills. Parents were aware that they were working through an attention and EF intervention with their children which may have led to biases in the post-intervention questionnaires.

For child outcomes, the next hypothesis predicted changes in child attention and EF skills as a function of family SES with children from low SES families making

greater gains. Previous research demonstrated that children from low SES families consistently perform poorer on cognitive tasks including tasks that include attention and EF skills, poorer academic performance, and increased mental health issues like anxiety, depression, and ADHD (Evans & Schamberg, 2009; Hackman & Farah, 2009; Last et al., 2018; Lawson & Farah, 2017; Noble, McCandliss & Farah, 2007) which demonstrate the need for effective cognitive interventions in this group. Previous studies also found that children who have more significant EF difficulties benefit the most from cognitive interventions (Diamond & Lee, 2011; Thorell et al., 2011). This may suggest that the DI program may be more effective for children who show impairments in EFs, including clinical groups such as ADHD or ASD, or children who are at risk of experiencing EF impairments such as children from low SES backgrounds. Given these results, it was predicted that children from low SES families would make more gains in their attention and EF skills after the intervention. However, the findings of this current study only found significant differences between SES levels on behaviour regulation subscale. Even within that subscale, there were only differences in two income groups (one low SES and one middle SES). While parents in the $40,001 to $75,000 and $100,001 to $150,000 income groups reported significant increases in their children's behaviour regulation skills, other income groups did not report significant changes. One explanation for these mainly non-significant findings may be related to sample characteristics. As discussed above, there were no significant associations between SES and most aspects of attention and EF in the current study, with the exception of organization and cognitive regulation skills Since there were no significant differences in attention and EF skills across different SES levels at pre-intervention, it is expected that there were no significant

differences in change in attention and EF skills across SES levels at post-intervention. If baseline differences were absent, it follows that no significant differences in post-intervention change would emerge. Second, the study's assessment of SES relied solely on income, which may not fully capture socioeconomic disparities in a region like British Columbia, where factors such as parental education or occupation may also play crucial roles. Since SES was measured narrowly, the observed differences between the two income groups may not reflect a broader trend but rather a spurious finding. Finally, based on the FSM, changes in parental factors, such as parents' stress or conflict, impact parenting behaviours which then impact child outcomes such as attention and EF skills, and behavioural change. However, the impact of parenting changes in children's attention and EF skills may be gradual and occur over time (Weller et al., 2024). As such, we may expect to see the improvements in attention and EF skills and behaviour in children gradually as opposed to immediate changes, particularly in families in lower SES brackets as they may be more prone to negative parenting practices that result from increased stress (Jackson et al., 2008; Martins et al., 2023). Based on this, it is possible that there would be more differences in children's attention and EF skills across SES groups after a while, after parents have further opportunities to implement the strategies they learned throughout the intervention which may positively impact child behaviour.

Association Between SES and Parent Stress

Previous studies have found a direct relationship between SES and parenting practices and parents' feelings of efficacy, with higher SES parents being more likely to engage in authoritative and positive parenting (Anton et al., 2015; Azad et al., 2014; Jackson et al., 2008). Based on the FSM, one factor that may explain the relationship between SES and

parenting practices is parental stress levels. Using the FSM lens, parents from low SES families are more likely to experience financial stress (i.e., unemployment, poorer work conditions (Liu et al., 2020; Martins et al., 2023). Additionally, these parents may work longer hours or have multiple jobs given financial stress which may then increase their overall stress levels. Overall, parents who experience more stress are at an increased risk of not engaging in positive parenting strategies (Liu et al., 2020; Martins et al., 2023). As such, the literature documents the relationship between family SES and parent stress. The current study also examined the relationship between family SES and parent stress as reported on the Carer QoL Questionnaire. There were no significant associations between SES and parent stress in the current study. One explanation for this finding may be due to the questionnaire used to measure stress. While this questionnaire indirectly assessed carer traits that are associated with stress, including support they have with carrying out care tasks, relational problems, problems with own mental health, and problems combining care tasks with daily activities, it is not a direct measure of parent stress. As such, it is possible that this measure was unable to pick up on nuances regarding parents' stress in the current study. The other measure of parenting stress used was a pre-intervention question about parent stress levels which was not associated with SES in the current study. Another explanation may be due to the factors described in the previous section about the location of the study and services and supports available to parents. As such, low SES in this area may not be associated with the same stresses as in some other areas where parents may not have similar supports or services.

Changes in Parent Stress

Research shows that parents from low SES families experience higher levels of stress which impact their parenting practices and child outcomes later in life (Conger & Donnellan, 2007). Low SES has been consistently linked to increased rates of mental health challenges for parents and children (Chen & Miller, 2013). According to the FSM, which was proposed by Conger and colleagues, financial hardship leads to heightened parental psychological distress, mental health difficulties, and increased parental relationship conflict, which in turn negatively impact parenting practices (Conger & Conger, 2002; Conger et al., 1992, Conger et al.,1993, Conger et al., 2002). As such, reducing parent stress levels, at least in part, may improve parent and child outcomes. Given this relationship, the current study examined whether participating in a cognitive intervention (DI) with a parent coaching and support component reduced parents' stress levels. Previous research demonstrated that parent-delivered interventions may reduce stress levels in parents by teaching them new skills to use and changing child behaviours that may be more stressful for parents (Burgdorf et al., 2019; McMahon & Forehand, 2003). While previous research showed promising results, the current study did not find any significant changes in parent stress levels following participation in DI in the sample. The insignificant findings of the current study may be due to a number of factors. First, as discussed previously, the questionnaire that was used to measure stress levels did not directly measured parental stress levels. Rather, it was a questionnaire that asked indirectly about traits that are associated with stress, including parents' level of support they have with carrying out care tasks, relational problems, problems with own mental health, and problems combining care tasks with daily activities. As such, it is possible that this measure did not pick up on nuances of parental stress levels.

Second, while previous research found benefits of parent-delivered interventions on stress levels, when parents from low SES families participate in home-based or parent-delivered interventions, they may face challenges such as time constraints and financial stress, which can limit their ability to fully engage in interventions (Pellecchio et al., 2018). Consistent with the literature, the current study examined the relationship between family SES status and stress associated with delivering a home-based intervention, and found a significant, negative correlation between family SES and intervention stress, indicating that parents from lower SES families experienced higher levels of intervention stress. This may be due to a number of factors including financial barriers, limited access to other resources or supports, elevated baseline stress levels, or an increased pressure to ensure that interventions work. For example, financial constraints such as limited financial resources can make it challenging for low-SES parents to access or fully engage in intervention programs. The costs associated with taking time off from work or other tasks to engage with the intervention may add extra stress to their stress levels (Scrimin et al., 2022). Additionally, parents and families from low SES may have less access to supports or other services, which can hinder their ability to participate effectively in interventions. For example, they may have increased stress around childcare if there are other children in the household which may negatively impact their engagement with DI and their child. Finally, parents from low SES families may have higher expectations from interventions such as DI as they may not have resources for other supports for their child. As such, parents may experience increased stress if they perceive the intervention to be less effective or not working as quickly as they hoped. These factors may all impact their experience during the DI and may explain why families from low SES backgrounds

experience more intervention-related stress. On the other hand, while SES was negatively associated with intervention stress (with families from low SES backgrounds experiencing more intervention stress), there were no significant increases in overall stress levels post-intervention. This is an important finding to note since it suggests that, although families from low SES backgrounds experienced higher intervention-related stress during the program, this stress did not persist after the intervention ended. This finding is important because it indicates that while the intervention may have posed greater challenges for low SES families in the moment, it did not lead to a lasting increase in overall stress levels. This could mean that other external stressors did not compound intervention-related stress over time or that families were able to adapt and manage the demands of the program effectively, potentially by applying the strategies they have learned throughout the intervention.

While quantitative analyses did not find significant changes in parent stress levels post-intervention, which may be due to the factors described above, qualitative analyses from interviews with parents revealed changes in parent stress levels. While the majority of parents from all SES levels reported decreases in stress levels, this decrease was more evident for the low SES group, with 92% of parents from low SES families reporting lower stress levels compared to 68% and 56% of the middle and high SES, respectively. The mechanism of stress reduction may be due to a number of different factors. First, parents reported better communication with their children and increased confidence in themselves as a parent after DI. Research suggests that when parents feel more competent and capable in their parenting abilities, they experience lower levels of stress and anxiety related to parenting (Sevigny & Loutzenhiser, 2009; Giallo et al., 2013). It is shown that

parents who believe in their ability to manage their children's behavior are less likely to feel overwhelmed which in turn reduces stress (Jones & Prinz, 2005). Similarly, confident parents tend to use more effective problem-solving and emotion regulation strategies in their day to day lives and interactions with their children, which buffer against stress (Deater-Deckard, 2004). Finally, improved communication between parents and children and confidence in parents' own skills foster more responsive and positive interactions between parents and children, which contribute to reduced frustration and emotional strain (Morris et al., 2007). Reduced frustration and increased positive interactions between parents and children may explain why parents report reduced stress levels after participating in DI. Another factor that may explain lower stress levels may be related to children's behaviour and cognitive skills. As discussed in the results section, DI was found to be effective in reducing some attention and EF challenges as reported by parents. By addressing cognitive development of children and reducing the intensity of attention and EF related concerns, DI may have alleviated some level of parent stress that is associated with their children's cognitive skills and behaviour. Consistently, previous research has shown that problems in children's EF skills were associated with higher parental stress and psychological distress. By addressing children's cognitive development and exercising attention and EF skills, DI may have reduced parent stress levels across the population.

Given the multifaceted nature of parent stress, and the factors that contribute to it including economic, interpersonal, personal, and cognitive factors, it is possible that a brief questionnaire (Carer Quality of Life) did not pick up nuances related to parents' experiences of stress. It is possible that another, more detailed questionnaire (i.e.,

Parenting Stress Index) may have been more effective at picking up different facets of stress (child characteristics, parent characteristics, environmental factors).

Association Between SES and Parenting Efficacy

Based on the FSM, families who experience financial strain or stress may experience feelings of low efficacy, which negatively impacts their parenting behaviours and how they respond to their children's behaviours (Sevigny & Loutzenhiser, 2009). Similarly, the FSM argues that financial stress in low SES families impact parents' own mental health and relationship conflict which are closely linked to parenting efficacy (Crnic & Ross, 2017). As such, the current study examined the relationship between SES and parent efficacy. While the results of the current study did not find an association between family SES and parents' perceptions of their efficacy at pre-intervention, this may be due to different factors. First, high levels of community or family support may mitigate the effects of low SES on parenting efficacy. In fact, Raikes & Thompson (2005) found that low-income parents who had strong social networks reported similar levels of parental efficacy as higher-income parents. While the current study did not collect data on parents' community or family supports, this may potentially explain the lack of correlation between SES and parents' sense of efficacy. On the other hand, as discussed in previous sections, programs such as StrongStart BC, Ready Set Learn, and Primary Years across the province and on Vancouver Island may provide supports to families from low SES backgrounds. Additionally, contextual factors such as geographic location or policy differences between countries or provinces may impact parents' sense of efficacy. For example, studies conducted in areas with strong social policies (e.g., free childcare, parental leave) may find weaker relationships between SES and parental

efficacy because government support helps buffer financial hardship (Fierloos et al., 2023). As discussed previously, there are programs and supports offered to families and children across BC regardless of their SES which may alleviate some of the burden for families and help them feel more effective in their parenting. Finally, parental personality traits may impact parents' sense of efficacy. In fact, previous research has found that parental self-efficacy was more strongly associated with personality traits than with socioeconomic factors (Coleman & Karraker, 2003). These personality traits may involve parents' motivation levels, optimism, and coping skills. While the current study did not measure parents' personality traits and how they may relate to their sense of their parenting efficacy, this may be a factor to look at in future studies.

Changes in Parent Self-Efficacy

Previous research has shown the benefits of home-based intervention for both parents and children although the focus has been more on parent-child behaviour interventions and parent skills training rather than the delivery of cognitive interventions (Kaminski et al., 2008; Png et al., 2024). Specifically, research shows that following participation in home-based interventions, parents generally report feeling more competent in managing their children's behaviors and improving family dynamics (Kaminski et al., 2008). These findings apply to parenting programs as well as other types of interventions such as cognitive or academic interventions (Weitzman & Greenberg, 2019). As such, this study aimed to determine whether a home-based, parent-delivered cognitive intervention (DI) would also increase parents' sense of their efficacy. The results indicated that participation in DI was associated with improvements in parent efficacy, both on qualitative and quantitative measures.

Quantitative analyses found significant increases in parents' perceptions of their efficacy after participating in DI intervention. On the other hand, analyses did not reveal change in parent self-efficacy as a function of SES. As mentioned previously, this may be due to the lack of variance in SES levels as the majority of the sample belonged in the middle SES group. It is possible that the lack of variability led to lower power to detect differences across SES levels. In addition, a previous meta-analysis found that structured parent training programs equally effective for disadvantaged and non-disadvantaged families (Leijten, Raajimakers, de Castro, & Matthys, 2013). This may indicate that all families benefit from parent training programs regardless of their SES status, which may explain the current nonsignificant findings based on SES.

Qualitative analyses of the current study found a similar pattern to quantitative analyses. Specifically, on qualitative measures, parents in the DI intervention group reported increased confidence and efficacy in managing their children's behavioral challenges and implementing structured strategies for cognitive development and emotional and behavioural functioning. In addition, the majority of parents reported experiencing personal growth, both in their own emotion regulation skills and in their parenting and coaching skills with their children. When parents feel more confident in their parenting and coaching skills, they may feel more equipped to handle challenging parenting situations, which may potentially be related to higher levels of efficacy (Jones & Prinz, 2005). These findings align with previous research which suggests that interventions incorporating parent training components can empower caregivers and promote positive parent-child interactions (Kaminski et al., 2008; Png et al., 2024). The observed improvements in parental efficacy can be attributed to several factors. First, the

intervention provided parents with specific, actionable strategies for supporting their children's EF development, which may have enhanced their confidence in their caregiving abilities. The structured and interactive nature of DI likely played a critical role in reinforcing parenting strategies, and helping caregivers feel more capable and engaged in their children's development. The structured nature of the intervention likely contributed to a sense of control and predictability, which has been shown to reduce parenting stress (Sevigny & Loutzenhiser, 2009). In addition, the weekly parenting groups with DI facilitators and other parents may have helped parents feel mor effective in their parenting. As explained in previous sections, these weekly sessions included information about DI, parenting strategies to help support parents and children during DI and in their day-to-day life. It is possible that these strategies and support from trained clinicians as well as fellow parents positively impacted the parents in the current study. Despite not being a parenting intervention, DI was effective in increasing parents' perceptions of their efficacy.

While quantitative analyses did not find differences in parent self-efficacy scores across SES levels, qualitative analyses found some trends in what parents prefer across different SES levels. While low SES families reported benefitted from concrete, structured behavioural strategies, middle and higher SES families used the intervention to finetune the strategies they had and to reflect on their parenting practices. These findings fit with the "knowledge gap hypothesis" which suggests that parents with higher levels of education and economic resources acquire and adopt parenting information and knowledge more rapidly (Bornstein et al., 2010; Roubinov & Boyce, 2018). In turn, parental knowledge about child development and positive parenting strategies is argued

to have an important role in the relation between SES and parenting behaviors (Morawska, Winter, Sanders, 2009; Roubinov & Boyce, 2018). Based on the knowledge gap hypothesis (Bornstein et al., 2010), it is possible that parents from low SES families preferred structured and behavioural strategies because their understanding or application of these strategies was lower at the beginning of the intervention. DI and weekly parenting groups as well as direct support from trained research assistants may have helped lower SES parents learn and apply these strategies with success. On the other hand, given the knowledge gap hypothesis, it is possible that middle and higher SES families had this knowledge prior to DI, and they used the intervention support to finetune their application and reflect on their effectiveness. These findings have important implications for future research and what interventions may focus on, which will be discussed in the future directions section.

Limitations and Future Directions

Although the study was an important first step in investigating the effectiveness of DI on parent efficacy and stress in a representative sample, it also includes several limitations that need to be considered. First, the current study was the first study that mainly investigated parent outcomes after DI intervention. Previous studies using DI focused on investigating the efficacy of DI on child outcomes including child attention and EF skills and far-transfer outcomes to other areas such as academic skills. The current study focused mainly on parents' experiences of delivering DI and changes in their skills including feelings of efficacy and stress levels with a focus on determining differences in parents' experiences across different SES levels. While the sample of parents and families that participated in the study was representative of the broader

Canadian and BC population regarding income levels, the distribution of SES and family income levels was not equal. Similar to the broader BC population, the majority of the sample fell within the middle SES range with fewer families belonging to lower and higher SES groups. This may have reduced the power of some analyses and made it more challenging to detect differences between SES groups. Even though ANOVA is relatively robust to differences in numbers between groups, it would have been more powerful if each SES level had the same number of families. Given this limitation, analysis of qualitative information (i.e., exit interviews) was utilized to examine differences in SES levels. Ideally, it would have been useful to recruit a large number of participants that belong to each SES levels to examine trends.

One strength of the current study is that family income was used as an ordinal variable across quantitative analyses. Unlike categorical income groupings, a continuous variable captures the full range of income differences, allowing for more precise and nuanced statistical modeling. Similarly, categorical income groups require setting income thresholds (e.g., low, middle, high), which may be arbitrary and vary across studies. Using income as a continuous variable eliminates this issue. While this is a strength of the current study, a limitation is its use of family income as an SES predictor. While income is one factor of SES, there are a variety of other factors such as educational attainment, financial security and individuals' subjective perceptions of social status to provide an accurate estimate of a complex and multifaceted term such as SES (Conger & Donnellan, 2007). Ideally, a combination of all these factors may be used to create one single SES score that describes an individual. However, the current study mainly included children of parents from highly educated backgrounds with less variability in

education and employment status which made it more limiting to consider other factors associated with SES. Similarly, participants from this current study were all recruited from one area in BC (Vancouver Island). This may have limited the generalizability of the findings, as the current sample is a more homogenous group of parent and child participants. Similarly, as discussed previously, neighbourhood factors and social supports for families and children impact parenting experiences, knowledge and skills as well as child outcomes such as cognitive skills. Given that all families were recruited from Vancouver Island, which is a safe area with supports available to families (i.e., childcare, early intervention) regardless of SES, the results of the study may have been more representative if participants were recruited from different areas of BC or Canada. Similarly, non-English speaking families were excluded from the current study which may have limited the diversity of the sample. Future studies may consider recruiting from non-English speaking populations (i.e., with interpreter help) to improve representation and generalizability to other populations.

Next, the current study included a mixed pediatric sample of children with and without diagnoses of neurodevelopmental disorders. While some child participants had official diagnoses, others were identified by their parents as having attention and EF difficulties. While this mixed sample likely helped with generalizability of findings to different groups, it may have made it more challenging to look at patterns or trends between different diagnoses or presenting concerns. Future studies may consider focusing on different diagnoses separately, or aiming to recruit an even number of participants for each diagnosis or presenting concern for analyses.

As mentioned in previous sections, one of the questionnaires selected as a measure of parent stress is not a direct measure of stress. Instead, it is a measure of carer quality of life and measures parents' experiences with typical stressors such as economic, time, and relationship-related stress. While it is a quick way of screening for parent stress, it does not systematically measure different aspects of parenting stress. Another measure, such as the Parenting Stress Index, may have been a more effective and valid way of measuring parent stress in this current study. While the Parenting Stress Index was initially included in this study, many parents found it to be too stressful to complete given its length and the nature of questions. As such, the researchers pivoted to another, less invasive questionnaire which may not have picked up on different aspects of parent stress.

While family SES is associated with parents' feelings of efficacy, stress, parent-child relationship quality and child outcomes, some research suggests that even when SES is low, the presence of strong social support can buffer negative outcomes by improving parental well-being and strengthening the parent-child bond (Ceballo & McLoyd, 2002). Parents with strong support systems (e.g., extended family, community programs, peer networks) experience less stress and feel more capable in their parenting role, even in low-SES contexts (Armstrong et al., 2005). Given this relationship, it may have been helpful to systematically examine parent support networks for the parents in the current study via questionnaires or structured interviews. Additionally, parent mental health plays a critical role in moderating the impact of socioeconomic status (SES) on parenting stress, parental efficacy, and parent-child relationships. While lower SES is often linked to increased stress, reduced parenting confidence, and greater parent-child

conflict (Conger et al., 2002), protective factors such as parental strong mental health can buffer these negative effects (Gutman et al., 2003; McLoyd, 1998). Consistent with the FSM, parents experiencing depression, anxiety, or chronic stress may have greater difficulty managing parenting challenges, which may lead to increased stress and a lower sense of efficacy (Reising et al., 2013). Conversely, parents with strong emotional regulation and resilience may be better equipped to handle financial hardships, which may mitigate the negative effects of low SES on parenting stress (Luthar, 2006). As such, it would have been ideal to measure parent characteristics such as parent resilience and mental health to look at protective factors in families from all backgrounds including low SES backgrounds.

One key limitation of this study is the differential attrition rates across socioeconomic groups. While 85% of families who enrolled in the study completed the intervention, 15% withdrew, with families from lower SES backgrounds being disproportionately represented in attrition (43% of those who withdrew were from low SES backgrounds, despite making up only 23% of the sample). Future studies should consider strategies such as enhanced participant follow-up, additional supports for lower SES families, or alternative data collection methods to improve retention and ensure more representative findings. Similarly, while all parents were able to attend and benefit from parent coaching groups, it was more challenging to meet fidelity requirements for tracking forms, particularly for families from lower SES backgrounds. Future research should explore ways to increase tracking form completion, such as simplified submission methods, digital reminders, or alternative data collection approaches to reduce burden on participants, particularly those from lower SES backgrounds.

Another limitation is the reliance on self-reported measures of parental efficacy and stress. While self-report is valuable for capturing subjective experiences, future studies should incorporate additional observational methods or physiological stress measures to corroborate findings. Parental interviews, direct observations of parent-child interactions, and biomarker assessments of stress (e.g., cortisol levels) could provide a more comprehensive understanding of intervention effects.

Similarly, another limitation of the current study is the reliance of parent-reported measures for child outcomes (attention, EF, and behaviour). Given that parents delivered the intervention to their children, there may be biases in what parents reported, as they may have unintentionally overestimated improvements in their child's attention, EF, and behavior due to their involvement in the intervention. This could be influenced by factors such as expectation bias, where parents anticipate positive changes and may perceive or interpret their child's behaviors more favorably. Furthermore, relying solely on parent reports limits the objectivity of the findings, as parents may have different perceptions or ideas about identifying changes in their child's cognitive and behavioral skills. Parents with higher stress levels or pre-existing concerns about their child's abilities may either underreport or overreport improvements based on their own perspectives and experiences. To strengthen the validity of future research, incorporating multiple assessment methods, such as teacher reports would provide a more comprehensive and objective evaluation of intervention effects on child outcomes.

The unique benefit of DI involves the three components of DI, including game play (process-specific approach), metacognitive teaching (compensatory approach), and parent coaching sessions that provide general skills. While all these may be needed to see

improvements in parent and child outcomes, one limitation is that is it challenging to determine whether there is a 'key ingredient' is for success of the intervention. Future studies should separate each component and deliver it separately to different groups to determine whether all three components are needed or if there is one 'key' component.

Additionally, this study used a single-arm design without a control or comparison group. While pre-post comparisons allow for preliminary conclusions, the absence of a control group limits causal inferences about intervention effects. In addition, parenting efficacy was measured through parent self-report rather than through objective behavioral assessments. While perceived efficacy is meaningful and aligns with theoretical models, future research might consider triangulating this with observational or teacher-reported data to better capture actual changes in parenting behavior.

Another limitation of the study is that the qualitative analysis was conducted by a single coder. Although this approach was required for the scope of the dissertation, it may limit the trustworthiness of the findings. For future studies, strategies such as member checking, peer debriefing, and inter-rater reliability procedures should be incorporated to enhance qualitative validity.

Next, developmental changes in children over the 6-8 week intervention period may have contributed to observed outcomes. Especially in early and middle childhood, EF and attention skills are rapidly developing, and some improvements may reflect natural maturation rather than intervention effects alone. Although the current study did not include a control group, it is unlikely that significant improvements in attention or executive functioning would occur over a short period such as 6–8 weeks without intervention. Nevertheless, it is possible that children who are younger and undergoing

more rapid periods of executive function development may be more responsive to the intervention. While this developmental consideration was not examined in the present study, future research should explore whether intervention outcomes differ based on child age, particularly by comparing younger and older cohorts.

Finally, the timing of post-assessment testing may be a limitation for this study. Post-assessment testing was completed shortly after the DI intervention was completed, which may be a very short duration to see long term changes (Bergman & Söderqvist, 2017). In particular, a previous meta-analysis showed that while interventions that incorporate parent training is effective for families across all SES levels in the short-term, the maintenance of treatment gains after the intervention may be harder for disadvantaged families (Leijten, Raaijmakers, de Castro, & Matthys, 2013) which indicates a need for long-term supports for these families. While the current study did not have longitudinal testing to see whether the effects of DI last over a period of time, future studies may incorporate this aspect.

Future studies in this area may benefit from measuring parent executive functioning skills directly. While this study focused on parenting stress and efficacy, understanding parents' own EF abilities may provide important context for how they engage with and implement the intervention. Assessing parent EF could also inform the tailoring of parent coaching strategies and explain this aspect of variability in outcomes.

Implications and Conclusion

Despite the limitations noted above, the current study has implications for using parent-delivered cognitive interventions to boost parent efficacy and parent-child relationship, reduce stress, and improve child cognitive skills. While previous research

found successful outcomes regarding changes in parenting skills and efficacy following parenting interventions, there is limited data regarding parent outcomes following participation in cognitive intervention. Further, the research is even more limited across different SES levels. As such, this study provides preliminary support for the use of cognitive interventions with parent training component. Policymakers and practitioners should consider integrating such programs into early intervention services, especially in low-resource communities.

While the data is mixed regarding changes in parent and child outcomes as a function of family SES, qualitative analyses support that there may be differences in what parents prefer in interventions depending on SES level. As discussed previously, parents from low SES families consistently reported benefitting from structured and direct behavioural strategies in their parenting practice. This finding has important implications for future interventions that incorporate parent training for parents from low SES families. A highly structured program that focuses on teaching practical skills may be particularly effective for these families. On the other hand, parents from middle or higher SES families may benefit from less structured interventions that focus on parent reflection and metacognition.

The current study demonstrated that interventions such as DI may be helpful for parent and child outcomes, both in disadvantaged and non-disadvantaged families. DI was found to be effective in improving children's attention and EF skills as reported by parents across the SES spectrum. This is an important finding since despite substantial efforts, the inequalities and gaps in cognitive skills, mental health, and achievement continue to be significant for children from low SES backgrounds (Chmielewski, 2019).

In fact, the Covid-19 pandemic may have further highlighted and exacerbated these gaps. Pandemic related service disruptions and changes, such as online education, access to healthcare, supports and services, disruption of in-person supports and services, likely contributed to this gap. Research shows that low-income families were disproportionately affected by such pandemic-related changes (Gassman-Pines et al., 2020; Herbst, 2021; Murray et al., 2022) which widened existing inequalities by limiting access to in-person services, increasing financial strain, and reducing opportunities for social support (Patrick et al., 2020; Gassman-Pines et al., 2020). Economic hardship and social isolation contributed to higher levels of parental stress during this time which was particularly relevant for low SES families (Cluver et al., 2020). Given the context of the pandemic, increased parental stress levels, and increased gap in cognitive and academic skills between children from low and high SES families, effective interventions may be even more important to support parents and children from low SES skills. As such, beyond individual benefits, the DI highlights the broader importance of accessible, affordable, evidence-based parenting and cognitive supports. Schools, healthcare providers, and community organizations could play a crucial role in disseminating such programs, which may help to ensure that at-risk families receive the guidance needed to foster their children's cognitive and emotional development.

In summary, this study provides preliminary evidence that a parent-delivered EF training program, DI, can potentially enhance parental efficacy and reduce parenting stress, particularly in families from lower-SES backgrounds. In addition, this study provides evidence that DI may improve attention and aspects of EF skills in children, as measured by parent perspective. It can be delivered at home by parents as parents from

different backgrounds and SES levels were able to complete the intervention. While the findings are promising, further research is needed to confirm long-term effects and optimize intervention strategies. Nonetheless, the results highlight the potential of structured, home-based interventions to empower parents and promote positive developmental outcomes for children. Expanding access to effective and affordable programs could be a valuable step toward supporting at-risk families and fostering resilience in both caregivers and children.

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Appendix A

Screening Interview

Ok, so now I would like to ask you a few questions to learn more about your child and to help us assess whether the Dino Island program is a good fit for you and your child.

First, we'll start with some basics-

1. What is your child's name?
2. What is your child's date of birth?
3. How old is your child?
4. What grade is your child in?
5. The Dino Island game is tablet-based and does require that the child has the ability to see and hear the game as well as the physical mobility to tap the screen. Does your child have any hearing, vision, or mobility impairments that might interfere with their ability to play the Dino Island game?
6. Does your child have any difficulties with paying attention, flexibility, memory, or self-regulation?
7. It's not required for study but does your child have any diagnoses of neurodevelopmental disorders (such as ASD, FASD or ADHD) or on a waitlist for an assessment?
8. Does your child hold any other specific diagnoses, such as a Learning Disability, Intellectual disability, or Anxiety?
9. Did your child have any early developmental problems, such as delayed walking or talking or other that were identified by a professional?
10. Does your child have any diagnosed medical conditions?
11. Has your child ever been diagnosed with a traumatic brain injury or concussion, sustained a blow to their head warranting medical investigation or treatment?
12. Has your child ever been diagnosed with a seizure disorder (epilepsy)?
13. Does your child take any medications?
14. What other services is your child currently receiving at school or at home?
15. Is your child receiving any other supports that I have not asked about?

Thank you so much for answering those questions, I know it can sometimes feel sensitive to share this information but I really appreciate it as it helps us understand more in our study. I've got a couple more study specific questions here as well-

1. Do you have access to an iPad or an Android tablet to access the intervention? (double check about tablet- phone will not work, must be tablet) [if no, say "We may be able to arrange for a loaner, so I will check into that for you"]
2. Do you have a computer/tablet at home with access to internet to complete the online training and weekly group meetings over Zoom?
3. Generally, what is your level of comfort with using computers?
4. Generally, what is your level of comfort with using tablets (iPad or Android?)
5. Have you (or the other parent/caregiver) ever completed an online course before?

Like I've mentioned, Dino Island is a parent-delivered program and accordingly, you'll be engaged with your child and the game the entire time. As a reminder, this entails about 2.5hrs per week spread across 3-5 sessions, and the program lasts for about 6 weeks.

Does this feel like something you can fit into your current schedule? [note: if not, can ask if they'd like to revisit it at another time- do not have to enroll and participate right this moment, we'd rather they have a good experience later on]

1. Do you have a quiet place at your home where you can complete the intervention with your child?
2. Any other barriers you'd anticipate in doing this program? For example, siblings in the home, vacations, any other courses/supports that take considerable time, upcoming medical procedures etc.

   In this case, can someone else step in?

Appendix B

Parent Sociodemographic Survey

Please fill out following information about yourself and your family members:

1. Your sex: _____ male ___ female ____ other
2. Your age: _____

3. Your relationship to child:
   - ____ Mother
   - ____ Father
   - ____ Other (please indicate the relationship) _____

4. Please indicate the **age** and **sex** of your child(ren) including the child participating in this study:

Child participating in this study:
Sex: (M/F/Other) Age: _____ Birth-date: _____

Other children in your household:
Sex: (M/F/Other) Age: _____ Sex: (M/F/Other) Age:
Sex: (M/F/Other) Age: _____ Sex: (M/F/Other) Age: _____

5. Child's cultural background/Race-Ethnicity (please check all that apply):
   - ___ White
   - ___ Black or African American
   - ___ Indigenous or First Nations
   - ___ Asian
   - ___ Asian Indian
   - ___ Hawaiian Native
   - ___ Pacific Islander
   - ___ Middle Eastern
   - ___ Alaskan Native or American Indian
   - ___ Hispanic, Latino, or Spanish
   - ___ Biracial/Other (Please specify): _____

6. Child's first language: _____

7. Languages spoken in the home:
   1. _____
   2. _____
   3. _____

8. Marital Status: (Please check one)

____ Married
____ Divorced
____ Living with partner
____ Single
____ Separated
____ Other (Please specify)
_____

9. If there is another adult living in the home, please indicate:
Age: _____ Sex: _____

10. Your education level (please check highest level attained):
___ No formal education
___ Grade school
___ Some high school
___ Some college or 2-year degree
___ Bachelor's degree (Major: _____)
___ Graduate degree (Please specify) _____
___ Other (Please specify) _____

11. Occupation (self): _____

12. Please indicate the best match for your current employment:
___Full time employment
___Part-time employment
___Home duties
___Studying
___Volunteer work

13. If there is another adult in the home, please indicate this person's education level (please check highest level attained):
___ No formal education
___ Grade school
___ Some high school
___ Some college or 2-year degree
___ Bachelor's degree (Major: _____)
___ Graduate degree (Please specify)
___ Other (Please specify)

14. Occupation (other adult): _____

15. If there is another adult in the home, please indicate the best match for this person's current employment:
___ Full time employment
___ Part-time employment
___ Home duties
___ Studying
___ Volunteer work

8. Which category best describes your total **household** annual income?

___ less than $25,000
___ $25,001-$40,000
___ $40,001-$75,000
___ $75,001-$90,000
___ $90,001 - $100,000
___ $100,001 - $150,000
___ $150,001 - $200.000
___ Over $200,001

Appendix C

Exit Interview

Participant ID: _____ **Date**: _____

Interviewer: _____

1. To start off, we are going to ask you a few questions about what the experience was like for you delivering the Dino Island intervention with your child at home. First question…

    a. What were the positives of doing the intervention?

    b. What were the negatives of doing the intervention?

    c. What were the major obstacles to doing Dino Island sessions at home?

    d. Were the online & written materials clear to you?

    e. Was the support level of the research team acceptable to you?

    f. Was there anything you found frustrating about the intervention or the research team's involvement with you?

    g. Is there a way we could have better supported you?

2. Now we are going to ask you a few questions about what the experience was like for your child during the DI game. First question…

    a. What were the positives of doing the intervention for your child?

    b. What were the negatives of doing the intervention for your child?

    c. Were there things about the game that were frustrating or barriers that arose for your child while playing the game?

    d. Did playing the game with your child change your way of interacting with each other, in any way?

3. Did you notice any *general* changes in your child's behaviour after participating in the intervention?

4. I am going to list different areas in your child's life and please let me know if you noticed a change (yes) or not (no). (*If they answer yes, ask them to elaborate on what*

kind of change they noticed. If they are unsure if there has been a change or not, list a few examples)

   a. Attention span (amount of info? Time of remembering?)

   b. Behaviour or mood

   c. Regulation of behaviour and mood

   d. Remembering

   e. Task completion (*if needed, prompt with: e.g., brushing their teeth start to finish, getting ready for bed, cleaning up toys)*

   f. Following directions (*if needed, prompt with: e.g., directions given by parent for child to get ready for bed, directions from others such as a coach or teacher)*

   g. Flexibility/openness to transitions

5. If you have noticed any changes, did you see these at home or out in the community? (*could prompt: e.g., has anyone mentioned anything about the changes outside of the home?)*

6. Metacognitive strategies (*define/provide example as needed*)

   a. Have you noticed your child spontaneously using any of the metacognitive strategies that you taught during or outside of the intervention sessions?

   b. Have you noticed your child spontaneously using any new (non-taught) metacognitive or learning strategies during or outside of the intervention sessions?

7. Was there anything specific about the program that your child enjoyed? Disliked?

8. Thinking about the weekly parent groups via Zoom, were there any barriers or anything that made them less effective (*ask in general; prompt as needed*)?

9. How was your overall experience using email and zoom? (for asking questions, sending in tracking forms and video calls)?

   a. Did the onboarding process make sense? Could we have made this process smoother for you?

   b. Did you find it easy to navigate? (e.g., attend meetings, message the research team, etc.)

   c. Was it a platform you would use again? If yes or no, why?

10. Has the program improved your communication with your child? What about their communication with others? How? *(if they answered "communication" in Question #3 as a general change seen in their child's behaviour, please just clarify, do not need to go through it again if they already spoke to this, just confirm)*

11. Have you seen any areas of growth for yourself?

    a. Personally (i.e., their own attention/EF/self-regulation, patience, emotional control)?
    b. As a parent (daily parenting tasks)?
    c. As a coach/teacher (e.g., in how you teach/scaffold new things)?

12. Do you have any other suggestions/feedback about the Dino Island intervention?
    a. Any technical issues that you may have faced (e.g., uploading/sending tracking sheets via Teleroo)?

    b. In-person testing and NC (*if they did*) sessions?

13. Were you able to fill any the tracking forms during the intervention? *(If they did, let them know we will send them an envelope with a return label to mail them back to us. We only need the forms, they can keep the rest of the doutang materials)*

14. Did you borrow an iPad from us for the intervention? *(if so, we can either 1) pick it up, 2) you can drop it off at UVIC, or 3) we will mail you a return box for you to mail it back to us – please note down if they borrowed once, which option they chose, and let Jess & Emily know via Slack)*

15. Would you like to be contacted for future studies?

Appendix D

Weekly Tracking Form

Date:

Child Name:

Parent Name:

Start Time:

End Time:

Total Intervention Time:

Name of Game	Metacognitive/Behaviour Strategies Used During Game	Type of Strategy Use*	Level of Success w/ Strategy (0-5)	Positive Outcomes? Yes or No

*1 = Taught by Parent; 2 = Re-introduced/ direct reminder by Parent; 3 = Cued (hinted at) by Parent; 4 = Identified with guiding questions by Child; 5 = Spontaneously generated by Child

Total time of session: _____

- In general, how did the session go? Were there any positive experiences for you and/or your child? Difficult experiences? Please briefly summarize:
- Between the last session and this one, about how many times were strategies used outside of Dino Island sessions (i.e., in day-to-day life)?

Parent-prompted: _____ Spontaneous use by child: _____

Please respond to these statements by circling one of the four response categories:

1. Outside of delivering DI, how much stress have you experienced this week?

0 = none 1 = a little 2 = moderate 3 = a lot

2. How capable did you feel this week while delivering the DI intervention?

0 = not at all 1 = a little 2 = moderately 3 = very capable

3. How stressful has it been for you to deliver the DI intervention?

0 = not at all 1 = a little 2 = moderately 3 = a lot

4. How much are you enjoying delivering DI to your child?

0 = not at all 1 = a little 2 = moderately 3 = a lot

5. When a challenge arises while delivering DI do you feel you can cope with it and find solutions?

0 = not at all 1 = a little 2 = moderately 3 = a lot

Appendix E

Carer Quality of Life Questionnaire

We would like to form an impression of your caregiving situation.
Please tick a box to indicate which description best fits your caregiving situation at the moment.

Please circle one of the following: 'no', 'some' or 'a lot of'.

1. I have **(no, some, a lot of)** fulfilment from carrying out my care tasks.
2. I have **(no, some, a lot of)** relational problems with the care receiver (e.g., he/she is very demanding or he/she behaves differently; we have communication problems)
3. I have **(no, some, a lot of)** problems with my own mental health (e.g., stress, fear, gloominess, depression, concern about the future)
4. I have **(no, some, a lot of)** problems combining my care tasks with my daily activities (e.g., household activities, work, study, family, and leisure activities)
5. I have **(no, some, a lot of)** financial problems because of my care tasks.
6. I have **(no, some, a lot of)** support with carrying out my care tasks, when I need it (e.g., from family, friends, neighbours, acquaintances).
7. I have **(no, some, a lot of)** problems with my own physical health (e.g., more often sick, tiredness, physical stress)

How happy do you feel at the moment? Please place a mark on the scale below that indicates how happy you feel at the moment.