THE IMPACT OF AN OUTDOOR LOOSE PARTS INTERVENTION ON NOVA SCOTIAN PRESCHOOLERS' FUNDAMENTAL MOVEMENT SKILLS

by

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Abstract

Introduction: Providing opportunities for children to develop fundamental movement skills (FMS) in early years settings is important for encouraging overall health and wellness. Integrating loose parts (e.g. wooden planks, buckets) into outdoor spaces could provide preschoolers with an opportunity to develop FMS as they provide greater affordances for outdoor play. **Methods:** The Physical Literacy in the Early Years (PLEY) project integrated loose parts into outdoor spaces at licensed childcare centres. Child demographic, anthropometric, and FMS data were measured pre- and post-intervention. Secondary data analyses were used to determine if children exposed to the loose parts intervention had improvements in FMS. Focus group discussions regarding educator's perceptions were used to determine if educators perceived a change in the children's FMS. **Results**: Although quantitative data revealed no change in FMS between groups, analysis of qualitative data revealed three themes of educators' perceptions of the relationship between loose parts play and preschoolers' FMS.

List of Abbreviations Used

PA – Physical Activity

FMS – Fundamental Movement Skills

SB – Sedentary Behaviour

MVPA – Moderate to Vigorous Physical Activity

BMI – Body Mass Index

SES – Socioeconomic Status

RCT – Randomized Control Trial

ICC – Intraclass Correlation Coefficients

SES – Socioeconomic Status

TGMD – Test of Gross Motor Development

PGMQ - Preschooler Gross Motor Quality Scale

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Chapter 1: Introduction

The early years (birth to 6 years) are a critical time for the development of physical, cognitive, social, and emotional skills (Carson et al., 2017). Establishing physical activity (PA) behaviours early in childhood is particularly important as they are related to positive health outcomes throughout life (Malina, 2001). Evidence has shown positive relationships between PA levels and bone and skeletal health, motor skill development, fitness, psychological and socio-emotional health, cognitive development, and cardio-metabolic health (Carson et al., 2017). PA guidelines recommend that preschoolers (age 3 to 4 years) accumulate at least 180 minutes of PA per day, of which at least 60 minutes should be energetic play (Tremblay et al., 2017). Children and youth aged 5 to 17 years are recommended to accumulate at least 60 minutes of moderate-vigorous physical activity (MVPA) per day, made up of a variety of activities (Tremblay et al, 2016). Recent research on Canadian children has however found only 61.8% of 3 to 4-year olds (Chaput et al., 2017) and 36% of 5 to 17-year olds (Roberts et al., 2017) are meeting these PA recommendations. Similarly, there has been an identified a shift in children's PA from unstructured and unsupervised active outdoor play to structured and supervised indoor activities (Active Healthy Kids Canada, 2012; Tremblay et al., 2015; Brussoni, 2019a).

Understanding factors that influence preschoolers' movement behaviours is critical to determine how to best support opportunities to be physically active in the early years. These are often explored using a socio-ecological model, recognizing individual, behavioural, social, environmental, and physical environmental factors across multiple levels (intrapersonal, interpersonal, organizational, community, public policy) (Mehtala et al. 2014). Several systematic reviews have identified motor skill development (Carson et al., 2017; Timmons et al., 2012), time spent outdoors (Bingham et al., 2016; Hinkley et al., 2008), and the childcare setting (De Craemer et al., 2012) to have a beneficial impact on the PA behaviours of preschoolers.

A key factor of children's PA behaviours is their fundamental movement skills (FMS). FMS are critical to develop in the early years as they can provide the basis for lifelong movement (Barnett et al., 2008). FMS include locomotor skills, object control skills, balance, agility, and fundamental sport skills (Hulteen et al., 2017; Eisenmann, 2018). Developing FMS at a young age has also been associated with perceived sport competence (Barnett et al., 2008) and a lower body weight (Lubans et al., 2010; Graf et al., 2004), whereas low FMS have been related to low cardiorespiratory fitness and PA levels (Hardy et al., 2012). In this sense, FMS in the early years can be seen as the gateway to lifelong PA. There is considerable evidence supporting active play interventions, as a means of improving children's FMS; however, to date, the majority of FMS interventions have used structured play methods (Foulkes et al., 2017; Tortella et al., 2016; Johnstone et al., 2019). As unstructured play offers children a diverse set of benefits (Pellegrini et al., 2009), it is critical to examine how unstructured play influences children's FMS.

Play, particularly unstructured, self-directed, and/or free play, dominates early childhood, and is critical for physical, cognitive and socio-emotional development (Pellegrini et al., 2009). Play fosters imperative skills such as problem-solving, collaboration, and creativity (Yogman et al., 2018), offers opportunities for exploration and risk taking (Brussoni et al., 2012), and contributes to self-awareness, confidence, competence, independence, perseverance, resilience, and positive mental health (Brussoni et al., 2012). As children take risks in play, they master situations and challenges and develop perceptual motor skills and spatial-orientation abilities (Sandseter & Kennair, 2011). Outdoor play typically offers more affordances for diverse types of play, including risky play, and has unique contributions to children's overall growth and development (Gray et al., 2015). Although the benefits of outdoor play are known, literature has noted marked historical declines in children's outdoor play, in Canada and worldwide (Gray, 2011) leasing Canada to focus on strategies to increase children's time spent being physically active outdoors (Tremblay et al., 2015). Outdoor play has been endorsed through a position statement geared towards key influencers in the early years (e.g. parents, educators, caregivers, media, government), based upon increasing evidence that children are spending less time outdoors than previous generations (Tremblay et al., 2015). Consequently, there has been growing attention into how to best support children's active, outdoor play, with its associated risks, which (theoretically) could contribute to children's FMS.

Play with loose parts, in indoor and outdoor environments, has been gaining attention due to increased understanding of its potential to enhance multiple developmental domains in childhood. Loose parts are open-ended play materials that are moveable and non-dictated, allowing children to use them in creative ways (Nicholson, 1971). Loose parts can be manufactured (e.g. buckets, rope) or natural (tree stumps, rocks, pinecones). There are no rules with open-ended materials, creating environments with less pressure and no risk of making mistakes (Drew, 2014). Although the concept of loose parts has existed for many years (Nicholson, 1971), little evidence exists on the effectiveness of integrating them into typical early years settings (e.g. home, childcare) as a means of improving PA behaviour and FMS (Houser et al., 2016). Much of the available evidence is in school-based children and youth, where the introduction of loose parts into schools' outdoor play spaces promoted participation, social negotiation, creativity, and improved the children's access to play opportunities (Armitage et al., 2010; Bundy et al., 2009). Some scholars are now advocating for children to be exposed to outdoor play environments that have a variety of loose parts available (Flannigan & Dietze, 2017).

The childcare environment has a significant impact on the health and PA behaviours of young children (Vanderloo et al., 2014). A large number (59.9%) of Canadian preschoolers attend licensed childcare centres (Statistics Canada, 2019). More specifically, 61% of children aged 0-5 years in Nova Scotia attend childcare at a centre (Statistics Canada, 2019), spending on average 24.1 hours per week there (Bushnik, 2006). As children spend such a large portion of their waking hours in childcare, it provides an ideal setting to intervene, with the goal of enhancing children's PA, including their movement skills (Adamo et al., 2014). Several systematic reviews, including multi-systemic interventions (based on the socio-ecological model), have demonstrated that intervening in childcare can have a positive impact on children's PA (Mehtala et al., 2014) as well as children's FMS (Barnett et al., 2016). It has also been said that including educator perspectives in early childhood research, although often ignored, can add a valuable piece of information (Gehris, Gooze, & Whitaker, 2014) and potentially deepen the understanding of the phenomenon.

Given the available evidence supporting the benefits of outdoor loose parts play on children's health, including socio-emotional and cognitive benefits (Flannigan & Dietze, 2017) as well as their PA behaviours (Bundy et al., 2017), it seems critical to examine the potential of embedding loose parts into the outdoor spaces of childcare centres as a means of improving other aspects of children's health, including FMS. To the researcher's knowledge, this type of evidence does not exist, which was highlighted as a priority in a recent scoping review (Houser et al., 2016). This would fill a gap in the literature and improve researchers' understanding of how outdoor play with loose parts contributes to FMS development in the early years.

Therefore, the purpose of this thesis is to explore the impact of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS, using an exploratory, pragmatic, multi-methods research approach. In line with this multi-methods approach, there are two objectives:

1) To explore the impact of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS (assessed quantitatively);
2) To explore educators' perceptions of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS.

Chapter 2: Literature Review

2.1 Play and Functions of Play

Play is a fundamental component of child's life as it is associated with healthy learning and development (Pellegrini, 2011). The concept of play, however, is a multidimensional and fluid concept, making it hard to define (Aras, 2016). Every child experiences play differently, possibly explaining why the definition of play varies. Play ultimately provides children with the freedom of choice and personal enjoyment, and must involve the child focusing on the activity, rather than the outcome (Hughes, 2003). Johnson, Christie, and Wardle (2005) further broke down this definition in describing play as: 1) a positive effect, being fun and enjoyable, 2) the motivation for play must come from within the child, 3) process-oriented, rather than product oriented, and 4) free choice, meaning the play is self-directed, self-selected, open-ended, flexible, and voluntary. A more specific form of play is active play, which can be described as being unstructured, freely chosen fun, differing from play only insofar as it must use large muscle groups to expend energy in PA (Truelove et al., 2017).

Another way research has defined play is by separating it into four distinct categories (i.e., motor play, object play, symbolic play, and social play; Johnson, Christie, & Wardle, 2005). Johnson et al. (2005) note that these types of play can happen alone or in combination with one another. Motor play is defined as children participating in locomotor play (e.g., running, climbing) or rough-and-tumble play (e.g., play fighting, tumbling; Johnson, Christie, & Wardle, 2005). Object play involves the child participating in exploratory play (e.g., taking objects apart) or constructive play (e.g., building blocks; Johnson, Christie, & Wardle, 2005). Symbolic play involves children using their imaginations to take on new roles or to create objects or people (Johnson, Christie, & Wardle, 2005). Lastly, social play is defined as a child either participating in solitary play (i.e., alone) or cooperative play (i.e., playing directly with others; Johnson, Christie, & Wardle, 2005).

Play is a critical element of a child's life, and different forms of play yield different opportunities for a child to develop. The following section will discuss various theoretical approaches to play, including the affordance theory (Gibson, 1979), which is described in more detail due to its alignment with this thesis.

2.2 Theories of Play

Play can be described using many theoretical approaches. Classical theories aim to explain why play exists and its function, and not to define play itself (Saracho & Spodek, 1998). Classical theories such as the surplus theory and relaxation theory see play as a means of energy regulation, while the recapitulation theory and the pre-exercise theory relate play to instincts (Saracho & Spodek, 1998). There are also dynamic theories, the psychodynamic theory and the constructivist theory, both aiming to explain play (Saracho & Spodek, 1998). The affordance theory (Gibson, 1979) is another theory related to play, in that play affords children with various benefits. As the affordance theory is most relevant to this work, the following section will aim to describe the affordance theory and its relevance to children's play, and more specifically, outdoor play.

The term "affordance" is critical in Gibson's theory of ecological psychology and direct perception (Gibson, 1979). Gibson believed that we perceive objects in terms of the possibilities they offer, or afford, us. Cornwell et al. (2003) provide examples of the affordance theory, such as the shape of a coffee mug handle affords grasping and drinking from it; a sidewalk affords locomotion and a direction; and lastly, the size, shape, and placement of the OK and CANCEL buttons on your computer afford accepting or denying an option. Another pertinent example of the affordance theory is that the outdoor environment affords children with opportunities to engage in activities they may not have the opportunity to do indoors (Tonge, Jones, & Okely, 2016).

More specifically, the affordance of play is dependent on the characteristics of the play environment as well as the characteristics of the child who interprets it (Sandseter, 2011). These characteristics could include what the environment *invites* us to do, such as climb-on-able or jump-up-on features, or a child's body size, strength, skills, courage, fear, etc. (Sandseter, 2011). The outdoor environment may have specific equipment, more space, various surfaces and/or natural features that promote participation and active play (Tonge, Jones, & Okely, 2016). Previous research, such as that done by Lee (1999), found that natural playgrounds afforded children with the most challenging play, while traditional playgrounds afforded children with the least challenging play and most amount of time spent standing and wandering. In addition, Fjortoft (2000) found that when children play in nature, opposed to in a traditional preschool play area, they are afforded with opportunities for functional play, including gross motor activities and basic skills such as running, jumping, throwing, climbing, crawling, rolling, swinging, and sliding. Encouraging children to play outdoors is critical as it affords them with the opportunity to play in diverse ways and develop key movement skills.

Similarly, in a study examining the affordances for risky play in preschools, Sandseter (2009) described how specific features of the childcare environment afford children with skills and opportunities to take risks. For example, climbable features afford children the opportunity to climb and encounter risk at great heights; balance-on-able features afford children the opportunity to balance and encounter risk at great heights; graspable/detached objects afford children the opportunity to throw, strike, fence, and engage in rough-and-tumble play; and dangerous tools afford children the opportunity to whittle, saw, and axe (Sandseter, 2009). In line with previous research, Sandseter (2009) found that when comparing an ordinary preschool playground to a natural playground, children are afforded a higher degree of risk. It has been shown that the element of risk affords many benefits to children's development, leading Sandseter to highlight the importance of access to natural play spaces.

The affordance theory shows how the environment, and the objects which children play with within that environment, will afford them differentiated play experiences. The importance of these play experiences, and play in general, will be discussed in the following section.

2.3 Importance of Play in Children's Health and Development

Play, particularly unstructured, self-directed, and/or free play, dominates early childhood, and is critical for physical, cognitive and socio-emotional development (Pellegrini et al., 2009). More specifically, active outdoor play, when compared to indoor play, offers more affordances for diverse types of play, contributing to children's overall growth and development (Gray et al., 2015). It is said that play is critical for various developmental skills, which children cannot be taught by their teachers or educators (Aras, 2016). The following section will outline the physical, cognitive and socio-emotional benefits of outdoor play to children's health and development.

2.3.1 Physical benefits of outdoor play. Over the last several decades, there has been a steady increase in literature documenting the physical benefits of outdoor play. The influence of outdoor play on children's PA is one of the most commonly cited physical benefits. A systematic review by Gray and colleagues (2015) examined eight studies focusing on the relationship between the time children spent outdoors and their PA behaviour. All eight studies reported that PA was higher when children were outside compared to when they were indoors. This study also found other positive benefits of outdoor time, such as less sedentary time, and better cardiorespiratory fitness. This led researchers to conclude that increasing unstructured outdoor play in school and childcare settings is critical for promoting a healthy, active life (Gray et al., 2015).

Regular PA in early childhood is critical for optimal growth and development. Several systematic reviews have demonstrated positive relationships between PA levels and adiposity, bone and skeletal health, motor skill development, fitness, psychological and socio-emotional health, cognitive development, and cardio-metabolic health in early childhood (Carson et al., 2017; Timmons et al., 2012). The benefits associated with PA have been well researched, with literature dating back several decades (Morris & Crawford, 1958). Conversely, high levels of physical inactivity and sedentary behaviour (SB) are associated with unfavourable health indicators such as increased adiposity (LeBlanc et al., 2012) and blood pressure (Vale et al., 2015), and decreased motor skills (Iivonen et al., 2013), cardiorespiratory fitness (Burgi et al., 2011) and psychosocial and cognitive development (LeBlanc et al., 2012). SB, specifically in childhood, also creates a pathway for SB later in life (Biddle et al., 2010). Due to the many negative health risks associated with leading a more sedentary lifestyle, 24-hour movement guidelines were created, providing activity, sleep and SB recommendations for children of all ages (Tremblay et al., 2016; Tremblay et al., 2017). Most recommendations are divided into age categories, however replacing sedentary screen time with energetic play, and trading indoor play for outdoor play, are recommended for children of all ages (Tremblay et al., 2017). This final recommendation is critical, as it is known that children participate in more vigorous, large motor PA when outdoors (Green, Riley, & Hargrove, 2012). Consequently, outdoor active play is an effective strategy for reducing children's sedentary time and increasing time spent moving.

Several interventions (Adamo et al., 2014; Jones et al., 2011) have determined that active play can positively influence another aspect of children's physical development, FMS. Jones et al. (2011) investigated the feasibility, acceptability and efficacy of a 20-week PA intervention in preschools with the goal of increasing children's movement skill development and PA (n= 97). This intervention was designed to be used indoors and outdoors, and involved a professional development workshop for preschool staff, and structured and unstructured activities for the children. Structured activities (3 days/week) involved the children practicing a taught skill through fun activities and games, while the unstructured activities allowed the children to practice their skills. Skills included running, catching, jumping, kicking, and hopping. Results showed an improvement in children's movement skill proficiency, movement skill development, and PA levels from pre- to post-intervention (Jones et al., 2011).

Another important benefit of active outdoor play is its ability to encourage risky play, which has physical and other developmental benefits for a child. Risky play is described as thrilling and exciting play, with the possibility of physical injury (Sandseter, 2007). Risky play can be categorized as activities that involve great heights, high speed, dangerous tools, dangerous elements, rough and tumble play, or disappearing/getting lost (Brussoni et al., 2015). It is an important aspect in childhood, as it encourages development, learning, and mental and physical health (Brussoni et al., 2015). There has been increased attention on children's developmental need for risky outdoor play, as the lack of it has potential adverse consequences (Little & Eager, 2010). A previous review by Brussoni et al. (2015) determined that risky outdoor play has many positive effects on health. Seven of eight studies examining the effects of play where children can disappear/get lost saw an increase in habitual and acute PA, and improvement in social health. Overall, the review found risky play increased PA and decreased SB. The environment in which the risky play was occurring also increased play time, social interaction, creativity, and resilience (Brussoni et al., 2015).

In addition to outdoor play being positively associated with PA, FMS, and risky play, an article on the benefits of outdoor play on children's development written by Kemple and colleagues (2016) states that an insufficient amount of outdoor play is associated with vision problems (e.g. myopia – nearsightedness; Rose et al., 2008), asthma (Lovasi, Quinn, Nekerman, Perzanowski, & Rundle, 2008), and vitamin D deficiency (leading to a risk for bone problems, cardiovascular disease, and diabetes; Misra, Pacaud, Petryk, Collett-Solberg, & Kappy, 2008).

It is clear that outdoor play in the early years (birth to 6 years) influences many components of children's physical development (PA, FMS, risk taking and others). All of these components are critical for children to develop optimally and are essential for children to live and maintain a healthy lifestyle. However, the benefits of outdoor play do not end with children’s physical development. There are many remarkable cognitive benefits that children achieve through outdoor play, which will be discussed below.

2.3.2 Cognitive benefits of outdoor play. Outdoor play also has a significant impact on children’s cognitive development. It fosters imperative cognitive skills such as problem solving, collaboration and creativity (Yogman et al., 2018). This is often shown when children play make believe, a form of free play that allows children to face conflicts, inhibit impulsive behaviours, express their emotions, follow social rules, and support the emotional well-being of others (Pyle, 2018). Yogman and colleagues (2018) believe that play is connected to both brain structure and function at all molecular, cellular, and behavioural levels, indicating that play is not frivolous, but is in fact the brain growing and developing.

Interestingly, Pellegrini and Holmes (2006) have found that countries that offer more recess to young children have greater academic success than those countries that provide less recess time. This evidence seems to support the link between outdoor play and cognitive health. Others have shown that when children participate in active play at recess, their self-regulation improves, leading to higher math and reading skills (Becker, McClellan, Loprinzi, & Trost, 2014). Previous research has also shown that recess significantly lowers levels of inappropriate in-class behaviour amongst children; conversely, when children do not participate in recess, they have higher instances of negative in-class behaviour (Ridgway, Northup, Pellegrin, LaRue, & Hightshoe, 2003). These links between recess time and cognitive health have been documented in school-aged children. For the purpose of this thesis, it is important to examine the cognitive benefits outdoor play has on children in the early years (birth to 6 years).

Similar to schoolteachers, early childhood educators also recognize the cognitive benefits of free play. They believe that children listen and are more focused after being provided the opportunity to have free play (Aras, 2016). This was again shown in a recent study examining the effects time spent outdoors during preschool hours has on children's cognitive and behavioural development (Ulset et al., 2017). Researchers looked at the amount of time preschool-aged children (mean age = 4.5 years) were spending outdoors and found that outdoor time at preschool may support the development of children's attention skills and assist in the protection against inattention hyperactivity symptoms (Ulset et al., 2017). Research has shown that active, outdoor play can be an effective tool in assisting in the development of children's cognitive skills.

Both the physical and cognitive benefits of outdoor play have been made clear in the previous two sections of this literature review. However, children also experience socio-emotional benefits from outdoor free play, which will be discussed in the following section.

2.3.3 Socio-emotional benefits of outdoor play. As discussed earlier, free-play also offers opportunities for exploration and risk taking (Brussoni et al., 2012), and contributes to self-awareness, confidence, independence, perseverance, resilience, and positive mental health (Brussoni et al., 2012), all of which are socio-emotional skills that are critical for children to develop optimally at a young age. Additionally, it has been said that a children's connection to their community and their social relations are negatively impacted as a result of various barriers to outdoor play (Casey, 2007). This again highlights the importance of encouraging children to participate in outdoor play. It helps children develop friendships, in turn fostering of a sense of social identity and well-being

(Gibson, Cronell, & Gill, 2017). Some researchers have developed animal-based studies to explore the benefits play has on socio-emotional development. Here, studies show that high amounts of play are associated with lower levels of stress (Wang & Aamodt, 2011), while low amounts of play cause the animal to develop emotional regulation deficits and failures in social interactions (Veiga, Neto, & Rieffe, 2016). In order to best support the proper development of children's socio-emotional skills, it is critical to encourage children to participate in outdoor free play.

The previous research has made it evident to researchers that children benefit in all domains from active, outdoor play. Educators, who may not be as familiar with the recent literature, are also seeing the many benefits of free play. In a study exploring early childhood educators' perceptions of free play, an educator was quoted as saying that:

> While playing children use their whole developmental areas. In terms of cognitive area they think, do decision-making, use problem solving strategies; in terms of psychomotor area they use their bodies, they cut, they draw; in terms of social area they communicate, learn to take their turn, listen, decide how to behave; in terms of language area they communicate, experience how to use the language effectively… (Aras, 2016, p. 1178).

This further describes the potential outdoor play has to benefit children in all developmental domains. It is critical to give children the opportunity to play outdoors, ultimately giving them the opportunity to develop many physical, cognitive and socio-emotional skills that are essential for optimal development and overall health and well-being.

Evidence shows the importance of children in the early years being encouraged to engage in free, unstructured, outdoor play, offering them physical, cognitive and socio-emotional benefits. In spite of this, opportunities for children to participate in free, unstructured, outdoor risky play have been declining over time (Brussoni et al., 2015). The following section will provide an understanding of historical changes in children's outdoor play, and of some of the consequences of these changes to children's health and development.

2.4 Changes in Children's Outdoor Play Over Time

Existing literature on outdoor play has noted marked historical declines in children's outdoor play, in Canada and worldwide (Gray, 2011). Several reports have identified a shift in children's PA from unstructured and unsupervised active outdoor play to structured and supervised indoor activities (Active Healthy Kids Canada, 2012; Tremblay et al., 2015; Encyclopedia on Early Childhood Development, 2018). Evidence shows that today's children are spending much less time playing outdoors than their parents did (Tremblay et al., 2015). In fact, it is believed that children are spending up to 50% less time engaging in outdoor play than children in the 1970s (Chiao et al., 2016). In the 2018 edition of the ParticpACTION Report Card, it was found that 5 to 6 year old children in Canada who are cared for at home or are in childcare spend an average of 1.8 and 2.1 hours per day playing outside, respectively (2014–15 CHMS, Statistics Canada; custom analysis; ParticipACTION, 2018). It was also found that only 37% of 5- to 11-year old Canadians in school are spending more than two hours playing outside (outside of school) (Freeman, King, & Pickett, 2016). A review by Gray (2011) discusses how this decrease in play is not recent, and rather has been documented for many decades. A study asking mothers to compare their childhood outdoor play time to their children's current outdoor play time found that 70% of mothers played outside daily; 56% said that when they did play outside it was for periods of three hours or more. When asked the same questions about their children, it was found that just 31% of children play outside daily and 22% play outside for three hours or more (Clements, 2004). This clearly shows the stark historical decrease in time children are spending playing outside.

As previously discussed, play is recognized as one of the most natural ways children can learn and explore. However, children are experiencing fewer opportunities to play, both at home and school. Due to an increased emphasis on school readiness, many early years programs are focusing less on free and active play, and more on structured activities (Pyle, 2018). It is therefore critical to encourage parents and educators to allow children to play freely and choose their own actions, providing limited guidance in order to ensure children experience the associated developmental benefits of unstructured, self-directed free play (Pyle, 2018). In Nova Scotia specifically, the updated Early Learning Curriculum Framework ensures there is a focus on play-based learning for children's optimal development, as opposed to school readiness (Nova Scotia Department of Education and Early Childhood Development, 2018). This encourages a joyful and engaging approach to learning (Nova Scotia Department of Education and Early Childhood Development, 2018). Continuing, this framework views children's learning as dynamic, complex and holistic (Nova Scotia Department of Education and Early Childhood Development, 2018). By focusing on children's holistic development, rather than individual components of development, educators are recognizing the connection between children's mind, body, and spirit, and are able to focus on ensuring the child develops in a happy, confident and healthy way (Nova Scotia Department of Education and Early Childhood Development, 2018). By taking a holistic approach to children's development the Nova Scotia Early Learning Curriculum Framework promotes play-based learning (Nova Scotia Department of Education and Early Childhood Development, 2018), one way to create more opportunities for children to play.

Similarly to the decrease in outdoor play, and despite the benefits of risky play, opportunities for children to participate in risky play have been declining (Brussoni et al., 2015). This is potentially due to societal and parental attitudes that have encouraged supervision and diminished independence (Jago et al., 2009). Furthermore, it has been thought that children's access to outdoor spaces may be limited by beliefs that children lack the competence to engage with the world alone, and are in danger when outside (Horton & Kraftl, 2018). Children are limited by the inability to walk or cycle to a friend's house or the local park without parental supervision (Veitch et al., 2006). This way of thinking is making children dependent on their parental figures to have the time and motivation to take them to play spaces (Veitch et al., 2006). Today's society of busy parents, in combination with the belief that children are dependent on their parental figures to take them to play, it is becoming increasingly difficult for children to have the opportunity to engage in unstructured, outdoor play.

Despite research suggesting that increased outdoor time could be an effective strategy for decreasing SB and increasing PA and fitness levels in children, there is still a decline in outdoor play time (Barber et al., 2013). The increase in time spent indoors and decrease in time spent outdoors is hindering children's physical development, shown by the upward trend of obesity and inactivity in children (Tremblay et al., 2015). It is suggested that the reduction in outdoor active play is also harming children's cognitive and socio-emotional development by resulting in a decline in creative thinking, in the ability to cooperate with others and an increase in mental disorders (Brussoni, 2019a). Consequently, there is a vested and growing interest in exploring opportunities to increase children's time spent outdoors. The following section will discuss the emergence of numerous outdoor play strategies in Canada that have the goal of changing children's structured, supervised, indoor time into unstructured, active outdoor play time.

2.5 Growing Endorsement of Outdoor Play for Children's Health and Wellness

Growing research showcasing the wide benefits of outdoor play (Brussoni et al., 2015; Gray et al. 2015) has led the Canadian Government and policy makers to place a renewed emphasis on strategies that increase children's time spent being physically active outdoors (Tremblay et al., 2015). One strategy developed by Tremblay et al. (2015), titled the Position Statement on Active, Outdoor Play, outlines key outdoor play influencers (e.g. parents, educators, caregivers, media, government). It states, "Access to active play in nature and outdoors- with its risks- is essential for healthy child development" (Tremblay et al., 2015, p. 1). Tremblay and colleagues show evidence to combat major misconceptions of risky play, sharing how children who participate in active outdoor play in natural environments (with risks) develop critical life skills such as resilience and self-regulation, and learn to deal with stress (Tremblay et al., 2015).

In 2013, the Lawson Foundation developed the "Outdoor Play Strategy" with the goal of shifting children's behaviours towards healthier lifestyles (Lawson Foundation, 2019). This strategy is responsible for funding the Position Statement on Active, Outdoor Play and works with organizations focused on children's outdoor play and its connection to PA, recreation, injury prevention, public health, early childhood education, environment, education, and mental health (Lawson Foundation, 2019). The goal of this strategy is to support projects that will produce tools, resources, and training to support unstructured, active, outdoor play (Lawson Foundation, 2019).

There are also many global champions supporting outdoor play, such as those in the Play, Learn, and Teach Outdoors Network (PLaTO-Net). This network is part of Outdoor Play Canada, whose goal it is to create a global network of leaders dedicated to supporting outdoor play, risky play, and outdoor learning and teaching through play (Outdoor Play Canada, 2018). Outdoor Play Canada is also partnered with many organizations interested in increasing every child's opportunity to play such as ParticipACTION, the Child and Nature Alliance of Canada, and the Healthy Active Living and Obesity Research Group (Outdoor Play Canada, 2018). The value of outdoor play is being widely promoted to the general public through well-known organizations and by researchers. Dr. Mariana Brussoni, a Canadian researcher focused on the importance of outdoor risky play for children's healthy development, recently published a piece in The Conversation Canada titled "From obesity to allergies, outdoor play is the best medicine for children" highlighting the magic of outdoor play and how best to support it (Brussoni, 2019b). When research is shared through outlets that are less academic, such as in The Conversation Canada, it reaches a more diverse audience, possibly including parents, teachers, and educators. It is critical that researchers share their knowledge on the benefits of active outdoor play using networks that will reach people on the ground level, people who may not read academic articles, such as parents and educators.

Although many Canadian organizations and researchers are promoting the importance of outdoor play to children's development and overall health and wellness, there are still aspects of children's development that could be supported by outdoor play but have not been investigated. One such aspect, that has not been thoroughly explored, is the influence of outdoor play on children's FMS development. The following section will define FMS and provide an overview of the importance of motor skill development in the early years. The literature review will then lead to the relationship between PA (including outdoor play) and FMS development.

2.6 The Importance of Fundamental Movement Skill Development During Early Childhood

FMS consist of locomotor activities (e.g. running, hopping, and jumping), object control skills (e.g. throwing, catching, kicking and striking), balance, agility, and fundamental sport skills (Hulteen et al, 2017). The following image (Figure 1) provides a classification of FMS, categorizing them into locomotor skills, stability skills, and manipulative skills (Eisenmann, 2018).

Locomotor Skills	Stability Skills	Manipulative Skills
Walking	Balancing	Throwing
Running	Landing	Catching
Hopping	Turning	Striking
Skipping	Twisting	Kicking
Bounding	Bending	Dribbling
Leaping	Stretching	Bouncing
Jumping	Extending	Pushing
Rolling	Flexing	Pulling
Galloping	Hanging	Carrying
Sliding	Bracing	Trapping
Dodging	Rotation	Collecting

Figure 1. Classification of fundamental movement skills (Eisenmann, 2018).

Active for Life (2019) highlights the importance of children developing FMS and other movements at various stages of life. Infants (age 0-2 years) should be learning basic skills such as grasping, sitting, and crawling, while preschoolers (age 4-6 years) should be mastering more complex skills such as running, throwing, catching, and skipping (Active for Life, 2019). FMS should be built upon as children age, progressing into more complex skills and assisting them in a range of physical activities. The follow image (Figure 2) outlines the age range for when children typically develop specific FMS (Early Years Physical Literacy Research Team, 2017), highlighting the preschool age (3 to 5 years), as a critical developmental stage for FMS and overall physical competence. Sport for Life emphasizes the importance of developing physical literacy (an individual's motivation, confidence, physical competence, knowledge and understanding to be physically active for life; Tremblay et al., 2018) in the early years (Sport for Life, 2019).

Developing both basic and sophisticated movement patterns and learning to regulate their behaviour is critical for young children in order to be successful in physical activity (Sport for Life, 2019).

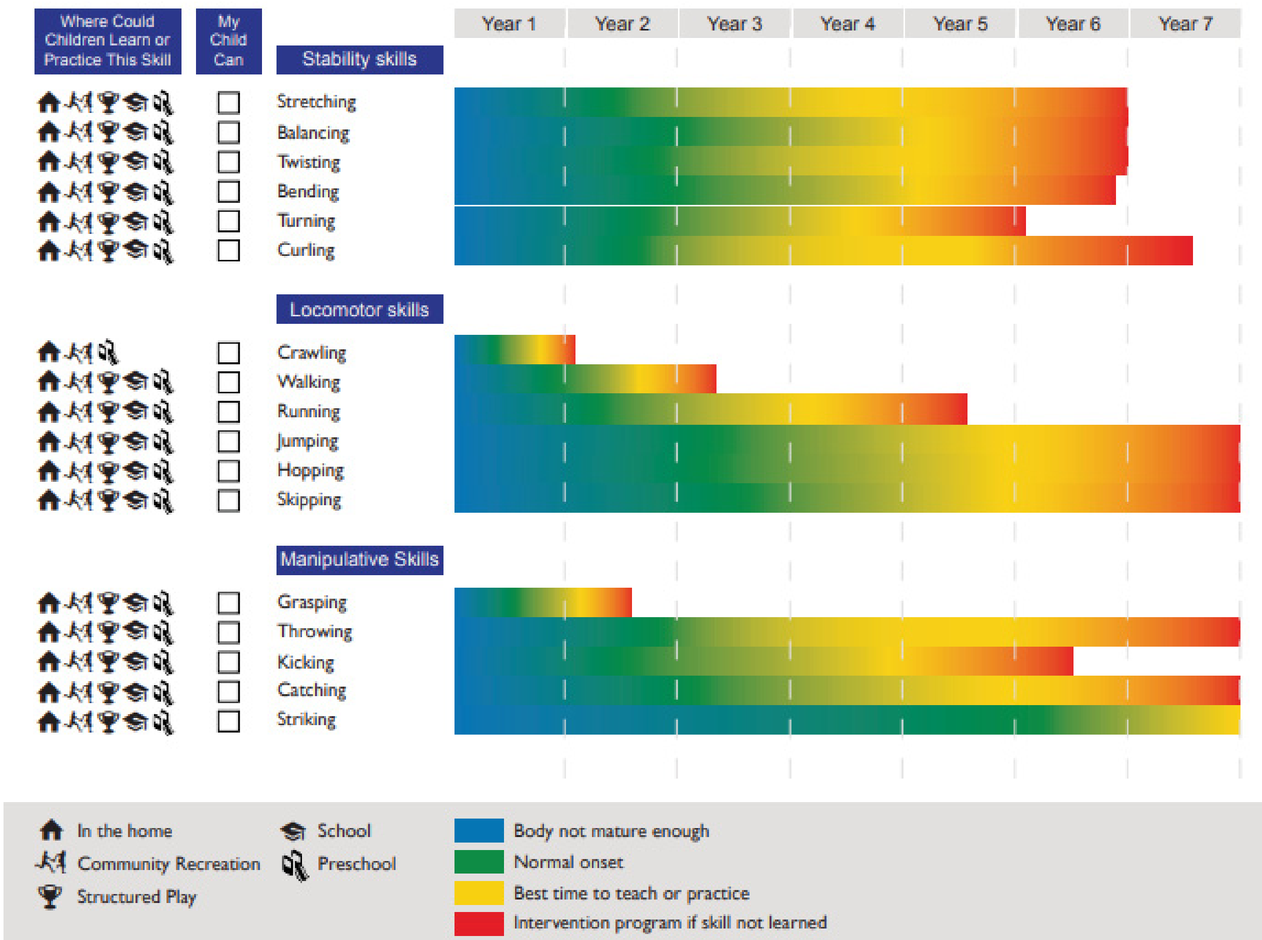

Figure 2. Fundamental movement skill chart (Early Years Physical Literacy Research Team, 2017).

The development of key FMS in the early years provides the basis for lifelong movement (Barnett et al., 2008) and provides the building blocks for the sport-specific movement skills required to participate in various physical activities throughout life (Cohen et al., 2014). Children experience rapid brain growth and neuromuscular maturation in early life (Foulkes et al., 2017), making this period ideal for developing key locomotor, manipulative and other motor movements, forming the basis for other more complex movements (Burton & Miller, 1998). The early years also represent a time where lifestyle behaviours are established, which then tend to track throughout the lifespan (Biddle et al., 2010). If children do not become competent and confident movers in early life, they may start to disengage from PA in later years (Stodden & Goodway, 2007).

Developing FMS at a young age is associated with perceived sport competence (Barnett et al., 2008) and a lower body weight (Lubans et al., 2010; Graf et al., 2004), whereas low levels of FMS have been related to low cardiorespiratory fitness and PA levels (Hardy et al., 2012). Consequently, it is clear that supporting FMS in the early years should be a priority. The following section will look more closely at PA (including outdoor play) as a correlate of children's FMS.

2.7 Relationship Between Physical Activity (Including Outdoor Play) and Fundamental Movement Skill Development

There is considerable evidence to support the health benefits associated with FMS competency in childhood, including greater PA (Lubans et al., 2010). Moreover, there is increasing evidence supporting the development of FMS in the early years and the tracking of PA throughout life (Stodden, Goodway, & Langendorfer, 2008). This section will first present evidence from studies showing a relationship between FMS and PA in early life, including evidence from interventions focused on improving FMS and PA. These insights will facilitate a discussion of studies illustrating how FMS competency in early life can lead to the establishment of healthy PA patterns throughout life.

A review by Tonge, Jones and Okely (2016) examined correlates of children's objectively measured PA. Among other correlates of PA such as the child's sex and age, their gross motor coordination was one of the most commonly cited correlates (Tonge, Jones, & Okely, 2016). Results of the review showed that 75% (3 out of 4) of studies found a positive association between children's FMS and PA, while only one found no association (Tonge, Jones, & Okely, 2016).

Additionally, a review by Engel and colleagues (2018) explored previous literature on the impact of FMS interventions on children's PA and FMS. Researchers reviewed FMS/PA interventions that measured both children's PA (objectively or subjectively measured) levels and FMS (objectively measured) in healthy children between the ages of 3 and 12 years (Engel et al., 2018). Fourteen studies were included in the final analysis, nine of which assessed preschool-aged children. Of the nine studies that assessed preschool-aged children, it was found that participating in a FMS intervention led children to have a small, significant improvement in total FMS. There were four studies that evaluated the effect of a FMS intervention on children's locomotor skills and object control skills separately, both finding small significant improvements (Engel et al., 2018). This review found only one study that evaluated balance and did not find the FMS intervention significantly improved it (Engel et al., 2018). In terms of PA levels, the preschool-aged children had a small, significant increase in total PA as well as MVPA, and a significant decrease in SB (Engel et al., 2018).

Other studies have found that more physically skillful children may engage in higher levels of PA, specifically in activities that require high levels of physical fitness (Stodden, Landendorferm, & Roberton, 2009), resulting in higher levels of cardiorespiratory fitness and improvements in body composition (American College of Sports Medicine, 1988). Conversely, previous research has shown that children who have low levels of self-efficacy for PA also have poorer gross motor skills, both tracking into adolescence and adulthood (Stodden, Goodway, & Langendorfer, 2008).

Adamo and colleagues (2014) examined the impact of a PA intervention titled: the Activity Begins in Childhood (ABC) intervention, on children's PA behaviours and FMS. A total of 6 licensed childcare centres in Ottawa, ON were randomly allocated to either the intervention (n=3) or control (n=3) group. Participants were aged 3 to 5 years (intervention: n=40; control: n=43). The ABC intervention taught early childhood educators how to promote physically active play throughout the day, providing centres with a PA kit including basic equipment and weekly schedules that suggested a set of activities (50% focused on locomotor activities, 33% focused on gross motor activities, and 17% focused on creative play). FMS were measured at baseline and 6-months post-intervention using the second edition of the Test of Gross Motor Development (TGMD-2) (Ulrich, 2000). Children exposed to the intervention had significantly greater improvements in their locomotor skills than children in the control group, leading researchers to conclude that a childcare provider-led PA-based intervention is an effective way to improve children's FMS (Adamo et al., 2014). A follow-up of the ABC intervention was completed by Wasenius and colleagues (2018) which recruited 215 preschoolers (age 3 to 5 years) from 18 licensed childcare centres in the Ottawa, ON area. The intervention spanned six months and participants were randomly assigned to a control group, childcare intervention group, or childcare intervention group with a parental component. Similar to the previous study, results showed that children exposed to the intervention had a significantly greater improvement in locomotor skills compared to children in the control group (Wasenius et al., 2018), adding to the existing literature highlighting the potential for preschool-based interventions to improve children's FMS.

A study in the UK also demonstrated the impact of a PA intervention on children's FMS. Foweather and colleagues (2015) developed a six-week educational program targeting preschooler's PA levels, FMS, confidence and fitness. The TGMD-2 (Ulrich, 2000) was used to assess children's FMS and ActiGraph accelerometers (ActiGraph wGT3X+; ActiGraph, LLC, Pensacola, FL, USA) were used to assess children's PA. A total of 99 3- to 5-year olds were included in the analysis, with findings revealing that object control skills were positively associated with light PA and locomotor skills were positively associated with MVPA (Foweather et al., 2015). These findings led authors to suggest that the development of physical competence of locomotor and object control skills in early life may be an important element in promoting preschool-aged children's PA (Foweather et al., 2015).

Establishing PA behaviours in the early years is critical for continuing to have healthy PA behaviours throughout life. As it is known that FMS and PA are highly connected, it is also important to explore how children acquire FMS. Without this knowledge, it is difficult to create effective interventions that influence both children's PA and their FMS.

2.8 Skill Acquisition

Skill acquisition theory recognizes skill progression from the point of initial learning to advanced proficiency (DeKeyser, 2007). For children, the process of learning movement skills occurs through active play and structured activities (Hardy et al., 2010).

How children acquire FMS is influenced by biological, psychological, social, motivational, and cognitive factors (Hardy et al., 2010). In order for children to acquire movement skills, they not only need to be taught the skills, but also need to be afforded with opportunities to practice the skills (Hardy et al., 2012). Previous research indicated that by the age of six years, children are developmentally capable of mastering most FMS (Gallahue et al., 2011). It, however, is believed that children require between 240 and 600 minutes of instruction time in order to master a FMS (Victoria Department of Education, 1996), and therefore if children are not provided with this time to learn, they will not be able to master the skills they are expected to know. Children develop movement skills in a sequential manner, meaning children build upon previously learned movements in order to acquire more advanced skills (Victoria Department of Education, 1996). In order for children to develop these more complex skills (e.g. overhand throw, forehand strike, two-hand side-arm strike, etc.) they must first master the introductory movement skills (e.g. catch, kick, run, vertical jump, etc.) they are first taught (Department of Education, 1996).

The Victoria (Australia) Department of Education (1996)'s Fundamental Motor Skill Manual for Classroom Teachers reviews how children acquire FMS and also highlights the importance of assessing children's FMS. By assessing children's FMS, one can determine the child's skill progression, helping to group them according to their movement skills and differentiate between children who are developing normally and those who are lacking skills (Victoria Department of Education, 1996). Measuring children's FMS is additionally important, as research shows that more skillful children are also more physically active, and that FMS may be a key component in encouraging children to be more active and maintain lifelong PA behaviours. When measuring children's FMS, there are a number of factors that should be considered when choosing the most appropriate tool for the population being evaluated. Several FMS assessment tools that are suitable for various age groups and populations will be discussed in detail below.

2.9 Fundamental Movement Skill Assessment Tools

There are a variety of valid and reliable tools for measuring FMS in the early years (Cools et al., 2009). The most appropriate tool depends on a number of factors, including how recently the tool has been updated, the population age, the location, and any developmental disorders (Cools et al., 2009). Each tool has the goal of assessing a specific target group and can be norm- or criterion- referenced. A norm-referenced test compares the scores of the child being assessed to the scores of a group of peers expected to have similar experiences (e.g. a child compared to their class) (Bond, 1996). A criterion- referenced test compares the child's score to pre-determined criteria (e.g. a child compared to a pre-determined performance level). While norm-referenced tests aim to rank a child, criterion-referenced tests aim to determine what the child can do, not compare them to others (Bond, 1996). Another form of movement assessment is through pupil monitoring, typically used by teachers, measuring where a child is developmentally according to the curricular developmental goals (Cools et al., 2010).

A 2009 review written by Cools and colleagues examines seven movement skills assessment tools for preschool children. These tests include the Motoriktest Für Vier-bis Sechjährige Kinder (MOT 4-6; Zimmer & Volkamer, 1987), Movement Assessment Battery for children (Movement-ABC; Henderson, Sugden, & Barnett, 2007), Peabody

Development Scales (PDMS; Folio & Fewell, 2000), Körperkoordinationstest fur Kinder (KTK; Kiphard & Schilling, 2007), Test of Gross Motor Development (TGMD; Ulrich, 2000), the Masstrichtse Motoriek Test (MMT; Vles et al., 2004), and the Bruininks-Oseretsky test of Motor Proficiency (BOTMP; Bruininks & Bruininks, 2005; Cools et al., 2009). This review lists a number of strengths and weaknesses for each test. For example: while the MOT 4-6 (German origin) is age-appropriate for preschool-aged children, the test is outdated (i.e. normative data from 1987), and there is little information on the test and results in international literature. The Movement ABC (Dutch origin) has international normative data available, however was not designed specifically for young children. The PDMS 2 (USA origin) includes qualitative aspects of movement behaviours and the subsets (reflexes, stationary performances, locomotion, object manipulation, grasping, and visual-motor integration) can be assessed separately; it however was designed to detect deficits and motor impairment. The KTK (German origin) assessment is a quick screen of stability, although the normative data is older (1974). The TGMD-2 (Ulrich, 2000) (USA origin) is age-appropriate for preschoolers and includes qualitative aspects of movement behaviours, however it does not evaluate fine motor skills or specifically assess stability (e.g. balance). The MMT (Dutch origin) includes both qualitative and quantitative assessments items, although it is was designed specifically for the detection of Attention deficit hyperactivity disorder. Lastly, the BOT-2 (USA origin) is a very detailed, age-appropriate instrument, however it has an emphasis on detection of deficits (Cools et al., 2009).

It is clear there are a number of FMS assessments for preschool-aged children, however they all have their own strengths and weaknesses. Many of these assessment tools are designed for the detection of irregular motor behaviours and do not have international normative data, limiting where the assessments can be used. The sample of children included in this thesis is a group of typically developing Nova Scotian preschoolers aged 3 to 5 years. This criterion eliminates the possibility of using the MOT 4-6, M-ABC, PDMS-2, KTK, MMT, and BOT-2 assessment tools. Although the review by Cools et al., (2009) does not review all FMS assessment tools, it does speak to why the TGMD tool is an appropriate assessment for the current study's population, which will be described in more detail below. However, one of the major limitations of the TGMD tool, as described previously, is that is does not evaluate fine motor skills or assess stability (e.g. balance) specifically. Balance is a critical aspect of FMS, encouraging both final and gross motor skills (Maxwell, Mitchell, & Evans, 2008), and therefore a tool that assesses balance specifically would provide important information on this fundamental physical skill.

The following sections will provide a more detailed overview of the two FMS assessments used in the present thesis, the TGMD-3 (third edition of the TGMD) (Ulrich, 2013a) and the Preschool Gross Motor Quality Scale (PGMQ) (Sun et al., 2010) balance subscale assessments, including the strengths and limitations of these tools, citing evidence of their use in preschool-aged populations.

2.9.1 Total Gross Motor Development (TGMD). The TGMD-3, developed in 2015, is the third version of the TGMD assessment tool developed by Ulrich (2013a). The TGMD evaluates the gross motor skills of children aged 3-10 years based on a qualitative performance criterion measure for each skill, rather than the outcome (Ulrich, 2000). This means that each skill is based on specific performance criterions (i.e., 3 to 5 performance criteria for each skill), rather than if the skill was performed correctly or not. Each criterion is assessed individually and represents the process necessary to complete each skill correctly. This test however only measures locomotor skills, object control skills and total FMS, leaving out a critical component of FMS: balance. Ulrich made changes to the TGMD-2 (Ulrich, 2000) to create the TGMD-3 based on feedback (Ulrich, 2013a). The major changes eliminated the leap and underhand roll skills and added the one hand side strike, underhand toss and the skip, changing the total number of skills from twelve to thirteen. Ulrich also modified multiple skill performance criteria in order to make them more valid and easier to score. The last modification from the TGMD-2 (Ulrich, 2000) was creating an electronic application in order to help professionally collect and manage the data (Ulrich, 2013a). The current TGMD-3 (Ulrich, 2013a) evaluates the total gross motor (total FMS) score, the sum of all thirteen skills, including locomotor (run, hop, gallop, skip, horizontal jump and slide) and object control skills (one-hand strike, two-hand strike, dribble, catch, kick, underhand throw, overhand throw) (Ulrich, 2013a). There is a set of performance criterion for each skill. For example: when assessing the child's ability to run, the administrator is not judging whether or not the child can run correctly, but instead whether: 1. Their arms move in opposition to legs with elbows bent; 2. There is a brief period where both feet are off the surface; 3. There is narrow foot placement landing on their heel or toes (not flat-footed); and 4. Their non-support leg is bent about 90 degrees so their foot is close to their buttocks.

The first edition of the TGMD was published in 1985, and has since had two new versions (University of Michigan, n.d.). The TGMD-2 (Ulrich, 2000) has been used in a number of studies assessing preschoolers' FMS (Adamo et al., 2014; Barnett, Salmon, &

Hesketh, 2017; Bélanger et al., 2016; Foulkes et al., 2017; Foweather et al., 2015; Wasenius et al., 2018; Yang, Lin, & Tsai, 2015), four of which are Canadian studies. The TGMD-3 (Ulrich, 2013a) has been used a number of times to evaluate school-aged children's FMS (Brusseau et al., 2018; Burns, Brusseau, & Hannon, 2017; Burns, Fu, Hannon, & Brusseau, 2017), yet only one study has used it to evaluate preschoolers' FMS (Mohammandi et al., 2017). Mohammandi and colleagues (2017) used the TGMD-3 (Ulrich, 2013a) to determine the motor development status of 3 to 10-year old children in Ahvaz, Iran (n=1600). Results showed that boys were more proficient in running, horizontal jumping, sliding, and in all object control skills, while girls were more proficient in galloping and skipping. Researchers also found that children's proficiency improved with age (Mohammandi et al., 2017). Consequently, age and sex may be important influencers of young children's FMS.

The TGMD-3 (Ulrich, 2013a) has been shown to have excellent intra-rater reliability for total FMS score (ICC= 0.99), as well as locomotor score (ICC= 0.99) and object control skills (ICC= 0.98). It also has excellent inter-rater reliability for total FMS (ICC= 0.97), locomotor skills (ICC= 0.96), and object control skills (ICC= 0.97) (Maeng & Webster, 2016) when assessing preschoolers' FMS.

As FMS are classified as locomotion, manipulation, and balance skills, it is a major limitation that the TGMD-3 (Ulrich, 2013a) only assesses locomotion and object manipulation. Balance, the body maintaining equilibrium while being disturbed by an external force, serves as a foundation for both location and object control skills (Gallahue & Donnelly, 2003). In order to account for children's balance skills, the Preschool Gross

Motor Quality Scale (PGMQ) balance subscale (Sun et al., 2010), which will be further discussed below, was also included in this study.

2.9.2 Preschool Gross Motor Quality Scale (PGMQ). The PGMQ scale was developed specifically for preschool-aged children (age 3-6 years) in 2010. This assessment was originally created to fill the gap of no normative FMS data for Taiwanese preschoolers (Sun et al., 2010). Before developing this assessment, the authors examined pre-existing FMS assessments and found that most tests evaluate quantitative motor skills, instead of motor quality (Sun et al., 2010). Sun and colleagues (2010) believed it was important to evaluate not only what children do, but also how they do it. Of the existing assessments at the time that looked at FMS data both quantitatively and qualitatively, the authors found the Gross Motor Performance Measure was only suitable for children with cerebral palsy and the TGMD was missing the key element of stability (Sun et al., 2010). The PGMQ assesses locomotion (down stairs, running, horizontal jumping, hopping, sliding, galloping, leaping, and jumping from side-to-side), object control (overhand throwing, catching, kicking, ball bouncing, and striking a stationary ball), and balance (single leg standing, tandem standing, walking line forward, and walking line backward) (Sun et al., 2010). The PGMQ assessment tool has shown to correlate well with the TGMD-2 (Ulrich, 2000), with total FMS scores ($r= 0.86$, $p< 0.001$), locomotion scores ($r= 0.82$, $p< 0.001$) and object control skills ($r= 0.76$, $p< 0.001$) (Sun et al., 2010). However, as the TGMD-3 (Ulrich, 2013a) tool has been recently updated to include feedback, it is the most up to date and relevant FMS assessment tool for the North American preschool population. For this reason, only the subscale missing from the TGMD-3 tool (Ulrich, 2013a), balance, was included in this study.

As the importance of FMS development in early childhood has been shown, it is critical to understand what aspects of a child's life support FMS development. The following section will use the Socio-Ecological Model (SEM), adapted from McLeroy et al. (1988), and developed by Mehtala et al. (2014), to depict how intrapersonal (e.g. the child's age and sex), interpersonal (e.g. educators and parents), organizational (e.g. the child's care centre, home, and school), community, and public policy factors influence children's FMS development.

2.10 Correlates of Fundamental Movement Skills in Children

Understanding the correlates and determinants of FMS in the early years is critical for developing and implementing effective interventions. Numerous reviews (Bingham et al., 2016; Hesketh et al., 2017; Hesketh et al., 2017; Hinkley et al., 2008; Mehtala et al., 2014) have used an ecologic model (demographic and biological; psychological, cognitive and emotional; behavioural; social and cultural; physical environment) to explore the correlates of PA. For example, Mehtala et al. (2014) adapted Bronfenbrenner's ecological systems model to include opportunities for preschool-aged children to be physically active. This SEM, shown in Figure 3, includes all factors that are known to promote PA, which are embedded within the various levels of influence: individual-level factors (sex, age, and self-efficacy), interpersonal-level factors (peers and family), organizational-level factors (home, neighbourhood, childcare centre, and practices and policies of an organization), community-level factors (standards, partnerships with organizations, and norms), and public policy (national and local regulations and laws; Mehtala et al., 2014). This model groups potential influences of behaviour, identifying commonalities and differences, resulting in the development of targeted interventions to improve children's health behaviours (Brug et al., 2005). Although there is substantial literature noting the correlates of children PA, there is limited evidence on the correlates of children's outdoor play (Marino et al., 2012) and children's FMS (Zeng et al., 2019). PLEY project data will be explored using secondary analysis within this thesis and therefore it is important to note that the SEM was used to design the PLEY project intervention (Houser et al., 2019). The SEM developed by Mehtala et al., (2014; Figure 3) will be used to describe the intrapersonal, interpersonal, and organizational correlates of FMS in children and for the purpose of this thesis, only these levels of influence, and not the community and policy levels, will be explored.

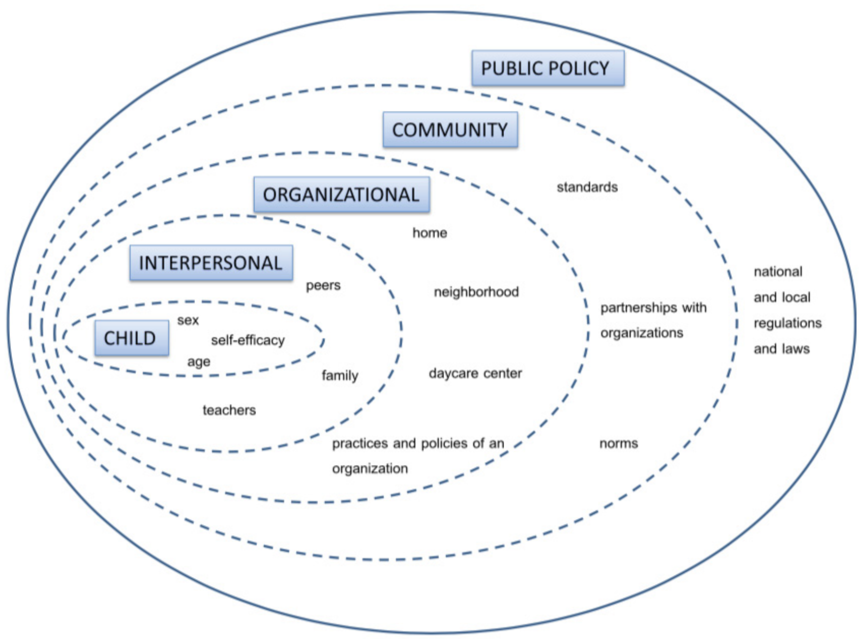

Figure 1 Socio-ecological model. Adapted from McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q* 1988, 15:351–377.

Figure 3. Socio-ecological model from Mehtala et al., 2014.

2.10.1 Intrapersonal correlates of children's fundamental movement skills. A number of intrapersonal correlates of FMS have been identified. Interpersonal factors are those that occur at an individual level, for example age or sex. A recent review by Barnett and colleagues (2016) found that a child's age, sex, weight, socio-economic status (SES), PA behaviour and sport participation are all associated with the child's FMS competence.

One of the most commonly referenced correlates of FMS is sex. Out of the 59 studies that Barnett and colleagues reviewed, 42 studies investigated sex as a correlate. Results showed significant evidence that being male is a positive correlate of object control competence and motor coordination (Barnett et al., 2016). In a recent 2019 study of the correlates of children's FMS, sex as a correlate was also supported (Zeng et al., 2019). Researchers found that object control skills scores were higher among boys, however locomotor skills scores and balance scores were higher among girls (Zeng et al., 2019). Conversely, an earlier study, also by Barnett and colleagues (2012), found no association with sex and locomotor or object control skills.

Another commonly explored correlate of FMS is age. Research shows as age increases, children's FMS, including object control, locomotor and balance skills, improve (Barnett et al., 2016). When specifically examining the correlates of preschool-aged children's FMS, Barnett and colleagues (2013) found that age is significantly correlated with both the children's locomotor skills and their object control skills. However, as Barnett et al. (2016) indicate, it is not surprising that the older the child, the more proficient they are, as they are likely continuously provided opportunities to practice and build upon their FMS over time.

Weight or Body Mass Index (BMI) is a less studied correlate of children's FMS. However, of the research examining its association with FMS, there have been trends showing that overweight children have lower FMS competency (Lubans et al., 2010).

Hardy and colleagues' (2012) study described the demographic and health-related characteristics of school aged children and youth (grades 2, 4, 6, 8 and 10) with low FMS competency. Authors found that children and youth who were overweight or obese lacked many different movement skills (Hardy et al., 2012). More specifically, grade 4 boys who were overweight or obese had low competency in object control skills and boys of all ages who were overweight or obese had low competency in locomotor skills. Overweight and obese girls in grades 4, 6, 8 and 10 also had a low competency in locomotor skills, however weight did not affect grade 2 girls' locomotor skills (Hardy et al., 2012). To further support the association between weight/BMI and FMS, a systematic review by Barnett et al. (2016) found 14 of the 59 studies explored BMI as a correlate of motor competence. Findings from these studies suggest that a higher BMI is negatively associated with children's motor coordination, skill competence, and stability (Barnett et al., 2016). Authors also found that when children have a high waist circumference and/or high body fat percentage, there is a negative association with motor competence (Barnett et al., 2016).

Recent research has shown child-perceived cognitive competence (e.g. good at puzzles, good at counting, etc.) to be a significant predictor of locomotor skills (Zeng et al., 2019). These results suggest that children who perceive that they have high cognitive competency also have high FMS. It is also important to explore the interpersonal correlates of children's FMS which includes the people they are surrounded and influenced by. This will be discussed in the following section.

2.10.2 Interpersonal correlates of children's fundamental movement skills. A number of studies have investigated the role of parents in influencing children's FMS. In

2019, Zeng and colleagues determined that parent education, BMI, and perception of the child's coordination accounted for 8.8% of the variance in the child's locomotor skills, however significance was only seen for parental education. Authors note that although the child's coordination and BMI did not reach significance, they were showing a trend towards significance and supported previous research. It has been found that children with highly educated mothers have high locomotor and eye-hand coordination (Giagazoglou et al., 2007). These findings may be explained by the results of a study by Gutman and Feinstein (2010), which found that parents with higher education reported more interactions with their child(ren) and engaged in more outdoor activities compared to less educated parents. This may afford children with more opportunities to support FMS development.

Many preschool-aged children spend several hours in childcare, surrounded by other children and early childhood educators. However, most interpersonal correlates of children's FMS have been focused on the parent level. It has been seen that teacher education is a significant predictor of children's FMS (True et al., 2017). Children spend such a large part of their waking hours in childcare and so it is critical to examine how the childcare environment, along with the home environment, can impact children's FMS. The following section will discuss the organizational correlates of children's FMS.

2.10.3 Organizational correlates of children's fundamental movement skills. Aspects of children's homes and their childcare environment have been associated with the development of their FMS. It has also been noted that there is, again, less literature available exploring the organizational correlates of children's FMS, when compared to intrapersonal correlates, leading Barnett et al. (2016) to recommended future research in this area.

When not in care, children spend a large portion of their day in the home setting, and therefore it is important to evaluate characteristics of the home environment that are associated with children's FMS development. It has been seen that the number of toys and equipment (e.g., balls, basketball nets, bats, climbing equipment/ trees suitable for climbing, pool or beach toys, etc.) in the child's home is a correlate of both locomotor and object control skills (Barnett et al., 2013). Continuing, Zeng and colleagues (2019) determined that a supportive home environment with stimulating play equipment can help to develop children's motor skill competence. Other environmental characteristics of the home, such as prosperity index of the municipality, type of housing, and street traffic have also been studied as organizational correlates of children's FMS, however proven not to be associated (Cools et al., 2011).

The childcare environment is another location where children often spend many hours during the week, and has been shown to support children's outdoor risky play (Sandseter, 2011), ultimately supporting children's FMS development. True and colleagues (2017) examined various preschool environment characteristics as correlates of children's FMS. Time spent in outdoor open space, classroom size/child ratio, quality of the preschool, fixed play equipment, portable play equipment, playground size, field trips per month, community organization visits per month, minutes outside per day, and electronic media use were all examined as potential correlates. Findings revealed that classroom size/child ratio, playground size, and electronic media use were all significant correlates of children's FMS (True et al., 2017).

A more thoroughly researched topic is the organizational correlates of children's PA (Bingham et al., 2016; Dowda et al., 2011; Hinkley et al., 2012; Hnatiuk, Hesketh, & Sluijs, 2016). It can be said that many of these correlates, such as preschool quality (Dowda et al., 2011) and time spent outdoors (Bingham et al., 2016), also may influence children's FMS, as PA is a known correlate of FMS.

There are clear intrapersonal (child), interpersonal (social), and organizational (environmental) correlates of children's FMS. This information allows researchers to create interventions involving these correlates, with the goal of increasing children's FMS. A thorough description of past FMS interventions in early years settings will be discussed below.

2.11 Fundamental Movement Skill interventions in early years settings

Many studies designed to support children's FMS involve a PA intervention (Adamo et al., 2014; Foweather et al., 2015; Wasenius et al., 2018) and several of these PA interventions were discussed previously. Many studies found that increasing children's PA lead to improvements in FMS. Several reviews have indicated that interventions and programs are an effective strategy for promoting FMS development in preschool settings (Van Capelle et al., 2017; Wick et al., 2017). This section will review several studies that support children's FMS through active play in early years settings.

Johnstone et al. (2018) conducted a systematic review and meta-analysis of studies that predominantly use active play in order to promote at least one of the following: objectively measured PA, FMS, cognition or weight status. Of the four studies that were eligible, only two (Adamo et al., 2014; Tortella et al., 2016) assessed children's FMS (Johnstone et al., 2018). Both of these studies found significant improvements in the intervention groups' FMS. However, due to the lack of eligible studies, the authors concluded that there is a need for high-quality active play interventions in order to determine the potential of active play in increasing PA levels and improving FMS, cognition and weight status in children (Johnstone et al., 2018).

Tortella and colleagues (2016) examined the FMS of 110 kindergarteners (experimental group: n= 71, 41 males and 30 females, mean age= 5.6 ±.0.3 years; control group: n= 39, 22 males and 17 females, mean age= 5.7 ± 0.3 years) in Treviso, Veneto, Italy. The intervention group was exposed to 30-minutes of unstructured play and 30-minutes of structured play on the playground Primo Sport 0246 (specifically designed to promote gross motor skills in preschool children up to the age of 6). The control group did not play at this park or have any structured play time (Tortella et al., 2016). FMS were evaluated using selected skills from the Test of Motor Competence (Leversen, Haga, & Sigmundsson, 2012), the Movement Assessment Battery for Children (Henderson, Sugden, & Barnett, 2007), the Test of Physical Fitness (Fjortoft, Pedersen, Sigmundsson, & Vereijken, 2011), and two dynamic balance skills were developed as part of the project (Tortella et al., 2016). Results from this study showed the intervention group significantly improved in 4 of out of the 6 motor skills, compared to the control group (Tortella et al., 2016).

Although not included in Johnstone et al (2018)'s review, Foulkes and colleagues (2017) implemented a 6-week active play intervention in six preschools in Liverpool, England. The intervention consisted of weekly 60-minute 'Active Play' sessions per week, aimed at staff and the preschool children (3 to 5 years old). An example of an Active Play session involves warming up, dancing, jumping, accuracy games, and a cool down (Foulkes et al., 2017). In order to assess children's FMS, researchers used the TGMD-2 (Ulrich, 2000) on site as well as video recorded the children completing the skills to later use the Children's Activity and Movement in Preschool Study Motor Skills Protocol (Williams et al., 2009). Results (n= 162, mean age= 4.64 ± 0.58 years, 53.1% boys), however, did not show any significant improvements in the intervention groups' total FMS, locomotor, or object control skills when compared to control groups (Foulkes et al., 2017).

In addition to Foulkes et al, (2017) and Tortella et al., (2016), a more recent 2019 study examined the feasibility of an active play intervention on children's PA and FMS (Johnstone et al., 2019). This 10-week intervention involved a 1-hour outdoor play session per week, 30 minutes of games and 30 minutes of free play. As this study was only exploring the feasibility of the intervention, the outcomes are only preliminary, and the RCT has yet to take place. The intervention took place in eight schools in Glasgow, Scotland on 137 children (intervention group: n=73, 34 males and 39 females, mean age= 7.1 ± 0.3; control group: n= 64, 24 males and 40 females, mean age= 7.0 ± 0.3). Children's FMS was measured using the TGMD-3 (Ulrich, 2013a) assessment tool. Results indicate a small effect on the intervention groups' locomotor score, however only a limited effect on children's object control skills (Johnstone et al., 2019); together, they show a trend of active play enhancing children's FMS.

These studies show that active play interventions are an effective strategy for enhancing children's FMS. It is important to note, however, that the majority of FMS interventions to date use structured play methods. Throughout this literature review, it has been made clear that children experience many diverse benefits through unstructured, child-led, free play. Although there is literature showcasing the benefits of structured play on children's FMS and literature showing the many other benefits of unstructured free play, there is a gap in the existing literature examining the effect unstructured play has on children's FMS. One strategy for promoting unstructured play is the use of loose parts.

2.12 What are Loose Parts?

Loose parts are defined as open-ended materials (manufactured or natural) that are moveable and non-dictated (Nicholson, 1971). This allows children to play in creative ways, interacting with the materials and their surroundings. These unstructured materials enhance children's sense of discovery and encourage them to engage in a more physically active manor (Drew & Nell, 2015). Sutton (2011) goes into a more thorough explanation of loose parts by defining them as:

> any collection of fully movable elements that inspire a person to pick up, re-arrange or create new configurations, even realities, one piece or multiple pieces at a time. Loose parts require the hand and mind to work in concert; they are catalysts to inquiry. Loose parts are the flexible edge of an inviting open-ended interactive environment that allows participants to make an imprint of their intention. Experiences with loose parts provide a profound yet playful way for children to form associations between learning and pleasure (Sutton, 2011, p. 409).

Loose parts can ultimately be any moveable object used for play, from recycled tires and stumps, to car parts or pinecones. There is no limit on what can be classified as a loose part, as long as it is available, safe, and age appropriate (Houser et al., 2016).

2.13 Impact of Loose Parts Play on Children's Health

Nicholson coined the term "loose parts" in 1971 showing the endless possibilities they can bring to play (Nicholson, 1971). Although the concept of loose parts has been present for over 40 years, there are very few studies and interventions examining the effects loose parts play has on children's health and wellbeing (Gibson, Cornell & Gill, 2017). Of the research previously conducted, the results have been positive.

Prior to the commencement of a cluster-randomized trial, Bundy and colleagues (2017) examined two playground-based interventions involving loose parts (Armitage, 2010; Bundy et al., 2009). Armitage (2010) evaluated the effect of Play Pods (filled with loose parts) on school-aged children's play experiences, socio-emotional skills, and cognitive skills in eight schools in Bristol (United Kingdom) using interviews and photographs. Bundy et al. (2009) also explored the use of a loose parts intervention as a way of promoting school-aged children's (5 to 7 years) activity and social skills, however researchers used accelerometers and teacher interviews. Although these studies employed different methods, they both found that loose parts promoted participation, social negotiation, creativity, and children's access to play opportunities. Yet neither of the studies involved a control group, lowering the quality of the studies (Bundy et al., 2017). Bundy et al. (2017) continued by implementing a 13-week playground intervention that consisted of placing recycled materials such as car tires, milk crates and cardboard boxes on Australian school playgrounds. Outcome measures included PA during school time, play and social interactions, children's and teacher's perceptions of competence and social acceptance, parent and teacher reports on social skills, and after school activities. Results showed that children at the intervention sites had an increase in MVPA and decrease in sedentary time while at school (Bundy et al., 2017). Although researchers did not find a significant difference in children's social play and skills or their perceived competence/social acceptance due to the intervention, researchers did determine that a loose parts intervention with school-aged children is an effective strategy for improving their PA behaviours (Bundy et al., 2017).

Additional benefits have been associated with children's play with loose parts such as: increased constructive play behaviours and dramatic play (Maxwell, Mitchell & Evans, 2008), improved engagement and understanding of the content in their play space (Sutton, 2011), more developed problem solving skills, and encouraged imagination in their play (Neill, 2013). These results are in line with the description Drew (2015) uses, stating that open-ended materials influence many aspects of children's lives, as there are no pre-determined rules or goals with this form of play.

Maxwell, Mitchell and Evans (2008) introduced loose parts into the outdoor setting of a childcare centre to examine how loose parts support preschool-aged children's dramatic and constructive play. Researchers observed type of play behaviour (functional, constructive, dramatic/ fantasy, or non-play) and type of social interaction (Maxwell, Mitchell & Evans, 2008). Results showed that children engaged in more constructive play with the loose parts and the amount children played also increased when loose parts were introduced (Maxwell, Mitchell & Evans, 2008).

Similarly, Flannigan and Dieze (2017) conducted a loose parts intervention in the childcare setting by examining how loose parts influenced children's play themes, patterns and behaviours. A total of twenty-seven preschool children (age 3 to 5 years) were observed. Researchers found that when children have access to loose parts, they commonly engage in dramatic and functional play, there are many pro-social behaviours such as turn taking, leadership, cooperation, etc., and children often use inclusive phrases such as “we” and “ours” (Flannigan and Dieze, 2017). In addition to loose parts encouraging children to play more, they are an effective strategy for developing language, communication, and pro-social skills.

Similar results were again showed by Engelen et al. (2018) who found loose parts increase constructive and creative play, as well as increase children’s creative, social and physical play (Engelen et al., 2018). Several studies (Mincemoyer, 2013; Neill, 2013) have also shown that children not only have significantly benefited from, but also prefer, loose parts to task specific toys. This characteristic makes it an ideal intervention to implement on children in the early years.

As outlined, previous research has shown the socio-emotional, cognitive and PA benefits of outdoor loose parts play in children. However, there is currently no research on the effect that outdoor loose parts play has on children’s FMS. Given that PA and FMS are closely related, it is possible that outdoor loose parts play may also enhance children’s FMS. One way to determine how loose parts are influencing children is through discussions with their educators. The following section will discuss how educators perceive outdoor play and loose parts in relation to children’s health and development.

2.14 Educator Perceptions

Early childhood educators play a critical role in promoting play during the care hours, as well as acting as a mediator of the space (Schlembach et al., 2018). Educators influence the play environment and dictate how the place is allowed to be interacted with, shaping the way children play (Schlembach et al., 2018). The Nova Scotia Early Learning Curriculum Framework states how important educators are in children's lives, as they ensure children have the opportunity to play, investigate, explore, question, pursue their interests, be recognized for their abilities, and develop friendships (Nova Scotia Department of Education and Early Childhood Development, 2018). Gehris, Gooze and Whitaker (2014) stated that any efforts to improve early childhood educational programmes require the involvement of the educators. As educators have such an influence on children's play, ultimately influencing their development, it is critical to determine how educators perceive the outdoor play environment and children's movement patterns.

In 2014, Gehris, Gooze, and Whitaker held focus groups with 89 educators in Pennsylvania to determine their perceptions on: 1) How movement influences children's learning; 2) What types of movement experiences are most beneficial for children; 3) What settings best support children's movement; and 4) Challenges related to children's movement. Researchers found that teachers respond to children's innate need to move, quoting a teacher saying "they're just [saying] 'I want to play. Can I play? I don't want to read a book. I want to play'. My kids are always very hands on, into everything, running around" (Gehris, Gooze, & Whitaker, 2014, p. 126). Researchers also found that educators believe that movement prepares children to succeed in both school and life, that teachers and educators benefit from moving together, and lastly, that when children move outdoors it promotes learning with one educator saying "They need that fresh air, they need to see the trees, they need to smell stuff, see different things out there that you can't have in a gym" (Gehris, Gooze, & Whitaker, 2014, pg. 128). Authors state how research in this area is lacking, as there have been studies to explore teacher's views on outdoor play, but there is no previous information available on early childhood educators perceptions on the best indoor and outdoor environments to support children's movement and learning (Gehris, Gooze, & Whitaker, 2014).

There have been studies that have looked at early childhood educators' views on outdoor free play by exploring their views on nature (Ernst, 2014; Schlembach et al., 2018). Schlembach and colleagues (2018) examined what benefits early childhood educators attribute to experiences in an urban nature playscape, using an online survey and in-person interview (both survey and interview n=8, only interview n=5). Results showed educators recognized the value of nature in inviting children to test their agility, coordination, and strength, ultimately facilitating their confidence and competence to move (Schlembach et al., 2018). Researchers also found educators believe children learn through participating in nature play, quoting an educator saying "...it is a natural healer...offers positive stimulation… Seems to be less restrictive than the playground..." (Schlembach et al., 2018, p. 90-91). This study supports the notion that outdoor natural play spaces support children's holistic development (Schlembach et al., 2018).

Ernst (2014) also explored early childhood educators' beliefs and practices regarding the natural outdoor setting by surveying 46 educators in Minnesota. Results showed that educators, on average, believe/strongly believe that experiences in the outdoor environment are critical for children's development and environmental appreciation, and aid children's cognitive, social and physical development (Ernst, 2014). Early childhood educators recognize that children benefit developmentally from outdoor free play, demonstrating the importance of creating interventions that support the promotion of children's outdoor, free play.

Several studies have also explored educator perceptions of factors that influence PA promotion within the childcare centre. Froehlich Chow and Humbert (2014) determined that various barriers and facilitators, such as personal health and wellness, lack of knowledge, and parental support, influence educators' ability to provide PA opportunities for the children in their care (Froehlich Chow & Humbert, 2014). In line with Froehlich Chow and Humbert's finding that educators' lack knowledge surrounding PA, it has been noted that only 28.7% of early childhood education students are familiar with the Canadian Physical Activity Guidelines for the early years (Martyniuk & Tucker, 2014). This is an interesting finding when compared to Tucker and colleagues' (2011) study, which found that the majority of the educators within their study believed that it was feasible for their preschool children to meet or exceed these PA guidelines. As several early childhood education students seem to be unfamiliar with the early years PA guidelines (Tremblay et al., 2016; Tremblay et al., 2017), it seems as though the early childhood education curriculum presents an opportunity to share PA guidelines, workshops, and activities (Martyniuk & Tucker, 2014). It has also been noted that involving educators in the development of PA programs is an effective way to target sedentary behaviours (Tucker et al., 2011). Although barriers and facilitators that influence educators' ability to promote FMS has yet to be explored, it is known that PA and FMS are highly connected, and therefore it is possible that several of these factors also apply to the promotion of FMS.

As Gehris, Gooze, and Whitaker (2014) explain, educators' perceptions and experiences are a valuable source of information, and very little has been done to understand their views on whether children's learning can be promoted through movement. Although the importance of educators' experiences in the outdoor environment has been shown, to date, no studies have explored educators' perceptions of outdoor loose parts play on children's FMS, a gap this study aims to fill.

2.15 Gaps in the Literature

Although the concept of loose parts play has been supported for more than 40 years, there is limited research and evidence supporting the impact of outdoor loose parts play on children's PA (Houser et al., 2016). More evidence exists on the value of outdoor loose parts play in assisting children to develop and strengthen their socio-emotional (Bundy et al., 2017) and cognitive skills (Flannigan & Dietze, 2017). To date, the evidence linking outdoor loose parts play to children's PA has been primarily explored in school-aged children and youth (Bundy et al., 2017). The lack of data on the impact of outdoor loose parts play in preschool-aged children is a limitation that has been noted in the literature (Houser et al., 2016). Furthermore, these studies have not used multi-methods (e.g. quantitative and qualitative) to assess the impact of outdoor loose parts play on children's PA, limiting a more comprehensive understanding of how outdoor loose parts play could impact PA behaviour. Importantly, there is no evidence on whether outdoor loose parts play supports children's FMS, particularly when it is integrated into early years environments (e.g. childcare centres). Given heightened attention into the value of outdoor loose parts play for children's development, and the gaps in the literature, an understanding of how outdoor loose parts play in childcare centre spaces might impact preschoolers' FMS seems appropriate, particularly when exploring the potential impact using a multi-methods design. By using a multi-methods design, educators' perceptions of the loose parts intervention will be explored. This piece of information has previously shown to be valuable, however it is often lacking when exploring children's childcare experiences. The lack of multi-methods research limits the depth of understanding on what impact a childcare-based outdoor loose parts intervention might have on preschoolers' FMS, making a valuable contribution to the literature.

2.16 Research Objectives

The purpose of this thesis is to explore the impact of a childcare-based outdoor loose parts intervention on Nova Scotian preschoolers' FMS, using an exploratory, pragmatic, multi-methods research approach. In line with this multi-methods approach, there are two objectives:

1) To explore the impact of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS (assessed quantitatively);
2) To explore educators' perceptions of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS.

2.17 Conclusion

The literature in this review identifies the importance of both active outdoor play and FMS development in the early years (birth to 6 years). Global rates of obesity (World Health Organization, 2019) and chronic disease are on the rise (Franks et al., 2010), and more specifically, the number of children being diagnosed with chronic diseases is also on the rise (Public Health Agency of Canada, 2011). As PA is a known preventative factor for both obesity and chronic disease, establishing healthy and regular PA patterns in early life is needed. Literature shows that FMS are a major correlate of PA in childhood, and that this is particularly important in the early years, as FMS and PA behaviours have been seen to track into adulthood. More physically skillful children may engage in higher levels of PA, specifically activities that require high levels of physical fitness (Stodden, Landendorferm & Roberton, 2009), also positively impacting their cardio-respiratory fitness and body composition (American College of Sports Medicine, 1988). Additionally, time spent outdoors has also been attributed to higher PA levels among children (Gray et al., 2015). The benefits of unstructured, active outdoor play with loose parts to children's health are also receiving more attention (Houser et al., 2016). It has also been seen that educators recognize the value of outdoor play for preschool-aged children, benefiting them cognitively, socially and physically. Despite these findings, the literature shows that outdoor play time is on the decline, in a sense, warning stakeholders that further work needs to be done on supporting children's outdoor play. Much of the previous research involving outdoor loose parts play is focused on school-aged children, and primarily documents the socio-emotional and cognitive benefits, leaving a large gap in the literature on the benefits of outdoor loose parts play in preschool-aged children. None of these studies have explored the impact of outdoor loose parts play on children's FMS, which is associated with PA. As children spend such a large portion of their day in childcare (Bushnik, 2006), and there is evidence supporting the value of outdoor loose parts interventions on children's health, it seems critical to examine the impact of childcare-based outdoor loose parts play on children's FMS. Additionally, exploring the educators' perceptions of the intervention is just as critical, as children spend such a large portion of their day under their care. Examining this topic using a multi-methods approach will help develop a more comprehensive understanding of how children's FMS development might be supported through outdoor loose parts play. To the authors' knowledge, this is a novel research question, and one that will provide a meaningful contribution to the field.

Chapter 3: Methods

3.1 Theoretical and Methodological Framework

This thesis is guided by the pragmatic worldview, providing to opportunity to use multiple methods of data collection and analysis (Creswell & Creswell, 2018). With a pragmatic paradigm, researchers put emphasis on the research problem, using multiple approaches in order to best compile knowledge about that problem (Rossman & Wilson, 1985). Pragmatism is in line with a multi-methods approach, as researchers are able to draw data from both quantitative and qualitative sources in order to best understand each research problem (Creswell & Creswell, 2018). The pragmatic worldview offers the researcher the freedom to choose methods, techniques, and procedures that best meets the needs of the project (Creswell & Creswell, 2018). Approaching this research study with a pragmatic worldview allowed for a deeper understanding of not only "what" is happening due to the integration of loose parts into the childcare environment, , but also explore it qualitatively, to further explore "what" was happening due to the intervention, in addition to determine "why" and "how" the intervention impacted the participants.

3.2 Study Design

This thesis used secondary data from a larger randomized, mixed-methods, controlled study titled the Physical Literacy in the Early Years (PLEY) project. As seen in Houser and colleagues' (2019) protocol paper, The PLEY project (2016-2019) focused on improving physical literacy, PA and active outdoor play in Nova Scotian preschoolers aged 3 to 5 years through the integration of loose parts into the outdoor environments of regulated childcare centres. Additional objectives were to examine the impact of the project on improving educators' attitudes, beliefs, perceived competency, and intentions toward incorporating loose parts play into practice; and the impact of the project on educators' and parents' understanding of play in child health and development. The PLEY project used a socio-ecological approach (McLeroy et al., 1988) focusing on altering the physical environment of childcare centre outdoor spaces, and exploring the impact of other levels of influence (e.g. intrapersonal, interpersonal, organizational, community, political) on children's engagement in outdoor loose parts play. A multidisciplinary team of researchers and early childhood educators worked together to develop the PLEY project. Notably, this project was supported through an interdisciplinary, multi-sector partnership of stakeholders (researchers, early years training institutes, educators, practitioners, families, health promotion and recreation sectors, government, business organizations and community champions).

Childcare centres that expressed interest in participating in the study, and met inclusion criteria, were visited by researchers. This visit consisted of a meeting with the director, further discussing the project, completing a survey, and viewing and photographing their designated outdoor play space. Two of these sites were excluded from the study based on their use of loose parts during outdoor play.

Prior to beginning the intervention, educators from the intervention sites received a one-day training session covering the main components of the PLEY project, including physical literacy (i.e., the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life; Tremblay et al., 2018), PA and FMS, active outdoor play and loose parts, and the benefits of risky play. This session involved presentations and hands on activities designed to promote the use of loose parts in active play and increase educator understanding of the importance of outdoor risky play for young children's health and development.

Following the one-day training session, intervention sites were given a loose parts kit, (shown in Figure 4) which included buckets and lids, rope and a pully, tree cookies, milk crates, a package of hose tube, 20+ balls of a variety of sizes and weights, wood pieces, bread tray, large cardboard tubes, funnels of different sizes, a tarp, 5' planks, 5' PVC tubing (4" and 2" diameter), rocks, and tires. Educators at the intervention sites were asked to immediately incorporate the loose parts kits into their outdoor play setting and photograph the children playing with loose parts as often as possible. These photos were then supplemented with documentation and used to create dialogue at educator focus group sessions (3- and 6-months post intervention). The control groups were asked to continue with their current outdoor play schedule and activities, and received a loose parts kit at the end of the intervention. The outdoor environments at the participating centres varied, however all sites met the regulations for childcare outdoor spaces. The intervention spanned six to eight months and included 18 sites (intervention: n=10; control: n=8). The data collection process (Appendix A) began in May 2016 and concluded in October 2018. Researchers performed weekly check-ins with intervention sites throughout the intervention and with control sites after baseline, 3- and 6-month data collection time points.

Figure 4. Loose parts kit provided to the intervention sites

3.2.1 Quantitative Approach. To examine the impact of the outdoor loose parts intervention on preschoolers' FMS, quantitative measures of FMS were explored. These included secondary data of: 1) children's objectively-measured total FMS score, and components of this total score (object control skills score, locomotor skills score), assessed using the Test of Gross Motor Development-3 (TGMD-3; Ulrich, 2013a); and 2) children's total balance score, assessed using the Preschooler Gross Motor Quality Scale (PGMQ; Sun et al., 2010). True experimental designs, in line with the current study, seek to evaluate the influence a treatment has on an outcome variable (Creswell & Creswell, 2018). To address the first objective, a comparison of changes in these quantitative measures of FMS over time (e.g. baseline, 3- and 6-months post-intervention), and between groups (intervention vs. control), were conducted. These quantitative measures of preschoolers' FMS were chosen based on previous research (Adamo et al., 2014; Wasenius et al., 2018) that has used the PGMQ (Sun et al., 2010) and the TGMD-2 (Ulrich, 2000), the preceding version of the TGMD-3, to measure preschoolers' FMS. Using a quantitative approach allowed for a sense of objectivity, providing answers to "what" might be happening to children's FMS as a result of engagement in outdoor loose parts play.

3.2.2 Qualitative Approach. Secondary qualitative data, derived through educator focus groups, were used to examine educators' perceptions of the outdoor loose parts intervention on preschoolers' FMS. Qualitative description (QD) was used as it describes an experience or event in facts and everyday language, providing a comprehensive summary of the phenomenon (Sandelowski, 2000). Focus group data aided in answering the second research objective by obtaining in-depth information from educators on how children's outdoor play with loose parts may have influenced their FMS. QD was used to describe qualitative data, as it requires less interpretation than phenomenological or grounded theory description and often results in easier consensus among researchers (Sandelowski, 2000). QD has been used similarly in the past by Schmidt et al. (2016) to describe older adult's perceptions of PA in rural communities using semi-structured interviews and summarizing the participant's perceptions. Researchers chose this method in order to provide a clear description of the data, instead of an interpretation (Schmidt et al., 2016). These data contributed to the understanding of "how" and "why" participants may have been impacted as result of engagement in outdoor loose parts play.

3.3 Researcher Reflexivity

It is important to note the personal experiences I have had that are related to this thesis. Growing up in a small town, I was often told to go outside and explore my surroundings. My parents were not afraid of letting me play outside, and in fact, encouraged it. As my parents are big advocates of being active, I played several sports growing up, including hockey, baseball, field hockey, soccer, and ultimate frisbee. Being raised to appreciate the outdoors and PA led me to pursue an undergraduate degree in Kinesiology. It was during this degree my passion for being active and encouraging those around me to also be active grew. Learning the benefits associated with PA only strengthened my drive to develop my own, and other people's, active, healthy lifestyles. This ultimately led me to pursue this master's thesis, focused on evaluating the effectiveness of an outdoor loose parts intervention on preschoolers' development. During the final years of my undergraduate degree, and during the first year of my master's degree, I was fortunate enough to have the opportunity to volunteer, and eventually work for the PLEY Project (Houser et al., 2019). During this time, I assisted with the measurement of children's height and weight, and FMS, at all three time points (baseline, 3- and 6-months post-intervention), led focus group discussions with educators (3- and 6-months post-intervention), helped with data entry of the quantitative data, and worked with other researchers to write a manuscript on the benefits and challenges of loose parts play (Spencer et al., 2019). Although this thesis involves secondary analysis of PLEY Project data, I was involved in the data collection and analysis prior to beginning my master's research. The topic of my masters is one that I grew to be passionate about through my undergraduate education, and not one that I researched while working as a research assistant. My experience collecting data throughout this project led me to use a multi-methods approach to answer my research question. While collecting the data, I was able to experience the limitations of the quantitative assessment tools (further discussed in the limitations section of this thesis) as well as the richness of the focus group data. My involvement throughout this project has created a personal bias as I have seen the benefits of outdoor loose parts play, firsthand. It is important to recognize the connection I developed to this project and data, even prior to beginning this thesis work, as it has created a possible bias in the interpretation of the data, although it was addressed as much as possible.

3.4 Ethics

Ethics approval for the PLEY project was obtained from the Dalhousie University Research Ethics Board in July 2016 (REB 2016-3924). An amendment to conduct secondary analysis of PLEY data in alignment with the current thesis' research question was submitted to Dalhousie University's REB on October 9th, 2019 and approval was obtained on October 10th, 2019. A copy of the ethics amendment approval is included in Appendix B.

3.5 Participants

3.5.1 Children. Regulated childcare centres across Nova Scotia that serve more than 20 children between the ages of 3-5 years were sent a general inquiry to determine their interest in the project. The PLEY project used a staggered approach for recruitment of the childcare centres in order to make up for participant drop out. For childcare centres to be eligible to participate in the PLEY project, each centre needed to have at least 10 preschoolers whose parents had provided consent for them to take part. During phase one (original cohort), 15 childcare centres expressed interest in participating in the project and met eligibility. Three additional centres were added in phase two (new cohort) to account for participant withdrawal in phase one centres. All children between the ages of 3 to 5 years were eligible to participate in either the intervention or control group. Only children whose parents gave informed consent (Appendix C) were formally assessed. In order to be included in data analysis for the present thesis, children must have had valid Test of Gross Motor Development-3 (TGMD-3; Ulrich, 2013a) and Balance Subscale of the Preschool Gross Motor Quality Scale (PGMQ; Sun et al., 2010) data. The participating childcare centres were randomly assigned to either the control or intervention group. All data were de-identified with arbitrary ID numbers and the researchers did not have access to any identifiable information. See Appendix A for the detailed PLEY project timeline.

3.5.2 Educators. Directors were approached in order to identify which educators would be interested in participating in focus group sessions. Number of interested educators varied from site to site, however all preschool educators were eligible to participate. Interested educators were then provided with an information sheet describing the PLEY project and their role within it, prior to being asked to provide informed consent to participate (Appendix D). Only focus group data from the educators exposed to the intervention were analyzed for the present study. All focus group data were de-identified with arbitrary ID numbers and it was ensured that researchers had no access to identifiable information.

3.6 Measures

3.6.1 Children.

3.6.1.1 Demographic and anthropometric data. Demographic information (age, sex) and anthropometrics (height and weight) were taken on participating children. According to the Canadian Society for Exercise Physiology (CSEP) protocols (CSEP, 2013), height was measured in cm (to the nearest 0.1cm) using a portable stadiometer (SECA, Hamburg, Germany), and weight was measured in kg (to the nearest 0.1kg) using a digital scale (A&D Medical, Milpitas, CA, USA). Height and weight were used to calculate children's BMI (kg/m2). Demographic and anthropometric data were collected at baseline and 3- and 6-months post-intervention.

3.6.1.2 Fundamental movement skill and balance data. Children's FMS were assessed using the TGMD-3 (Ulrich, 2013a), while children's balance was assessed using the Preschool Gross Motor Quality Scale (PGMQ; Sun, 2010). The TGMD-3 (Ulrich, 2013a; Appendix E) is a validated tool that measures the gross motor ability of children 3 to 11 years by comparing children's scores to pre-determined standardized norms. Total gross motor (total FMS) score was calculated using the sum of all thirteen skills including locomotor (run, hop, gallop, skip, horizontal jump and slide) and object control skills (one-hand strike, two-hand strike, dribble, catch, kick, underhand throw, overhand throw). The TGMD-3 (Ulrich, 2013a) has shown to have excellent intra-rater reliability for total FMS score (ICC= 0.99), as well as locomotor score (ICC= 0.99) and object control skills (ICC= 0.98). It also has excellent interrater reliability for total FMS (ICC= 0.97), locomotor skills (ICC= 0.96), and object control skills (ICC= 0.97) (Maeng & Webster, 2016). When researchers are well trained and qualified, the intra-rater and interrater reliability of the TGMD-3 (Ulrich, 2013a) is excellent (Maeng & Webster, 2016). Several studies have used the TGMD-3 (Mohammandi et al., 2017; Ulrich, 2013a) and the previous version, the TGMD-2 (Barnett, Salmon & Hesketh, 2016; Yang, Lin & Tsai, 2015; Adamo et al., 2014; Foulkes et al., 2017; Wasenius et al., 2018; Belanger et al., 2016; Foweather et al., 2015; Ulrich, 2000), to assess preschoolers' FMS. The PGMQ (Sun et al., 2010; Appendix F) is a validated tool that includes four balance measurements (single leg standing, tandem standing, walking line forward, and walking line backward) (Sun et al., 2010). The PGMQ (Sun et al., 2010) has been reported to have adequate concurrent validity with the TGMD-2 (Ulrich, 2000) ($r = 0.86$, $p < 0.001$) (Sun et al, 2011).

The following TGMD-3 protocol was used to measure children's FMS (Ulrich, 2013b). Each researcher was trained how to administer the TGMD-3 (Ulrich, 2013a) and PGMQ (Sun et al., 2010) allowing them to thoroughly practice demonstrating and scoring the skills. Although researchers were trained and provided with the opportunity to practice, inter-rater reliability was not measured within this study. The researcher assessed one child at a time by first demonstrating how to correctly preform the skill and then asked the child to perform the skill. Each skill had various criteria and was either scored a zero, representing a movement performed incorrectly, or one, representing a movement performed correctly. Each child was given one practice trial and two scored test trials for each skill. The two scored test trials were then added to get the total score for each skill. The total locomotor score was a sum of six locomotor skills (run, hop, gallop, skip, horizontal jump and slide), the total object control score was a sum of seven object control skills (one-hand strike, two-hand strike, dribble, catch, kick, underhand throw, overhand throw), the total FMS score was a sum of locomotor and object control skills (thirteen skills in total), and the total balance score was the sum of four balance skills (single leg standing, tandem standing, walking line forward, and walking line backward). In order to maximize safety, children were to wear rubber-soled shoes during the testing. Within this study, however, researchers often had to assess the children outdoors, due to space constraints, resulting in children often wearing different footwear and clothing. Ulrich (2013b) notes that if the researchers are not interested in comparing the results to normative data (such as within this study), adaptation of the procedures and performance criteria can be altered to fit the researchers needs.

3.6.2 Educators.

3.6.2.1 Educator focus group data. During the educator training session (12 educators and 2 directors in attendance), educators were asked to photograph and document the children participating in outdoor loose parts play throughout the intervention. Educators were told to take photographs of children's play with loose parts that "caught their attention". The photo documentation forms (Appendix G-H) prompted educators to describe their experiences and attitudes towards active, outdoor play and physical literacy, how the play with loose parts might have helped the children learn FMS, how the children were using the loose parts, what specific movements they saw (providing examples of locomotor, object control, and balancing skills), what they heard during the play, what teaching strategies were used to extend the play and the development of FMS and physical literacy, and what other areas might have been enhanced during the play. Finally, educators were asked to evaluate the associated risk of the play, on a scale from 0 "low" to 10 "high". Educators provided all photographs and photo documentation to researchers ahead of focus group sessions. They were also asked to bring one photograph and associated photo documentation to the focus group sessions to share and promote discussion.

Educators participated in focus group sessions mid-way through the intervention (3 months) and again at the end of the intervention (6 months). There were 5 groups of educators and directors (7 educators and 2 directors) at the original cohort's 3-month focus group, and 3 groups of educators (13 educators) at the original cohort's 6-month focus group. During the new cohort's focus group sessions there were 4 groups (12 educators, 2 directors, and 1 manager) at the 6-month session, and 3 groups (14 participants) at the 6-month session. Only intervention sites were invited to participate in the focus group sessions at the 3-month time point, while both intervention and control groups participated at the 6-month time point. This allowed the educators from the control group to hear about the intervention group's experiences. Researchers also facilitated on-site focus groups for two childcare centers that were unable to attend these sessions.

During focus group sessions, educators were placed in small groups (3 to 4 per group) with educators from different centres. This allowed educators to share their centre's experiences and hear the experiences of other centres in the loose parts outdoor play intervention. Each focus group had a facilitator and a note-taker and was audio-recorded. At each focus group table, facilitators described the purpose of the focus groups, provided guidelines ensuring privacy and confidentiality, and received verbal consent from each educator to audio-record the conversations and to use anything educators said as anonymous quotes (Appendix I). At the beginning of the focus group sessions, educators were reminded that everyone's opinion and feedback was welcome, and were asked to respect everyone's opinion and only respond to questions as they felt comfortable. Focus group questions (Appendix J-M) were divided into the following categories: outdoor active play, loose parts, risk-taking, policies, and challenges/benefits of the intervention. Educators were asked to bring one photograph and its corresponding documentation to discuss within their focus group table. After reviewing feedback from the original cohort's 3- and 6-month focus groups, a few minor changes were made to the new cohort's focus groups questions. These changes involved including a visual image of the physical literacy APPLE Model (Early Years Physical Literacy Research Team, n.d.) in order to create a better understanding of the definition of physical literacy and more comfort when discussing physical literacy and FMS. A question about educator and family engagement was also edited, creating two separate questions on the same topic. All questions aimed to allow educators to explore and share their experiences. The focus group question period lasted approximately 45-60 minutes, comprising mostly of in-depth conversations about the outdoor loose parts intervention.

3.7 Data Analysis

3.7.1 Quantitative. All secondary quantitative analyses were conducted using Statistical Analysis Software (SAS) (Version 9.4). Descriptive statistics of children's demographics, body composition, and the dependent variables were used to describe participants. Similar to Adamo et al. (2014), in order to include all TGMD-3 (Ulrich, 2013a) and PGMQ (Sun et al., 2010) assessments, an intention-to-treat (ITT) basis was used. ITT analysis is a common technique used in RCTs, as it allows participants who withdrew from the study or violated initial protocol to still be included in analysis (Soares

& Carneiro, 2002). This method preserves the original sample size, as every subject who was originally randomized is included in the final analysis. ITT is often described as "once randomized, always analyzed" (Gupta, 2011). If participants were missing data from one or two time points (baseline, 3-month, or 6-month), but had data at the remaining time point(s), they were still included in the analysis. This was an ideal method for the PLEY project, as there was a large drop-out rate amongst the participants (shown in Appendix A). Linear multilevel modelling for repeated measures was used to determine if children at the intervention sites had greater increases in TGMD-3 (Ulrich, 2013a) measured total FMS scores and subscales of the total score (object control skills, and locomotor skills, scores), and PGMQ-measured total balance scores (Sun et al., 2010), compared to children at control sites. A Statistics Canada employee assisted in the completion of the multi-level modelling to ensure the analysis was completed correctly. The data set was hierarchical, with time being the first level variable, the children being the second level variable, and the centre being the third level variable. The children were "nested" or "clustered" within centres, introducing dependency within the data (Field, 2009). Multilevel modelling accounted for possible clustering of childcare centre, as children who belong to the same centre may have been more similar. Possible confounding variables, such as age, sex, BMI, environment and SES were also included in the models, as previous literature has shown these variables influence children's FMS (Barnett et al., 2016). 95% confidence intervals (95% CI) and p-values were calculated and statistical significance was defined as an alpha less than 0.05.

3.7.2 Qualitative. Educator focus groups were conducted to gather the qualitative data that were used in this thesis. The focus group data were previously transcribed verbatim, organized using Microsoft word (version 16.16.3). Qualitative data were analysed using thematic analysis on Microsoft Word (version 16.16.3), as it allowed the researcher to describe the data without over-interpretation, and instead use the words of the participants (Braun & Clarke, 2006). An inductive coding process was used throughout this study, which is a common form of analysis for understudied topics (Braun & Clarke, 2006). The researcher's knowledge on relevant information, such as FMS, children's development, outdoor play and loose parts influenced how the data were coded. Although the researcher was aware of previous theories in this field, an inductive coding process was used and therefore the codes were developed from the data itself (Braun & Clarke, 2006), as opposed to beginning the coding process with a pre-determined set of codes.

The process of thematic analysis first involved becoming familiar with the data. This was done previously, as the researcher had read the transcripts for the broader research project, familiarizing the researcher with the data. As these focus groups were aimed at the larger research project, there was a lot of rich data that was related to this thesis' research objectives and therefore researchers needed to "winnow" the data (Guest, MacQueen, & Namey, 2012). This process involves focusing on related aspects of the data and disregarding other parts (Guest, MacQueen, & Namey, 2012). Next, 6-month data was coded by the researcher, with the second research objective in mind. Once the researcher finished the coding process, the researcher's supervisor then coded the 6-month data and the two discussed any inconsistencies in coding. After it was determined that the researcher and their supervisor were coding similarly, the researcher then coded the 3-month data independently in order to determine if there were any new findings.

Double coding was originally done in order to increase rigor (Ranney et al., 2015), however it is common to have one coder continue to code the remaining transcripts independently once a coding structure becomes well defined (Ranney et al., 2015). Coding was done in order to label categories of data that were relevant to the research question. The coding process involves organizing the data (sentences or paragraphs) into segments and using a word to represent the category (Rossman & Rallis, 2012). Once the coding process was complete, the researcher began to develop common themes based on connections between codes. Themes are major qualitative findings that show multiple perspectives from the participants (Creswell, 2014). This was done through conversations with the researcher's supervisor and meetings with committee members. During the development of themes, sub-themes were also developed. The sub-themes are more specific themes that fall under a broader theme. During conversations with committee members, it was decided to condense the original five themes into three. This was done once similarities between themes two to four were recognized. For example, originally themes two to four involved 1) combination of movements; 2) repetition; and 3) risk-taking. As each of these themes centred on a means of improving children's movement skills, they were condensed into one theme (movement skill development) and then broken down into subthemes. As per Braun and Clarke (2006), in order to organize the data, researchers choose themes that both occurred frequently and answered the research objectives. Researchers then use the developed themes to provide a detailed description of the data.

As previously mentioned, QD was used in order to summarize the information from the data and present it in a clear way. QD is a method used to provide a description of a phenomenon from the participant's perspective, without over-interpretation (Schmidt et al., 2016). This is the most appropriate method, as this study aims to determine educators' perceptions of the outdoor loose parts intervention on children's FMS. The results of the focus groups were shown using a descriptive summary in the results section.

Chapter 4: Results

4.1 Quantitative Data

4.1.1 Descriptive Statistics. Demographic information including group (control or intervention), site, environment (urban, suburban or rural), SES (high, medium or low), age (3, 4, or 5 years old), sex (male or female), and BMI were collected at baseline. Table 1 presents the descriptive statistics (number of observations (N) and the percent of number of observations (%)) for these independent variables. These frequencies are based on the baseline values, and distributions are subject to change due to the attrition that occurred between baseline and the 3- and 6-month time points. Group, sex, and environment are well-balanced; however, age is unbalanced, with the 4-year-olds comprising 50% of the sample. SES was originally collected in three categories. However, the low SES category comprised 45% of the sample, and therefore the medium and high categories were combined in order to make it more balanced. Seven extremely low or high BMI values were removed from the dataset. According to World Health Organization growth charts (World Health Organization, n.d.) children between the ages of 3 and 5 should not have a BMI score lower than 12 or higher than 21. In each of these seven cases, the child had a possible BMI score (11.99-20.99) for the additional two time points, leading researchers to believe the unlikely BMI scores were data entry errors. Each child contributed valid FMS data and therefore only the unlikely BMI scores were set to missing, as the rest of the subject's data were admissible for the study.

Although only baseline age was used throughout the multilevel model analysis, descriptive statistics (mean, standard deviation (std), and range) were computed for the continuous independent variables (age in decimals and BMI) in order to show the change over time, shown in Table 2.

Table 1

Descriptive statistics for categorical independent variables

Independent variables		N	%
Group			
	Control	94	45
	Intervention	115	55
Site N=209 children	# of centres	18	
Environment			
N=209	Urban	76	36.4
	Suburban	62	29.7
	Rural	71	34.0
SES			
N=209	Low	94	45
	Moderate & High	115	55
Age			
N=195	3 years	66	31.6
	4 years	96	45.9
	5 years	33	15.8
Sex			
N=197	Male	109	52.2
	Female	88	42.1

Table 2

Descriptive statistics for longitudinal independent variables

	Baseline			3 Months			6 Months		
	N	Mean (Std)	Range	N	Mean (Std)	Range	N	Mean (Std)	Range
Age (in Decimals)	195	4.24 (0.64)	3.00-5.91	146	4.74 (0.63)	3.47-5.85	75	4.80 (0.53)	3.79-6.04
BMI (kg/m^2)	178	16.07 (1.37)	12.73-20.88	103	16.04 (16.51)	12.63-20.58	98	15.88 (1.46)	12.86-19.62

Table 3 presents the mean, standard deviation and range of the four FMS variables (total FMS score, total locomotor skills score, total object control skills score, total balance score) across the three time points (baseline and 3- and 6-months post-intervention) in intervention and control groups as well as the combination of both groups (total). These FMS variables are defined as the dependent variables in the multilevel models. The possible scores vary between each dependent variable based on the number of possible points a child could score on the assessment. Possible locomotor scores range from 0-46, possible object control scores range from 0-54, possible total FMS scores range from 0-100, and possible balance scores range from 0-36. All of the FMS variables have mean values that increase over the three time points (1= baseline, 2= 3-months post-intervention, and 3= 6-months post-intervention), regardless if the group was intervention or control. This increase shows a gradual positive linear effect, which is shown in Figures 5-8. These figures also depict the minimal difference in FMS scores between groups (control vs. intervention), which was explored further during the multilevel model analysis.

Table 3

Descriptive statistics (N, Mean, Std., Range) of the dependent FMS variables by time

	Baseline			3 Month			6 Month		
	N	Mean (std)	Range	N	Mean (std)	Range	N	Mean (std)	Range
Locomotor									
Control	75	25.17 (8.18)	6.00-43.00	44	26.16 (7.04)	15.00-44.00	36	29.33 (8.99)	9.00-42.00
Intervention	103	24.60 (9.24)	5.00-46.00	69	27.74 (9.62)	5.00-46.00	63	30.89 (7.08)	16.00-46.00
Total	178	24.84 (8.79)	5.00-46.00	113	27.12 (8.71)	5.00-46.00	99	30.32 (7.76)	9.00-46.00
Object Control									
Control	75	22.33 (6.92)	6.00-39.00	44	27.78 (6.40)	12.00-42.00	36	29.06 (7.10)	14.00-47.00
Intervention	103	24.66 (8.20)	8.00-44.00	69	28.43 (8.43)	13.00-50.00	63	30.22 (7.86)	14.00-53.00
Total	178	23.68 (7.76)	6.00-44.00	113	28.14 (7.66)	12.00-50.00	99	29.80 (7.58)	14.00-53.00
Total FMS									
Control	75	47.51 (12.91)	14.00-77.00	44	53.96 (11.81)	27.00-78.00	36	58.64 (14.46)	31.00-85.00
Intervention	103	49.26 (15.48)	17.00-81.00	69	56.32 (16.56)	21.00-96.00	63	60.32 (12.48)	34.00-63.00
Total	178	48.52 (14.44)	14.00-81.00	113	55.40 (14.88)	21.00-96.00	99	59.71 (13.18)	31.00-85.00
Balance									
Control	74	15.28 (7.05)	0.00-30.00	44	17.78 (6.98)	5.00-34.00	26	21.25 (8.11)	2.00-35.00
Intervention	103	15.90 (7.67)	0.00-33.00	69	19.39 (7.13)	5.00-35.00	63	21.05 (6.26)	2.00-34.00
Total	177	15.64 (7.40)	0.00-33.00	113	18.76 (7.90)	5.00-35.00	99	21.12 (6.95)	2.00-35.00

Note. locomotor = total locomotor score; object control = total object control score; total FMS = total FMS score; balance = total balance score.

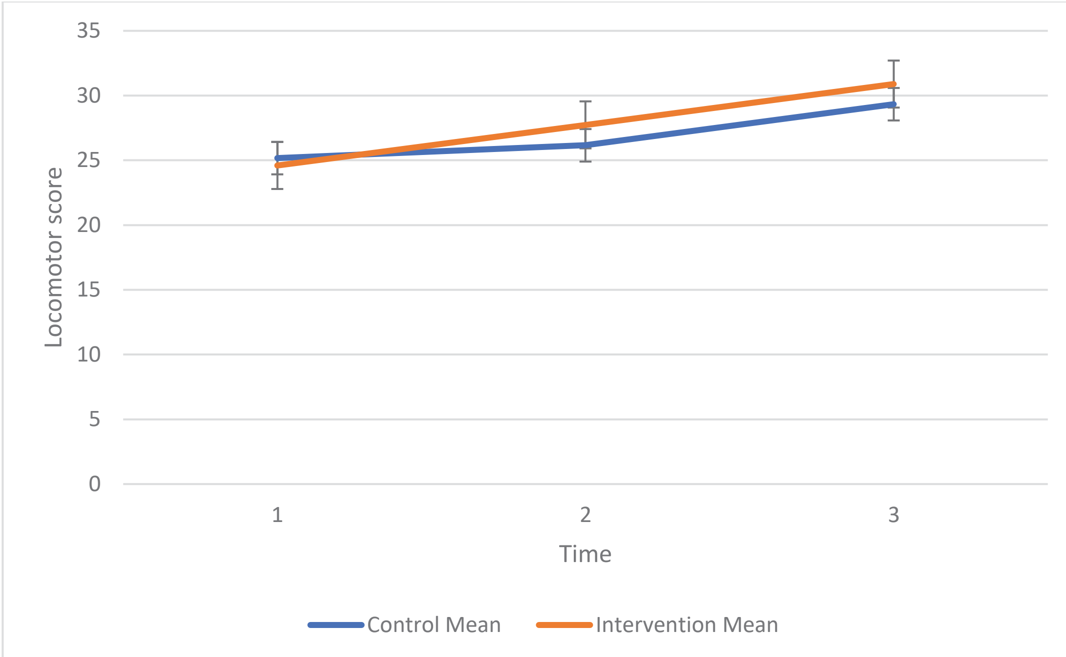

Figure 5. Line graph depicting change in total locomotor skills scores (mean) over time (baseline and 3- and 6-months post-interventon) in the control group and intervention group (group means presented). Locomotor score = total locomotor score; Time 1 = baseline; Time 2 = 3-months post-intervention; Time 3 = 6-months post-intervention; Control = control group; Intervention = intervention group;

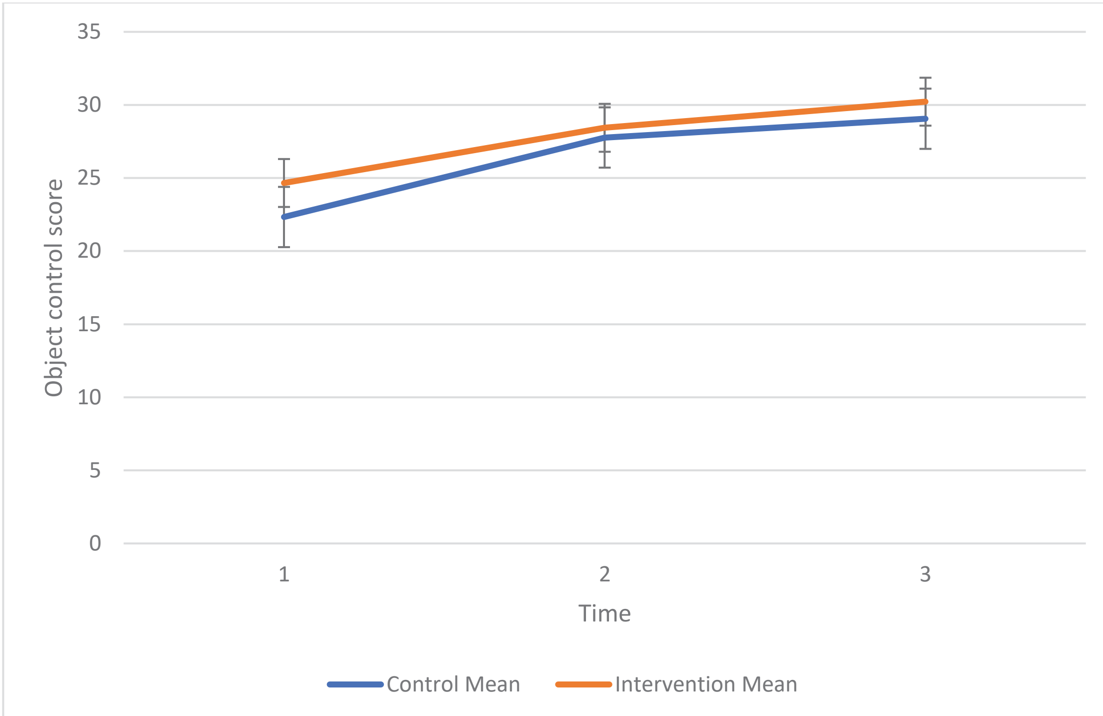

Figure 6. Line graph depicting change in total object control skills scores over time (baseline and 3- and 6-months post-interventon) in the control group and intervention group (group means presented). Object control score = total object control score; Time 1 = baseline; Time 2 = 3-months post-intervention; Time 3 = 6-months post-intervention; Control = control group; Intervention = intervention group.

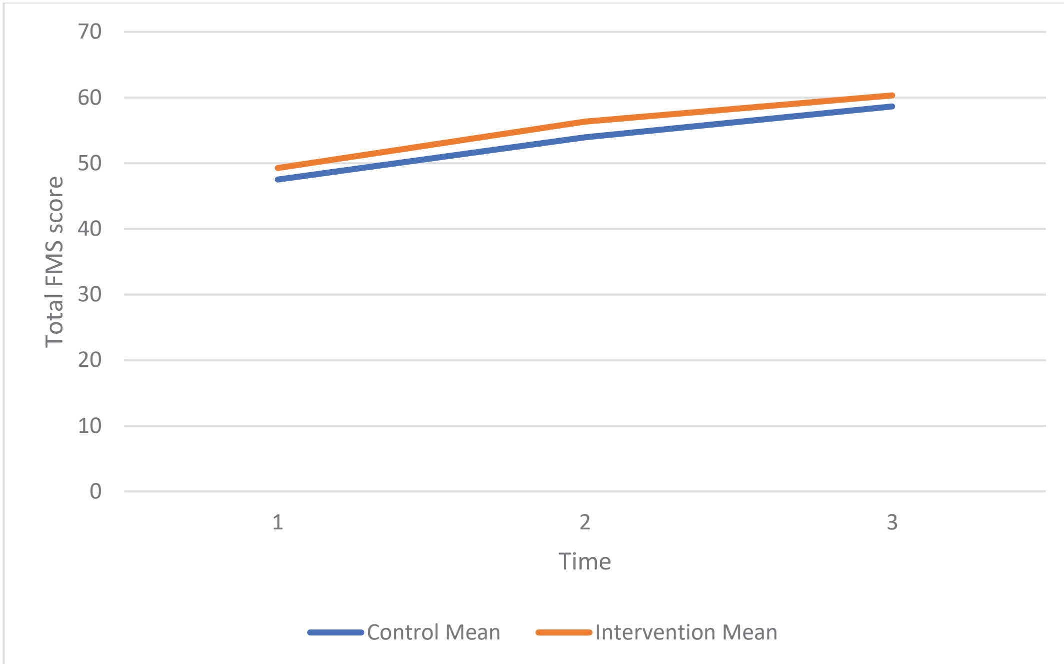

Figure 7. Line graph depicting change in total FMS scores over time (baseline and 3- and 6-months post-interventon) in the control group and intervention group (group means presented). FMS score = total FMS score; Time 1 = baseline; Time 2 = 3-months post-intervention; Time 3 = 6-months post-intervention; Control = control group; Intervention = intervention group.

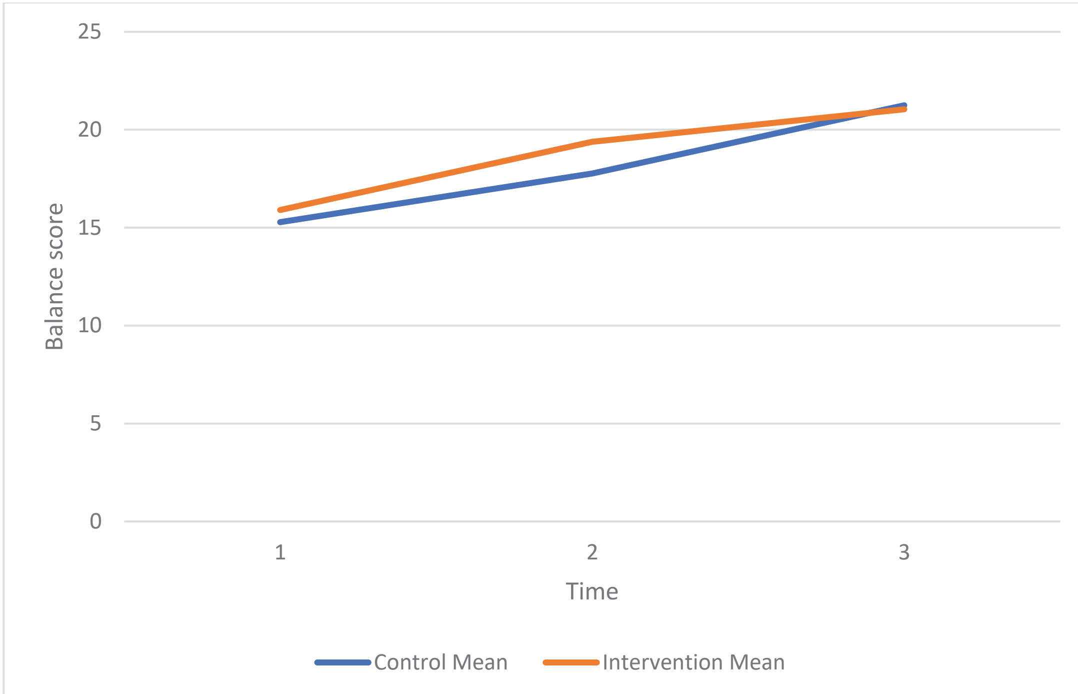

Figure 8. Line graph depicting change in total balance scores over time (baseline and 3- and 6-months post-interventon) in the control group and intervention group (group means presented). Balance score = total balance score; Time 1 = baseline; Time 2 = 3-months post-intervention; Time 3 = 6-months post-intervention; Control = control group; Intervention = intervention group.

The intraclass correlation coefficient (ICC) was calculated for all dependent variables. The ICC is a calculation of the percentage of variance that is explained by the various components of the multi-level model. For example, 33% of the variation in locomotor skills is explained by the variance between subjects, 66% is explained by the variance within subjects, and 1% is explained by the variance between sites. The ICC is similar among the remaining three dependent variables: object control, total FMS, and balance (shown in Table 4). The ICC indicates that between 20% and 33% of the variance in the various FMS measures are explained by the differences that the subjects exhibited amongst themselves, compared to the rest of the group. The majority of the ICC is allocated to the within-subjects level, meaning that the largest amount of variance is explained through the subjects' own development. The greatest amount of variance in FMS is explained through the changes that the subjects made in their FMS scores over time, presumably getting better as they aged. The third level, which controls for the variance between sites, was non-significant for each dependent variable and therefore taken out of each model. This left each model with two levels, time being the first, and the children being the second level. Although the children are nested within centers, it was seen that this clustering did not have a significant effect on the children's FMS.

Table 4

Intraclass correlation coefficients (ICC)

	Locomotor	Object Control	Total FMS	Balance
Between subjects	0.33	0.19	0.29	0.25
Between sites	0.01	0.05	0.03	0.00
Within subjects	0.66	0.76	0.68	0.75

Using multilevel modeling, the relationship between each dependent variable and the loose parts intervention was explored. Many models were run for each dependent variable in order to determine the model that best predicts each dependent variable. A total of 12 models were run for the total locomotor skills score variable, 15 models for the total object control skills score, 12 models for the total FMS score, and 19 models for the total balance score. The final models for each dependent variable are shown in Tables 5-8. Based on previous literature (Barnett et al., 2016), age, sex, BMI, childcare environment (enviro), and SES were tested in each model, as these variables have been found to influence children's FMS (Barnett et al., 2016). Interactions between independent variables were also tested once one variable was shown to predict the dependent variable on their own. Variables were added one at a time, and the change in log-likelihood (-2LL) determined if the variable made the model better. When adding one variable at a time, the number of degrees of freedom increased by 1. Therefore, in order for the variable to have improved the model, and for the variable to stay in the model, the decrease in -2LL must have been ≥3.84, as per the critical values of the chi-square distribution. Table 5 shows the model that best explains children's total locomotor skills score. This model includes time, age, the interaction between time and age, and BMI. Each model is slightly different and depicts the best model for each dependent variable. For each variable, significance was also recorded. In order for the variable to stay in the model, it did not have to be significant. For example, in Table 5, the interaction between time and age is not significant, with a p-value=0.17; however the -2LL did decrease by ≥3.84, and therefore it was kept in the model. This means that the time-by-age interaction aids in predicting the best model, however does not have a significant association with the dependent variable. Group was added last to each final model in order to answer the first research objective: did an outdoor childcare-based loose parts intervention impact children's FMS. In all four models, adding group did not decrease the -2LL by ≥3.84 and therefore if did not make the model better at predicting the dependent variable, in addition to group being non-significant. The outdoor loose parts play intervention therefore did not predict any of the four dependent variables: total locomotor skills score, total object control skills score, total FMS score, and total balance score.

Table 5 shows that total locomotor scores are significantly higher at 6-months post-intervention when compared to baseline scores. The time effect is comparing scores of time 1 (3-month) and time 2 (6-month) to scores at baseline. Using the estimate values, it is found that children had a non-significant 2.42 point increase in total locomotor skills scores from baseline to 3-months post-intervention, and children had a significant 6.12 point score increase in total locomotor skills scores from baseline to 6-months post-intervention. Additionally, 3-year old children had significantly lower total locomotor scores than 4-year old children at baseline. The age estimates are comparing 3-year old children to 4-year old children, and 5-year old children to 4-year old children. It was found that 3-year old children have a significant 6.86 point lower total locomotor skills score than 4-year old children, and 5-year old children had a non-significant 0.68 point higher total locomotor skills score compared to 4-year old children. Although the remaining effect variables (time-by-age interaction and BMI) did help to better predict children's total locomotor skills score, based on the associated -2LL, the effect was not significant.

Table 5

Final repeated measures model for total locomotor skills score

Effect	Group	Time	Age	Estimate	St. Error	Significance	95% CI
Intercept				31.64	4.50	<0.0001*	22.76, 40.53
Time		1		2.42	1.26	0.057	-0.07, 4.92
		2		6.12	1.32	<0.001*	3.52, 8.72
Age			3	-6.86	1.33	<0.001*	-9.48, -4.25
			5	0.68	1.71	-0.69	-2.70, 4.06
Time*Age		1	3	2.48	1.80	0.17	-1.08, 6.04
		1	5	2.24	2.87	0.44	-3.42, 7.90
		2	3	1.77	1.83	0.33	-1.84, 5.39
		2	5	-4.22	3.57	0.24	-11.27, 2.82
BMI				-0.29	0.27	0.29	-0.82, 0.25
Group	1			-0.007	1.04	0.99	-2.07, 2.05

*Note. Time 1= 3-months; Time 2= 6-months; Age 3= 3-year old; Age 5= 5-year old; Time*Age 1, 3= 3-month, 3-years old; Time*Age 1, 5= 3-month, 5-years old; Time*Age 2, 3= 6-months, 3-years old; Time*Age 2, 5= 6-months, 5-years old; Group 1= Intervention*

*$p < 0.05$

The estimates in Table 6 show that children's total object control skills scores were significantly higher at both 3- and 6-months post-intervention when compared to baseline scores. Three-month scores were a significant 6.16 points higher when compared to the baseline scores, and 6-month scores were a significant 9.32 points higher when compared to baseline scores. Also, 3-year old children had significantly lower total object control skills scores than 4-year old children. As seen using the estimates, 3-year old children had a significant 3.76 point lower score than 4-year old children, and 5-year old children had a non-significant 0.30 point lower score when also compared to 4-year old children. The model also shows statistically significant relationships between total object control skills score and sex. At baseline, boys exhibited a statistically significant higher total object control skills score than girls. Boys and girls started the study with a 4.19 point difference in their scores. However, the Time-by-Sex interaction reveals that girls' total object control skills scores increase significantly over time, compared to boys –

resulting in a total object control skills score that is 0.50 points higher than boys, 6-months post-intervention.

Table 6

Final repeated measures model for total object control skills score

Effect	Group	Time	Age	Sex	Estimate	St. Error	Significance	95% CI
Intercept					22.53	3.98	<0.0001*	14.68, 30.39
Time		1			6.16	1.52	<0.0001*	3.17, 9.15
		2			9.32	1.53	<0.0001*	6.31, 12.35
Age			3		-3.76	1.19	0.0019*	-6.12, -1.40
			5		-0.30	1.54	0.85	-3.34, 2.74
Time*Age		1	3		-0.05	1.76	0.98	-3.34, 2.74
		1	5		2.48	2.81	0.38	-3.53, 3.43
		2	3		-0.58	1.80	0.75	-4.13, 2.97
		2	5		8.21	3.46	0.02	1.39, 15.03
Sex				1	4.19	1.09	0.0002*	2.04, 6.35
BMI					0.04	0.24	0.87	-0.43, 0.51
Time*Sex		1		1	-1.26	1.72	0.46	-4.67, 2.14
		2		1	-4.69	1.73	0.007*	8.10, -1.27
Group	1				-1.19	0.88	0.18	-2.94, 0.55

*Note. Time 1= 3-months; Time 2= 6-months; Age 3= 3-year old; Age 5= 5-year old; Time*Age 1, 3= 3-month, 3-years old; Time*Age 1, 5= 3-month, 5-years old; Time*Age 2, 3= 6-months, 3-years old; Time*Age 2, 5= 6-months, 5-years old; Sex 1= male; Time*Sex 1,1= 3-months, male; Time*Sex 2,1= 6-months, male; Group 1= Intervention*

*$p < 0.05$

Total FMS scores are significantly higher at both 3- and 6-month post-intervention when compared to scores at baseline, shown in Table 7. The estimates show that 3-month total FMS scores were a significant 9.81 points higher than baseline scores, and 6-months scores were a significant 13.18 points higher than baseline scores. Additionally, the estimates in Table 7 show that 3-year old children have a significant 9.12 point lower total FMS score than 4- year old children at baseline, and 5-year old children have a non-significant 2.20 point higher score than 4-year old children.

Table 7

Final repeated measures model for total FMS score

Effect	Group	Time	Age	Estimate	St. Error	Significance	95% CI
Intercept				56.14	7.40	<0.0001*	41.54, 70.74
Time		1		9.81	1.45	<0.0001*	6.96, 12.67
		2		13.18	1.49	<0.0001*	10.24, 16.11
Age			3	-9.12	1.84	<0.0001*	-12.74, -5.49
			5	2.20	2.59	0.40	-2.91, 7.31
BMI				-0.28	0.45	0.53	-1.16, 0.60
Group	1			-1.13	1.71	0.51	-4.51, 2.25

Note. Time 1= 3-months; Time 2= 6-months; Age 3= 3-year old; Age 5= 5-year old; Group 1= Intervention

$*p < 0.05$

The estimates in Table 8 show that total balance scores at 3-months post-intervention are a non-significant 3.06 points higher than at baseline, and 6-months post-intervention scores are a significant 6.88 points higher than at baseline. Continuing, 3-year old children have a significant 5.30 point lower total balance score when compared to 4-year old children at baseline, and 5-year old children have a non-significant 0.06 point higher score when compared to 4-year old baseline scores. Lastly, boys have a significant 2.6 point lower baseline balance score when compared to girls.

Table 8

Final repeated measured model for total balance score

Effect	Group	Time	Age	Sex	Enviro.	Estimate	St. Error	Significance	95% CI
Intercept						25.86	3.80	<0.0001*	18.37, 33.35
Time		1				3.06	1.66	0.07	-0.22, 6.35
		2				6.88	1.74	0.0001*	3.45, 10.30
Age			3			-5.30	1.11	<0.0001*	-7.49, -3.11
			5			0.06	1.42	0.97	-2.73, 2.86
Time* Age		1	3			2.27	1.54	0.14	-0.78, 5.32
		1	5			1.92	2.45	0.43	-2.91, 6.75
		2	3			0.80	1.58	0.61	-2.32, 6.75
		2	5			-5.02	3.03	0.10	-11.01, 0.98
Sex				1		-2.6	0.85	0.002*	-4.38, -1.01
BMI						-0.41	0.22	0.07	-0.86, 0.03
Enviro.					1	2.49	1.20	0.04	0.12, 4.87
					2	-1.80	1.24	0.15	-4.24, 0.66
Time* Enviro.		1			1	-1.23	1.80	0.50	-4.79, 2.33
		1			2	1.41	1.92	0.47	-2.40, 5.21
		2			1	-2.59	1.83	0.16	-6.20, 1.03
		2			2	1.98	1.99	0.32	-1.95, 5.91
Group	1					-1.52	0.85	0.08	-3.21, 0.16

*Note. Time 1= 3-months; Time 2= 6-months; Age 3= 3-year old; Age 5= 5-year old; Time*Age 1, 3= 3-month, 3-years old; Time*Age 1, 5= 3-month, 5-years old; Time*Age 2, 3= 6-months, 3-years old; Time*Age 2, 5= 6-months, 5-years old; Sex 1= male; Time*Sex 1,1= 3-months, male; Time*Sex 2,1= 6-months, male; Enviro. 1= urban; Enviro. 2= suburban; Time*Enviro. 1,1= 3-months, urban; Time*Enviro. 1,2= 3-months, suburban; Time*Enviro. 2,1= 6-months, urban; Time*Enviro. 2,2= 6-months, suburban; Group 1= Intervention*

$^*p < 0.05$

4.2 Qualitative Data

Educator perceptions of a childcare-based outdoor loose parts intervention on preschooler's fundamental movement skills

The second objective of this thesis was to explore educator perceptions of a childcare-based outdoor loose parts intervention on preschooler's fundamental movement skills (FMS) using qualitative description. Focus group discussions at 3- and 6-months post-intervention were explored by coding and categorizing the quotations into themes and sub-themes using thematic analysis. This section will provide an overview of the three themes and various sub-themes (shown in Table 9) that were developed in relation to educators' perceptions of the intervention on preschooler's FMS.

Table 9

Qualitative themes and subthemes

Theme	Subtheme
1: Holistic development	Problem solving
	Mentoring and teamwork
	Imagination
	Communication
	Enjoyment
2: Movement skill development	Combinations of movements
	Repetition
	Risk taking
3: Educators	Awareness
	Support

Each theme is supported by quotations from focus group participants, identified using the 3-month (3M) or 6-month (6M) time point and identified by either original cohort (OC) or new cohort (NC).

Theme 1: Holistic development. Educators were asked to describe specific pictures they had taken of the children playing with the loose parts. They were asked to go into detail explaining what the children were doing, what they heard the children saying, the skills they saw the children exhibiting, and what caught their eye about the experience. The educators often spoke about the children using cognitive and socio-emotional skills concurrently with their physical skills while playing with the loose parts.

Not only did educators perceive that children were fostering their physical skills, such as various FMS, but as that was happening, they shared examples of how children were developing cognitive and socio-emotional skills such as 1) problem solving; 2) mentoring and teamwork; 3) imagination; 4) communication; and 5) enjoyment. The following sections explore these cognitive and socio-emotional skills that the children were developing, while physically manipulating the loose parts.

Problem solving. Educators described how children often had to problem solve while playing with the loose parts. Several educators spoke about how children had to figure out how to move their bodies differently with each loose part, as well as with one another. Loose parts play was encouraging children to move their bodies in various ways; however, in order to do so, they had to problem solve and plan how they were going to move their bodies and the loose parts. Examples educators used of the children problem solving were the children figuring out how to fit a pipe in a hole, and problem solving how to throw a plastic ball differently due to the weather conditions.

> "Well it just shows like when you have different sizes of loose parts like how they use them differently and how they need to move their bodies differently, like if they're big or if they're small, how they can think of how they're going to make it work, they have a plan, it's kind of how they make it work together you know. Cause you had to fit the pipe in the hole there and that could be quite challenging, that was balance." (6M-OC)

> "Because they were harder to throw because they were so light and the wind would kind of, so they had to sort of adjust the course of where they were going to throw it if it was a windy day. So, yah that kind of took a different skill, different maneuvering." (3M-OC)

One educator described a specific photograph where several children were using the loose parts as an obstacle course. One child, however, wanted to go the opposite direction from the other children. The educator used the photograph to describe how the child had to problem solve in order to get around the other children without falling or disrupting the other children's play. The child had to figure out how to move their body in order to accomplish their goal of going through the obstacle course backwards.

> "… they were trying to figure out how to get around each other because they were like the rest of them were kind of heading this way and he was trying to go the opposite way as everybody else, so he was trying to figure out how to get around here without falling off…in the end he ended up getting, he got down into the sandbox and then climbed back up on the other side of her and kept going, and just kept walking around children every time he got to them, he would get down and then back up. He was determined to go backwards." (6M- NC)

Many educators spoke to how the loose parts provided opportunities for children to develop and build upon their problem solving skills. However, one educator expanded upon this idea, as she believed that physically building with loose parts also improved children's socio-emotional problem solving skills and cooperation with one another.

> "…I feel like they're trying to build all these different things that's helping their problem solving skills, is kind of transferring over into their social skills with their peers too like problem solving with planks might not feel like it's the same as problem solving with friends, but it's kind of transferable for them which is really cool." (6M-NC)

Mentoring and teamwork. Several educators recalled that the children often made creations that involved an element of risk, such as bridges and teeter totters. Educators indicated that these projects were frightening to many of the younger children who may not have experienced them before. The older children recognized the younger children's fear, and offered support and guidance to them, which helped to both ease the younger children's anxiety and build their confidence. Educators spoke about how the older children taught the children the necessary movements for the specific task and/or helped them along the way by guiding or holding their hands. When engaging in loose parts play, the older children mentored and encouraged the younger children. By showing the younger children how to complete the movements, they were helping to develop these children's movement skills, while also building upon their own movement skills.

> "…so when they built this and the other younger ones were standing back watching them, you could just kind of see fear in their eyes and so they thought o.k. well I'll give it a try or whatever and some of them were really wobbly, they didn't have the coordination that these guys had at all and in fact some of the other children would come over and take their hand and show them around and then you could see the confidence building each time they went til eventually they could do it themselves. So it was really nice to see how they worked together and were mentoring each other and cooperating and helping the younger ones, so that they could grow their gross motor skills too so I think that was one big thing, advantage of the whole program right because they, the younger ones learned from the older ones yah." (6M-NC)

> "And they did, some of the younger kids going from the bench down, like if they were, got nervous, the older kids would hold their hands and help them down which I thought was really nice. Like the five-year old's helping the three-year old's so that was really sweet." (6M-NC)

As many of the loose parts are larger than the children in this study (e.g. wooden planks, PVC pipes, tires) the educators spoke about the children having to work together in order to move and manipulate the objects. Children had to work as a team in order to play with the loose parts. Many of the loose parts were materials that children had not played with before. By working in teams, children were able to communicate and talk through how they were going to use these objects.

> "Well at [learning center], I found a lot more cooperative play and less fighting when we brought the loose parts in cause like all of a sudden they were you know working together to try to figure out the pulley or working together to make things and build things and it was less like fighting, that's one of the first things I noticed" (3M-OC)

> "When they were building it, some of the children were just like let's make it bigger, and if one child would be carrying one of the big planks, they would kind of yell over like somebody can help cause it's too big, it's too heavy, and they would kind of partner up and work together." (6M-NC)

> "But that does take a different kind of coordination too because you're not just trying to coordinate your own body, you're also trying to coordinate with

> somebody else so those are different fundamental skills to kind of move your body in coordination with another person." (3M-OC)

Imagination and creativity. Educators spoke about how during the outdoor loose parts intervention, the children discovered new ways to move their bodies using their imagination. Whether the children were building a rocket ship, a campfire, or an obstacle course, they had to more their bodies differently in order to build each one. One educator spoke about how children's creativity and imagination, in terms of how they manipulated and played with the loose parts, directly affected their movement.

> "At [learning center] I noticed there was, it definitely increased the creativity in their play…it seemed to increase their movement because all of a sudden they weren't just o.k. I'm going to play here at the slide the whole time we're outside, it was you know they were creating all these different games and imaginary play and that was getting them to use a lot more of our playground space like o.k. we have to go over here and we have to get this and then we need to carry all of that over here because this is where our super hero base is and then we have to go over here and save this person. So, they were incorporating it into imaginative play a lot and then I felt that encouraged them to be moving around more." (3M-OC)

The children used their imagination with the loose parts by creating new ways to use the same materials, keeping their interest peaked. Educators also spoke about how the children would use their imagination to continue their play by finding new ways to move with the loose parts.

> "Oh, definitely their balance, coordination and their imagination, like I say you could tell they found a new way to go across." (6M-OC)

> "And with the loose parts, it encourages creativity so there's so much they can do with them, and like and so like you said the riskiness could increase as they become more creative and they think of different ways to play with the loose parts too." (3M-NC)

Communication. The educators recalled how the children started to communicate with one another much more when they were playing with the loose parts. By using more words, the children were able to share their ideas and plan with one another what they wanted to do with the loose parts, which affected how they moved the loose parts and their own bodies.

> "So they decided that they wanted to make a bridge, so they put the, yah so they put the ramps on here and so the fascinating thing about it is that they were moving this board because they, in talking to each other and experimenting with movement, they began to realize that if it was inclined down that the truck would go down, and if they put it level the truck would go straight and if they lifted it up, the truck would go backwards. And so they were discussing this and all the different ways that they were controlling the movement of the truck. So, it was very interesting to listen to the conversation and how they were figuring all of this out on their own." (6M-NC)

> "Yah definitely, to plan and talk about how they're making it or what they're making, and we do this, do this, we can go higher, stack this, communication, they're being, they're creative, they're building and getting more creative." (6M-OC)

One educator also spoke about how the opportunity to play with and manipulate loose parts outdoors strengthened children's communication skills, particularly those whose first language was not English. These children were picking up the English language quicker as a result of listening to, and communicating with, other children through loose parts manipulation. The children had to communicate in English in order to participate in the play, moving the loose parts and their own bodies.

> "We have a lot of children at this site that are learning English, it's a very multicultural neighborhood and it's been remarkable like how fast these children are learning English because they're trying to help with building these things and so they're learning the words for it and they'll say can I help and then they'll come in to you know listening to all the cues that they're giving each other and catching on to them until they're using them. Yah so you can just see it and then it goes over and the parents are mentioning how their language skills are really building and how they're at home they only speak the other languages, the only time they speak English is here and the parents have noticed that language is really being built." (6M-NC)

Enjoyment. While describing their experiences during the intervention, the educators often mentioned how the children were laughing and smiling while physically playing with the loose parts. The children were happy that they had a larger variety of materials to play with, and the additional freedom to explore their outdoor environment. Educators spoke about how children seemed to get joy and pleasure out of physically manipulating the loose parts and building things, and tended to laugh and smile a lot while imitating each other's movements. If children are enjoying manipulating the materials and moving their bodies, there is likely a better chance they will continue to engage with them, further developing their movement skills.

> "I think they were a lot happier, I mean seeing all the same stuff on the playground every day and then getting all of this stuff that they could just put together themselves, I found them, I find them more busy and I find them much happier than just having the climber and the like the soccer net or whatever." (3M-NC)

> "… a lot of laughter, [laughs] a lot of laughter, and a lot of, like, imitating each other's movements, so when the little girl, had fallen over, the one in blue… they tried to re-enact it [laughs]…" (6M-OC)

In many instances, the educators spoke about how much the children were enjoying playing with the loose parts because they were having fun moving their bodies in different ways and completing tasks they did not know they could complete.

> "So, this is actually up for a long time and they were having fun. They would put different things in the bucket and then try to pull it on the other side and they would all work together and figure it out, sometimes it would be different things in there, they'd be hauling it up for whatever reason that they could think of but you know that's something I would never have thought of to put in a playground for kids." (3M-OC)

> "Like they're pulling on the string, they're like pulling while the other little girl is kind of like balancing there, they're having fun together." (3M-NC)

Theme 2: Movement skill development. Through focus group discussions with educators, it became evident that educators felt that the children were developing their movement skills through outdoor loose parts play. Educators spoke of various factors that influenced movement skill development: 1) combination of movements; 2) repetition; and 3) risk taking. The following sections will discuss educators' perceptions on how these factors influenced children's movement skill development by playing with the loose parts.

Combination of movements. Educators were asked to describe the children's play with the loose parts, in addition to how they were moving their bodies. Participants explained that when children were playing with the loose parts, they were moving their bodies in a variety of ways. These descriptions of children's outdoor play with loose parts highlighted multiple physical skills (e.g. balancing, pulling, carrying), rather than just one skill in isolation. Children needed to execute a series of physical skills in order to move and manipulate these objects.

> "Lifting, balancing, pulling and carrying, some bending, some stretching, they were all, yah so going down to get the balls and then crawling over to get them and then they would look down and see where they were and how many were in there." (6M-OC)
>
> "… they would have to, you know, crawl along, on their hands and knees and then they were underneath um, their stomach and kind of shimmying underneath and climbing through, like this, on their stomach, and um, lifting, dragging, rolling, they were doing everything to try and maneuver these, you know, parts, so that they would do what they wanted eventually" (3M-NC)

One educator spoke about observing a change in how the children were moving their bodies due to their engagement with loose parts outdoors. They expressed that, prior to the outdoor loose parts intervention, the children would be only running, or only jumping, executing just one movement skill in isolation. When loose parts were introduced into the outdoor play environment, children's movement patterns became more complex and exploratory, with a variety of movement skills emerging within one activity.

> "… like a lot of the time it was just, I want to say bare gross motor, like just what are you doing, I'm running. What are you doing, I'm jumping, what are you doing, like just fooling around, just no materials being used which isn't necessarily a bad thing, but that has its limits and I feel that with the loose parts the value in that comes from now they're exploring, now they're thinking more and now it's helping other domains, it's just not the [bare] gross motor so if the loose parts introduced it's what am I making, I'm making a ramp to run off and then run down so now my running has a climbing and balancing and thinking instead of just like straight running from one end to the other. So, it's definitely helped them expand their play which has been interesting to watch." (3M-OC)

Repetition. As educators discussed the children playing with the loose parts, they often spoke about the children using the same materials to build similar projects over and over. This repeated use of the loose parts allowed children to unintentionally practice the movement skill associated with each project. When playing with the loose parts, the educators recalled the children learning from their mistakes and recreating and extending play. By repeating the movements associated with each task, the children were provided with the opportunity to learn from their mistakes and begin to master their movement skills. Educators recalled the children developing confidence after completing the skills a number of times, eventually leading to the children progressing in their skills. As the children were enjoying playing with the loose parts, they were drawn to play with the materials over and over, leading them to advance the skills they were using, without it being intentional or structured practice.

> "Giving them the opportunities to learn from their mistakes cause they are going to make mistakes and chances are they are going to fall, and chances are they

> might hurt themselves but they're also going to learn the next time I'm not going to do that so how can I make it better so that doesn't happen again." (6M-OC)

The educators shared how much they believed the children's confidence in their bodies was improving while playing with the loose parts, and with that, their movement skills were also improving. As the children repeated their movements, educators felt that they became more confident that they could complete the task, helping to improve their associated movement skills. The educators spoke about the children being able to balance and walk across wooden planks better, completing the movement faster and more confidently.

> "So, uh, and some of them were not – don't have the balance or coordination that some of the older ones do, so they do start up a little more slowly and tentative then – but then when they go through these movements – you can really see that their coordination is improving, their balance is improving, and they – their fear is gone now…" (3M-NC)

> "… and this little girl is cautious so when we first, the children at first built this little ramp, probably two and a half feet high off the ground so it's a bit of an incline... She was very cautious and the little boy that first built it he was encouraging her, you can do it, you can do it, and he actually would walk along holding her hand until she became comfortable. And then it's hard to tell but she's running across it, she moved on from nervous to not cautious at all." (6M-OC)

Educators also spoke about how the children would often reproduce what they had previously made on a different day or in a different area of the playground. By reproducing what they previously made with the loose parts, the children were provided with the opportunity to build upon the same movement skills they used before. Several educators mentioned that when the children were repeating their play experiences with the loose parts, they often extended it by adding additional loose parts, having more children join the play, or by moving their bodies differently. This was perceived to allow the children to continue their play, and gave them the opportunity to try new movements and build upon their previous skills. Educators indicated that by extending their play, the children were able to challenge themselves, which maintained their interest and kept them playing with the loose parts.

> "Yah I think it's sometimes they need the challenge. Like if they've climbed or ran or balanced on this thing like 90 times a day, they need a new way. They still want to do a bit of exploring like the repeat activity is just like that well's run dry so it's like I'm going to walk around the perimeter of our play area backwards today, it's still balancing but now I'm doing it backwards cause that's new, and I've tried that, can I do that? I don't know. So, it is like the sense of accomplishment if they can do it." (3M-OC)

Risk taking. As the educators discussed the children engaging in risky play with loose parts, it was evident to the educators that the children were also developing their movement skills. Playing with loose parts in their outdoor environment seemed to allow children to test the limits of what their bodies could do; it also presented an opportunity for the children to develop risk-assessment skills. The educators recalled how children's movement and manipulation of loose parts sometimes created an element of risk (e.g. carrying heavy loose parts, climbing and balancing at great height). In order to navigate these risks, children needed to move their bodies in different ways, which demanded various movement skills.

> "… this boy carrying three crates is definitely risky because like you just said, it could drop, he's holding on to the bottom crate and the other two are just there, so he is balancing and he can't really see, he can see a little bit cause there's holes but it's pretty risky, and he's walking on uneven ground which is [inherently] risky cause he could trip, he could drop the crates. And then the one with the slide and the rope that's risky cause they could get a burn on the hands from the rope, they could slip when climbing up." (3M-OC)

> "So, it was moving around the tree, so you had to try balance and then hold with your hands for the rope to get up to the tree so there is a bit of risk cause you can fall very easily." (3M-NC)

One educator spoke about how children's engagement with loose parts offered challenges (and inherent risks within these challenges) that children were determined to conquer, which demanded diverse movements. In this instance, the educator recalled how amazed they were of the child for being able to complete the task using their skills, noting how risky and difficult the task was. By allowing the children the opportunity to engage in risky play, the educators also afforded the children the opportunity to develop and hone their movement skills.

> "… they climbed up on with the rope and got on to the tree but the risk was kind of medium so I stood behind them because if they fell it was you know quite a distance but the determination to get their foot over the tire, to hold themselves up with the rope, to touch the tree and hold the tree was amazing…" (3M-NC)

Theme 3: Educators. When educators were asked about their own experiences with the loose parts, many revealed the outdoor loose parts intervention made them more 1) aware of children's physical development and their physical skill sets (i.e. FMS); as well as 2) how to support them.

Awareness. Educators recognized that they were much more knowledgeable about, and comfortable discussing, children's cognitive and socio-emotional development, and how to support it, rather than their physical development. Multiple educators spoke about how they saw the children moving in different ways when they played with the loose parts, and how perhaps they would not have been so aware of the children's movements had the intervention not made them focus on the children's physical development.

> "I think it helped me focus more on the physical and the gross motor skills where it is so easy when you see children engaged with loose parts to see like the cognitive benefits and the social-emotional, and those come to mind so easily and we get so excited about them but it's really helped me focus more on what the

> physical skills are and what skills they need to work on, what they're already really good at so I feel like I'm better at identifying that now." (6M-OC)

One educator recognized that loose parts play was benefitting the children by increasing the amount of physical exertion they were undertaking when playing with the materials. When the children were using more energy, they were able to be calm inside and benefit from their quiet time. However, prior to the introduction of loose parts, the children had not burned off enough energy to calm down inside, making it difficult for them to engage in quiet time.

> "... when they're outside playing and they don't have really heavy, like the rope that we have or the spools or the tires or they don't have the big heavy things that they can pick up and run and move and pull and if they're just running and then all of a sudden we're stopping that and having them, we have to go inside, we have to sit, we have to have quiet time but their bodies are still so jacked up … if they have the rope that they're pulling, they're actually exerting, physically exerting that energy so that if you get them to do that twenty minutes before we go inside, then they're down like we can have them go in and expect them to be able to just come in and stay." (6M-NC)

Support. In addition to the educators being more comfortable recognizing children's physical development, many spoke about how they are supporting the development of children's FMS differently than before the intervention. Several educators mentioned that once the loose parts intervention began, they became more cognisant of the language they were using around the children. This change in attitude allowed educators to step back and allow the children to evaluate the situation themselves, instead of stopping them when there might have been an element of risk. Educators spoke about how their involvement in the project had increased their understanding of how to support children's physical development through outdoor loose parts play.

> "… and I found I've been trying to steer away from be careful and kind of phrase like more open-ended questions, like what would happen if you step your foot there… So, I definitely try and encourage the children to test their own limits of self-risk and their comfortableness in their risky play…" (6M-OC)

> "so anyway, yeah, and you know, supervise, and let them, um, play, and experiment with their gross motor skills, and take risks, if they want to, and jump from wherever they want and balance where they want." (3M-NC)

One educator mentioned that when educators (in general) recognize that being outside is beneficial to children's physical development, they will continue to be aware of the physical domain and will become more comfortable supporting it.

> "Honestly yah let's just get them outside and let them run. But if we can focus more on this idea then and really learn about it and really take it into consideration and realize that we truly can help the children develop certain skills that have to do with their bodies and how to use them, then we won't necessarily overlook that which I think is super important." (3M-NC)

4.3 Summary.

This chapter presented results from the investigation of two research objectives: 1) To explore the impact of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS (assessed quantitatively); and 2) To explore educators' perceptions of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS. Quantitative assessments of children's FMS allowed for direct comparison of pre- and post-intervention scores by group (control vs. intervention). By exploring educators' perceptions of children's outdoor loose parts play, researchers were able to develop a deeper understanding of the relationship between outdoor loose parts play and children's FMS, helping to further understand "what" is happening, and additionally answering "how" and "why" outdoor loose parts play intervention impacted the participants. Quantitative analyses revealed that total FMS scores (total locomotor skills score, total object control skills score, total FMS score, and total balance score) increased over the course of the study in both control and intervention groups, however there were no significant differences between control and intervention groups. Unlike the quantitative results, analyses of qualitative data revealed several themes that spoke to a connection between outdoor loose parts play and children's movement skills development. These results will be further explored in comparison to previous literature in the following discussion section.

Chapter 5: Discussion

5.1 Introduction

The aim of this study was to explore the impact of an outdoor loose parts intervention on preschoolers' fundamental movement skills (FMS) using an exploratory, multi-methods approach. This study was comprised of two objectives: 1) To explore the impact of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS (assessed quantitatively); and 2) To explore educators' perceptions of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS. These objectives were explored through secondary analysis of quantitative and qualitative data from the PLEY project (Houser et al., 2019). Using multilevel modelling, children's FMS were analysed to determine if there was a significant difference in total FMS scores between control and intervention groups over time. Additionally, educators participated in focus group discussions, sharing their experiences from the outdoor loose parts intervention and their perceptions of how the intervention impacted children's FMS.

Quantitative analysis revealed no significant difference in any dependent variables (total locomotor score, total object control score, total FMS score, and total balance score) when comparing control and intervention groups. The final models that best predict the dependent variables are shown in the results sections of this thesis. While the loose parts intervention had no significant impact on children's quantitatively assessed FMS, several confounding variables, such as time, age, sex, BMI, and environment, were shown to influence children's FMS. This finding is in line with several systematic reviews (Barnett et al., 2016; Zeng et al., 2019) that highlight correlates of children's FMS. Unlike the quantitative results, qualitative analyses of educators' perceptions revealed several themes that spoke to the impact of outdoor loose parts play on children's FMS: 1) Holistic development; 2) Movement skill development; and 3) Awareness. In contrast to the quantitative results, the qualitative results indicate that an outdoor loose parts intervention has a positive influence on children's FMS.

This discussion will provide an in-depth summary of both the quantitative and qualitative results, comparing both to previous literature. It will also present the strengths and limitations of the study, trustworthiness and rigor, knowledge mobilization strategies for these findings, the implications of this research, and lastly, recommendations for future research.

5.2 Interpreting Quantitative data

The importance of FMS development in early childhood is known (Active for Life, 2019) and there has been an increase in awareness of outdoor loose parts play (Casey & Robertson, 2016) given the affordances it provides for children's play (and their movement). Despite this, to the authors' knowledge, no study has investigated the impact of outdoor loose parts play on children's FMS. This research is the first of its kind and therefore is exploratory in nature. Although there have been previous childcare-based FMS interventions that have shown positive results (Van Capelle et al., 2017; Wick et al., 2017), it has been noted that there is a need for additional high-quality outdoor play interventions in order to determine if it is an effective strategy for improving children's FMS (Johnstone et al., 2018). The current study aimed to help fill this gap in the literature.

Child demographic data (age, sex, and BMI) and centre demographic data (group, site, environment, and SES) were collected at baseline from both control and intervention sites. Multilevel modelling allowed all children to be included in the analysis, regardless if they had missing data. At baseline there were 209 children (male = 109, female = 88, missing = 12) and their average age was 3.83 ±0.69 years (178 children at baseline with valid FMS data and 99 children at 6-months post-intervention (44% drop out rate)). Descriptive statistics (mean, std., and range) for the dependent variables (total locomotor skills score, total object control skills score, total FMS score, total balance score) were calculated for both intervention and control groups across the three time points (baseline, 3- and 6-months post-intervention). Children's total FMS scores (all four dependent variables) were significantly higher at the 6-month time point in comparison to baseline. Children's total object control score and total FMS scores were significantly higher at the 3-month time point in comparison to baseline. Quantitative analysis also revealed that age had a significant effect on children's total locomotor skills score, total object control skills score, total FMS score, and total balance score. These results are in line with previous literature stating that as age increases, children's FMS also increase (Barnett et al., 2016; Mohammandi et al., 2017). It was also found that time also had a significant effect on all four dependent variables. As Barnett et al. (2016) indicated, this finding is not surprising, as it is likely that children are continuously provided with similar opportunities to build upon their movement skills over time.

The multi-level modelling analysis showed that children's grouping (control or intervention) did not have a significant effect on any the four FMS variables. In other words, children exposed to the outdoor loose parts play intervention had similar total FMS skills to children in the control group. The low ICC between sites reflects the eventual results of the study. The sites themselves are quite homogeneous in terms of the subjects' FMS scores, which is why the lack of difference between the control and intervention group was not surprising. It is important to note researchers did not preform a manipulation check. Although pictures and experiences from the educators informed researchers that children were playing with the loose parts, there was no way to ensure all children participating in the study played with the loose parts. Additionally, although all sites were visited prior to the intervention to determine they did not have an adequate number of loose parts in their outdoor play space, researchers did not follow up with control sites during the intervention to ensure they did not acquire any additional materials throughout the duration of the intervention.

A previous review noted that interventions which were shorter than 6 months, compared to 6 months or longer, yielded a larger positive change in children's FMS (Wick et al., 2017). However, of the 30 studies included in this analysis, only eight studies had a longer duration (≥6 months). Researchers further stated that the fading positive effects seen in longer-term FMS interventions creates challenges in developing strategies that lead to sustained FMS development, indicating the difficulties faced when developing an effective FMS intervention. Despite Wick and colleagues' (2017) findings that indicate shorter-term FMS interventions show larger positive effects on children's FMS, this study did not see significant changes in FMS at the 3-month time point or the 6-month time point.

The few childcare-based outdoor play interventions focused on improving children's FMS have seen varied results. Tortella et al. (2016) implemented an outdoor play intervention (n= 110 preschool-aged children) and found that children improved in 4 of the 6 motor skills assessed when exposed to 30-minutes of unstructured play and 30-

minutes of structured play on the playground Primo Sport 0246 (a playground specifically designed to promote gross motor skills in preschool children up to the age of 6). Similarly, preliminary results of another intervention using structured and unstructured play as a means to enhance children's FMS (n= 137) found a small effect on children's locomotor skills, and a limited effect on children's object control skills, from 30-minutes of games and 30-minutes of free play (Johnstone et al., 2019). Although quantitative results of this study are contradictory to Tortella et al. (2016) and Johnstone et al. (2019), they were similar to Foulkes and colleagues (2017) who implemented a 6-week active play intervention (n= 162). Foulkes et al. (2017) did not find any significant improvements in the intervention groups' total FMS, locomotor, or object control skills when compared to the control group after one 60-minute 'Active Play' session per week. All of the above-mentioned studies examined the influence of a play intervention on children's locomotor skills, object control skills, total FMS, and balance, however the findings are inconsistent. Together, this highlights the ongoing need to explore the relationship between outdoor play (particularly unstructured outdoor play) and young children's movement skills.

The current study differs from the above-mentioned FMS interventions, as it only involves unstructured, child-led, outdoor loose parts play, as opposed to an intervention that includes both structured and unstructured outdoor play. Additionally, previous research assessing children's FMS have not used one consistent FMS assessment tool, and the interventions have differed in duration, making it difficult to compare results. To date, children's FMS are typically assessed quantitatively; however, in doing this, researchers have limited the thoroughness of the data collected. Without qualitative data, researchers are missing context and depth on how children are playing, and the benefits it has to their development. This is critical information for the development of future interventions, as it provides details on what happened throughout the research process from the experiences of the participants. This information will help to shape future interventions, programs, policies, and research in providing more in-depth findings on the relationship between outdoor loose parts play and children's FMS development. The more detail researchers are able to explore, the more information there is available for research, policy, and curriculum development. The following section will discuss educators' perceptions of the loose parts intervention on children's FMS.

5.3 Interpreting Qualitative data

Focus group sessions with educators provided details on the educators' perceptions of the loose parts intervention and children's FMS. The following section will explore the results of this current study in comparison with other research findings.

Holistic development. When describing their perceptions of the intervention on children's FMS, several educators indicated that outdoor play with loose parts provided children with the opportunity to develop physically, as well as cognitively and socio-emotionally. The physical benefits of loose parts play are largely understudied, with physical activity being the only physical variable investigated (Bundy et al., 2017). To date, the majority of literature has focused on children's cognitive (Armitage, 2010) and socio-emotional (Flannigan & Dieze, 2017) development. The current study found that outdoor loose parts play helped children to develop physical skills, while also developing their problem solving skills and their mentoring and teamwork skills. In addition, children's imagination was flourishing, communication skills were developing, and they were enjoying themselves. These findings demonstrate that development in the early years is not one-dimensional, but holistic. Holistic development describes all aspects of human development (cognitive, physical, emotional, spiritual, and social development) as being interwoven and interdependent (New Zealand Government, 2017). New Zealand's early childhood curriculum (2017) states that as children develop holistically, it is important to provide them with opportunities that enable growth across all developmental domains, as opposed to only providing them with opportunities that develop one domain exclusively. The Nova Scotia Early Learning Curriculum Framework also believes that children's learning is holistic in nature and encourages their educators to take a holistic approach to teaching (Nova Scotia Department of Education and Early Childhood Development, 2018). Several other age appropriate activities such as reading or playing tag do not encourage children to develop holistically, unlike playing with loose parts outdoors. For example, reading may help children develop cognitively and socio-emotionally, and, playing tag may enable children to develop physically and socio-emotionally. However, unlike outdoor play with loose parts, these activities do not allow children to develop in all three developmental domains. Results of this study show that several educators spoke about how children were frequently provided with the opportunity to develop in all domains while they were playing with the loose parts outdoors and therefore also potentially points to a gap in only focusing on FMS in the quantitative section.

Neill (2013) similarly discussed how loose parts enable children to develop in eight HighScope Preschool Curriculum developmental indicators, including:

> Problem solving and use of resources (Approaches to Learning) and cooperative play (Social and Emotional Development);… coordinating large muscles to move heavy materials or using eye-hand coordination to manipulate loose parts (Physical Development and Health); using vocabulary to describe actions (Language, Literacy, and Communication); combining loose parts to create new shapes (Mathematics); pretend play (Creative Arts); gaining knowledge about the natural and physical world (Science and Technology); and making decisions about which materials to use for a project (Social Studies)… (Neill, 2013, p. 6-7)

Neill's finding is directly in line with the first theme of this thesis: showing that loose parts not only provide children with the opportunity to develop physically, but also develop simultaneously in all other domains, or holistically.

Similar to the current study, previous literature has shown that children develop their problem solving skills and imagination through physical manipulation of loose parts outdoors (Neill, 2013). Building and object manipulation skills are also supported through loose parts play, which has also been noted in previous research (Maxwell, Mitchell, & Evans, 2008). Although the current study did not specifically assess the type of play or frequency of play children were participating in, educators often spoke about the children being physical by building with the loose parts. Loose parts play also creates opportunities for children to demonstrate pro-social behaviours. Like the current study, Flannigan and Dieze (2017) found that when introduced to loose parts, children exhibited many pro-social behaviours, such as leadership and cooperation, in addition to an improvement in their communication skills. A notable finding from this study is the influence that outdoor loose parts play had on children's English communication skills for children whose first language was not English. The inclusive nature of loose parts may aid children who are struggling to learn English as they can still participate in the play without being fluent in English, but also develop their English communication skills while doing so. This is an important finding, and one that has been seen in previous research (Mincemoyer, 2013; Neill, 2013).

The final finding within this theme was that play with loose parts outdoors provides children with a joyful experience. Educators recalled how often children were laughing while they were physically manipulating and building with loose parts. It is important to know that children are enjoying this form of play, as it also provides them with substantial developmental benefits. A popular tip for parents to encourage their children to be active is to keep the focus on fun (Kids Health, 2018). Keeping the focus on fun is important, as children are more likely to participate in an activity they enjoy. This finding provides rationale for the inclusion of loose parts in future interventions, as children enjoy playing with them, which may lead to higher engagement throughout the intervention.

This study shows that outdoor play with loose parts is beneficial for all aspects of children’s development. The physical nature of outdoor loose parts play simultaneously provides children with cognitive and socio-emotional health benefits by encouraging them to problem solve, mentor others, engage in teamwork, use their imagination, communicate with their peers, and enjoy themselves while playing. Outdoor loose parts play is a feasible way to support the holistic development of children, as opposed to providing children with play opportunities that might only focus on one developmental domain at a time.

Movement skill development. As previously mentioned, this is the first study to evaluate the effect of outdoor loose parts play on children's FMS, and therefore there is little literature to compare it to. Educators were asked what movement skills they saw children developing, which provided researchers with information about the way children were moving their bodies while playing with the loose parts. When educators were describing the children moving, they frequently spoke of the children using a combination of movement skills. One educator recognized the difference in the children's play pre- to post-intervention, stating how children were no longer exhibiting primarily one type of movement (e.g. just running, or just balancing), but now combining multiple movements in a singular play experience (e.g. lifting, carrying and balancing). Flannigan and Dietze (2017) similarly found that children would move their bodies in a variety of different ways when manipulating the loose parts, stating how "children would jump and walk and squat over a pile of logs" (Flannigan & Dietze, 2017, p. 4).

This is an important finding in relation to the quantitative results. Children's FMS were assessed quantitatively using the TGMD-3 (Ulrich, 2013a) and the PGMQ (Sun et al., 2010) assessment tools. The TGMD-3 (Ulrich, 2013a) assessed children's total gross motor (total FMS) score, calculated using the sum of thirteen skills including locomotor (run, hop, gallop, skip, horizontal jump and slide) and object control skills (one-hand strike, two-hand strike, dribble, catch, kick, underhand throw, overhand throw). The PGMQ (Sun et al., 2010) includes four balance measurements (single leg standing, tandem standing, walking line forward, and walking line backward). Each of these skills is scored individually based on specific criteria for each skill. The multilevel model analysis showed that the loose parts intervention did not have a significant effect of children's total locomotor skills score, total object control skills score, total FMS score, or total balance score. Educator focus group data suggests that children were not engaging in many of the movements that the TGMD-3 (Ulrich, 2013a) assessed (e.g. hopping, sliding, catching, kicking, etc.). This may mean that the open-ended nature of outdoor loose parts play cannot be assessed properly using a structured FMS tool, but rather requires new ways to think about evaluating the development of FMS. Qualitative results show that children's play with the loose parts demanded a combination of FMS, however within this study, children's FMS were only assessed quantitatively one skill at a time. This finding may explain why there was no significant change in children's quantitative FMS scores due to the loose parts intervention. Children may have not improved at individual skills such as running, hopping, and throwing independently, as they were not doing these individual skills while playing with the loose parts, they were instead doing skills such as lifting, pulling, carrying, bending, and stretching. Educators also described how children were using various combinations of FMS; neither the TGMD-3 (Ulrich, 2013a) or the PQMQ (Sun et al., 2010) are designed to assess how FMS are used in combination with one another. In other words, the way educators described the children manipulating the loose parts (e.g. lifting, carrying, balancing, etc.) may not have translated into an improvement in the FMS assessed by the TGMD-3 (Ulrich, 2013a; e.g. running, hopping, etc.) and PGMQ (Sun et al., 2010; e.g. single leg standing, walking line backwards, etc.). Additionally, educators did not describe children running with loose parts, throwing balls, or kicking balls, all of which were skills assessed with the TGMD-3 (Ulrich, 2013a). This finding may indicate that quantitatively assessing individual FMS may not be the appropriate way to assess FMS during a loose parts intervention. If researchers had used a quantitative tool (e.g. direct observation) that had assessed the FMS that educators were talking about (e.g. dragging, pulling, carrying, balancing, twisting, etc.), there may have been a significant quantitative intervention effect.

Several educators also spoke about children using the same loose parts to recreate and build upon their play. This allowed children to learn from their mistakes and improve FMS. For example, if a child was trying to walk across a bridge they had built but fell off, they would try again and learn from their last experience. Once children mastered the skills, they often added loose parts in order to extend the play or make the play last longer. By extending their play, children were afforded with the opportunity to complete additional movement skills that were not involved in the first task.

A previous review found that structured FMS interventions have improved children's FMS (Riethmuller et al., 2009). As children repeat the same skills over and over, they learn from their mistakes, become more confident in themselves, and learn to master skills. Although the current study is an unstructured, outdoor play intervention, which allowed children to use their imagination in how they played with loose parts, children independently decided to repeat the movements they were using during their loose parts play, possibility mimicking the effect of a structured play intervention. Although children were not asked to repeat their movements, which would have taken place in a structured play activity, results showed that children repeated their movements on their own, enhancing their movement skills. This finding speaks to how children are developing their movement skills. Literature has shown that children acquire skills when given the opportunity to practice and build upon their skills (Hardy et al., 2012). By providing the children with the materials to practice their skills, and the time to do so, they were able to begin to master the several movement skills they were using in order to move and manipulate the loose parts. This finding can also be connected to the previous theme, which found that children enjoy themselves while playing with loose parts. If outdoor loose parts play can have the same effect as a structured play program on children's FMS, and also elicit a sense of joy, it can provide a means for encouraging children to engage in PA and sustain PA behaviour.

Educators indicated that children became more confident in themselves after attempting a movement skill a number of times. This is consistent with previous literature, which found that when children successfully learn a new motor skill, they concurrently develop self-confidence (Gehris, Gooze, & Whitaker, 2014). Additionally, Gehris and colleagues (2014) also found that children were helping other children develop their movement skills and confidence by demonstrating the skills and then allowing the child to attempt it on their own, which is consistent with the mentoring and teamwork that emerged as benefits of outdoor loose parts play in the current study. These findings show the strong connection between children's self-confidence and FMS development. As previous research has also shown that loose parts play improves children's confidence (James, 2012), this study corroborates these findings, as educators were seeing children's FMS develop concurrently with their confidence in their movement.

This study additionally found that playing with loose parts created an environment that allowed children to take risks, ultimately encouraging movement skill development. The educators spoke about the children engaging in risky play, such as balancing and climbing at heights and carrying heavy materials. Educators indicated that all of these risky activities helped the children to develop risk-assessment skills in addition to movement skills. This finding is in line with the Position Statement on Active, Outdoor Play which states: "Access to active play in nature and outdoors- with its risks- is essential for healthy child development" (Tremblay et al., 2015, p. 1). Results of this study corroborate the beliefs of the Position Statement on Active, Outdoor Play by showing that outdoor loose parts play encourages risk taking and enhances a key aspect of children's development, namely, the physical domain.

Previous literature has showcased the benefits of risky play. Brussoni and colleagues (2015) determined that risky play is critical for children's physical heath, which is critical for optimal development. It was found that risky play increases children's PA and also children's play time, and decreases time spent sedentary (Brussoni et al., 2015). As several PA interventions (Adamo et al., 2014; Foweather et al., 2015; Wasenius et al., 2018) have shown that PA is strongly correlated with FMS, it can be said that risky play seems to ultimately influence children's FMS. Risky play provides children with the opportunity to develop various movement skills, as they may need to balance, climb or grasp when at great heights, or manipulate their bodies in different ways when carrying a large object. It therefore follows that risky play provides children with the opportunity to develop FMS and loose parts are a means to encourage children to participate in this risky play.

Awareness. Several educators spoke about how being part of the PLEY Project increased their understanding of the importance of the children's physical development and how to support it. Educators indicated they learned how to focus on the physical skills children were developing while playing with the loose parts. They also stated that this allowed them to become more confident in supporting the children's development of their movement skills while playing with the loose parts. Educators stated that it is important to allow children to experiment with their gross motor skills, take physical risks, and give them opportunities to move their bodies in the diverse ways that will enhance their FMS. This is an important finding, as previous literature has stated that educators play a critical role in promoting play during care hours, ultimately shaping the way children play (Schlembach et al., 2018). As educators have such a large influence on children's play, it is critical they understand the importance of children's physical development and FMS, and the impact outdoor loose parts play can have.

Educators' recognition that outdoor unstructured play, of which loose parts play is an example of, is beneficial to children's FMS development is in line with previous literature. It has been seen that educators recognize that nature play enables children to test their agility, coordination, and strength, ultimately facilitating their confidence and competence (Schlembach et al., 2018), and more broadly, their physical development (Ernst, 2014). Several examples of loose parts include natural materials such as stones, stumps, logs, branches, sand, etc. (Neill, 2013), highlighting the connection of nature play and loose parts play.

This is the first study to examine educators' perceptions of an outdoor childcare based loose parts intervention on children's FMS, in addition to also exploring the effect of outdoor loose parts play on quantitative measures of children's FMS. Based on the results of the qualitative analysis of this study, loose parts afford children with opportunities to: develop physically while simultaneously developing emotionally and cognitively; and to develop their movement skills by combining various movements into one activity, repeating and extending their play, and engaging in risky play. Participation in this intervention also encouraged educators to be more aware of how outdoor loose parts play supports children's physical development. Unlike the qualitative findings, quantitative assessments did not show a significant impact of outdoor loose parts play on children's FMS. Possible reasons for these inconsistent findings will be explored in the limitations section of this thesis.

5.4 Strengths

This study is novel in that it is the first to explore the relationship between an outdoor loose parts intervention and children's FMS. Previous research has evaluated the impact that outdoor loose parts play has on children's socio-emotional development (Bundy et al., 2017) and their cognitive development (Flannigan & Dietze, 2017), however there is very limited literature on the influence of outdoor loose parts play on children's physical development. This study explores this relationship both quantitatively and qualitatively, allowing for a deeper understanding of this relationship. Assessing children's FMS quantitatively allowed for a direct comparison of pre- and post-FMS measures within subjects and between them. However, this form of data does not answer the "why" or "how", but only the "what". As the purpose of this study was to explore the impact of a childcare-based outdoor loose parts intervention on NS preschoolers' FMS, it was important to not only explore it quantitatively, but also explore it qualitatively, to further explore "what" was happening due to the intervention, in addition to determine "why" and "how" the intervention impacted the participants.

This RCT included both an intervention and control group, strengthening the quality of research compared to previous loose parts interventions that lacked a control group (Armitage, 2010; Bundy et al., 2009). The advantage of using an RCT design is that it provides a means to explore cause and effect relationships, while minimizing bias and confounding factors (Spieth et al., 2016). The current study also had a large sample size across multiple SES (low and medium/high) and environments (urban, suburban, and rural). It is important to ensure diversity in children's SES and environments are included in children's FMS research, as it has been seen that SES influences children's FMS and, more notably, there is a need for more research on the organizational correlates of children's FMS (Barnett et al., 2016).

Additionally, as previously mentioned by Gehris, Gooze, and Whitaker (2014), educators' perceptions and experiences are a valuable piece of information. For a childcare-based outdoor loose parts play intervention or initiative to be successful, it is critical that educators recognize the importance of outdoor loose parts play to children's development and learn how to support it. This study involved the educators by discussing their perceptions and experiences throughout the intervention, which gave insight into educators' thoughts regarding outdoor loose parts play and children's FMS. This is an aspect that many other FMS interventions neglected (Adamo et al., 2014; Foulkes et al., 2017; Johnstone et al., 2018; Johnstone et al., 2019; Tortella et al., 2016), however is an important aspect in determining the possible sustainability of a program. By including educators perceptions, it was clear that educators were not only speaking about children's movement skills improving, but more broadly, their physical literacy improving. While describing the children's outdoor play with loose parts, educators went beyond describing the children's physical movements, but also described how their confidence and motivation to move was also improving as they were playing. This is a novel and important finding. It is recommended that future research expands upon this finding, to further explore the impact of outdoor loose parts play on children' physical literacy.

This research was also strengthened by the use of a multi-methods design. By including both quantitative and qualitative forms of data collection and analysis, researchers can draw from multiple data sources in order to best answer research questions (Creswell & Creswell, 2018). Instead of only exploring how outdoor loose parts play influences quantitative measures of children's FMS, qualitative data were also explored, providing details on educators' perspectives of outdoor loose parts play on children's FMS. Having a multi-methods approach highlighted the discrepancies between the quantitative and qualitative results, which is a notable finding, and will aid in the development of future FMS and outdoor play interventions.

5.5 Limitations

As mentioned in the data analysis section, this study had a large drop-out rate due to children beginning school. There were 178 children at baseline, and 99 children at 6-months post-intervention (44% drop out rate). A large drop-out rate may affect the validity of a study, as participants who completed the study may differ from participants who dropped out (Bell, Kenward, Fairclough, & Horton, 2013). This study would have benefitted from beginning the data collection more than six months prior to the beginning of school (September) in order to minimize the number of children who withdrew from the study. It would have also been beneficial for this study to have greater participation from the sites. By having more children at each site participate, the results would be more generalizable by accounting for the possibility of sampling bias (e.g. only active families participating in the study).

As previously mentioned, the lack of manipulation check was a limitation, as researchers could not ensure participating children played with the loose parts and that control sites did not acquire loose parts. Another limitation of this study was the effect of season. The original cohort (n=15 childcare centres) and new cohort (n=3 childcare centres) were on different data collection timelines. The original cohort had data collected in spring (baseline), fall (3-month), and winter (6-month), while the new cohort had data collected in winter (baseline), spring (3-month), and summer (6-month). Due to the seasonal differences, children in different cohorts may have had different opportunities to engage with the loose parts outdoors. Educators indicated that one of the major challenges of the study was the loose parts getting buried under the snow, limiting which materials the children could play with (Spencer et al., 2019). Further, this may mean that children in the original cohort—the majority of the sample—were able to play with the loose parts more during the beginning of the intervention, compared to the end, possibility limiting their opportunities to develop FMS throughout the entire study. Season also influenced the quantitative FMS data collection, as several sites did not have an indoor area to complete assessments. Children instead had to be dressed in their outdoor clothing to be assessed outside. During the winter months, research assistants and student volunteers struggled with accurately evaluating the children's movements when they were wearing snowsuits, mittens, and winter boots, which could have impacted the validity of FMS data.

Another limitation was the quantitative FMS assessment tools used within this study. These tools may have introduced bias into the quantitative data as researchers may have anticipated the intervention would improve children's FMS and scored the children higher than children at the control sites. Continuing, the TGMD-3 (Ulrich, 2013a) and PGMQ (Sun et al., 2010) only assess children's movement for that one moment in time. In addition, these tools did not assess many of the movement skills that educators mentioned were being supported through outdoor loose parts play. Although another assessment tool may have been more appropriate within this study, determining that the TGMD-3 (Ulrich, 2013a) and PGMQ (Sun et al., 2010) were not assessing the skills children were using throughout this intervention is important information. This finding may influence the way researchers assess children's movements in future interventions. Within this study, an appropriate assessment FMS tool would have captured the different combinations of FMS children were developing, and what skills they were using while playing with the loose parts outdoors. For example, Hirose, Koda, and Minami (2012) video recorded children at the start of their play, continuing the recording until their play was over. By video recording the children, analyses can be more precise, as skills can be re-played, slowed down or sped up (Foulkes et al., 2015). This method would have allowed researchers to assess how the children were playing with loose parts throughout an entire outdoor play session (e.g. intervention sites) and what FMS were emerging through that play. By video taping standard outdoor play without loose parts (control sites) and outdoor play with loose parts (intervention), and then taking the same approach to identifying FMS in both groups, researchers could accurately compare findings between groups. This may have allowed researchers to determine if outdoor loose parts play was leading to more diverse FMS than outdoor play without loose parts. Additionally, there were a number of research assistants and volunteers doing the quantitative FMS assessments. The assistants and volunteers were different throughout each time point, and each data collection day. Having the same FMS observers assess the same children, at all three time points, would have strengthened the validity of this study, as each observer may have assessed FMS slightly differently.

An additional limitation is that total FMS scores were used as dependent variables in this study (total locomotor skills score, total object control skills score, total FMS score, and total balance scores); the impact of outdoor loose parts play on specific FMS (e.g. running, hopping, galloping, catching, kicking) was not explored. The majority of previous literature has explored children's FMS in a similar way, using total FMS scores (Engel et al., 2018; Foulkes et al., 2017; Foweather et al., 2015; Johnstone et al., 2019; Wasenius et al., 2018). However, some studies have assessed the impact of interventions on specific FMS (Tortella et al., 2016). Examining the impact of outdoor loose parts play on specific FMS may help to determine the FMS that are most/least impacted by outdoor loose parts play. While this was not the objective of the current study, this is something that could be explored in future.

Lastly, qualitative data, derived through educator focus groups, are open to many forms of bias, which may impact participant responses and interpretation of data collected. Educators may be influenced by the interviewer's phrasing or body language or by fellow educators, their responses and/or body language. Recall bias is also a possibility, as participants may have selective recall or misconceptions of the events (Gratton & Jones, 2004). Additionally, focus group data was limited to the experiences of the intervention site educators as researchers do not have data from the control group educators. Control group educators may have seen similar impacts on children's development, however due to outdoor play rather than loose parts play. Having control group data would have provided further information on the influence of loose parts play in comparison to outdoor play. Continuing, results of this study were not given back to the participants in order to ensure the data is being presented as the participants intended. As this study involved secondary data analysis of PLEY project data, the analysis of the transcripts was done long after the focus groups were held, making it difficult to perform member checking with the results. The important steps taken to mitigate these limitations will be discussed in the Trustworthiness and Rigor section.

5.6 Trustworthiness and Rigor

Several steps were taken to ensure this research is trustworthy and rigorous, an important aspect in qualitative research. Trustworthiness and rigor address the validity of the research, ensuring the findings are accurate and credible (Creswell & Creswell, 2014). During data collection, researchers attempted to facilitate authenticity by utilizing the suggestions by Milne and Oberle (2005): allowing participants to speak freely, ensuring their voices were heard, and accurately representing the participant's perceptions. This was done by encouraging all participants to speak when they felt comfortable, by asking all participants to respect each other's opinions, and audio-recording and transcribing the focus groups verbatim. Lastly, Creswell and Creswell (2014) recommend providing a rich, thick description in order to accurately convey the results. By using qualitative description, participants' direct quotes were used in the results section of this thesis, ensuring no interpretation errors and creating realistic results.

5.7 Knowledge Translation

The results of this study will be presented at relevant conferences on topics such as outdoor education and health. This thesis will also be publicly available in the Dalhousie Faculty of Graduate Studies Online Thesis archive. Researchers aim to publish this study in an academic journal, allowing for the results to be more easily accessible. In order to share the important findings, an infographic of the results will be given to Nova Scotia childcare centres, regardless if they participated in this study, to the parents of the children who participated, to critical local stakeholders such as Early Childhood Education institutions and the Nova Scotia Department of Education and Early Childhood Development, and to global stakeholders such as those associated with Outdoor Play Canada (e.g. ParticipACTION, the Child and Nature Alliance of Canada, and the Healthy Active Living and Obesity Research Group). Finally, researchers will consider sharing these results using a widely accessed platform, such as the Conversation Canada. As previously mentioned, this resource reaches a more diverse audience than an academic article, possibly including parents, teachers, and educators.

5.8 Implications

It is known that the early years are a critical time for development, and that play is fundamental to children's physical, cognitive, and socio-emotional development (Pellegrini et al., 2009). Determining the types of play that allow children to not only develop within one domain, but rather holistically in all developmental domains, is critical for the creation of future initiatives aimed at improving children's development and overall health and wellness. Literature shows how opportunities for children to play outdoors has declined historically (Gray, 2011), and therefore there is great interest in determining how to support children's outdoor play, and how to enrich children's outdoor play experiences. This research indicates that when children play outdoors with loose parts, it enables them to develop holistically, strengthening their physical, cognitive and socio-emotional wellbeing. This finding supports the Nova Scotia Early Learning Curriculum Framework, which believes that children's learning is dynamic, complex and holistic (Nova Scotia Department of Education and Early Childhood Development, 2018) as well as provides a method (outdoor loose parts play) for supporting this type of development. The results of this study also show that educators were more comfortable recognizing and supporting children's cognitive and socio-emotional development, and their knowledge about children's physical development lacked. The increase in educator knowledge about children's physical development and how to support it was evident in focus group data, with educators revealing several ways in which outdoor loose parts play supported children's FMS development. This important finding will help to inform future early childhood education curriculum by firstly, showing the need to develop educators' knowledge surrounding children's physical development, of which FMS is an important part, and secondly, highlighting the value of outdoor loose parts play as a means for supporting children's physical development and other important aspects (cognitive and socio-emotional health). Continuing, it is important to know that educators were not only speaking about how outdoor loose parts play improved children's FMS, but also physical literacy as a whole. Physical literacy stakeholders such as Active for Life, Sport for Life, and ParticipACTION could use this finding to promote the use of outdoor loose parts play as a means for enhancing children's physical literacy development.

There are several additional qualitative results from this study that can be integrated into early years curriculums, including, but not limited to, the importance of unstructured outdoor loose parts play on children's FMS development. This is a key finding that will benefit children's development if introduced into early years curriculum. By putting less emphasis on structured outdoor play, and more on unstructured outdoor loose parts play, children will enhance all of their developmental domains concurrently and enjoy themselves more while doing so. Educator perceptions of the value of outdoor loose parts play to children's FMS (and other aspects of development) may offer a compelling means to encourage outdoor loose parts play practice in other early years settings when communicated to early years stakeholders. A meaningful way that may substantially impact the effectiveness of early childhood education curriculum on outdoor, unstructured play, is by incorporating the results from the study that include educators' perceptions. Sharing the lived experiences of educators who have supported outdoor loose parts play, and the benefits they believe outdoor loose parts play bring to children's health and development, may be a way of making these findings more understandable, relatable, and believable to other early years educators and associated early years stakeholders who value the perspectives of early childhood educators. These findings have the potential to elicit a real change in the way that educators approach and support children's outdoor play.

Lastly, the results of this study may influence the way researchers evaluate the impact of outdoor loose parts play on children's FMS. By including educator perceptions of outdoor loose parts play on children's FMS, it was clear that outdoor loose parts play was not eliciting the FMS that the quantitative measures (TGMD-3, PGMQ) were assessing, and therefore these tools are likely not appropriate for assessing the impact of unstructured outdoor play interventions on children's FMS. This is a novel, and notable finding, that is of value to other researchers when trying to determine which tools to use in similar study designs. These findings provide justification for future researchers to consider the use of different FMS assessment tools/methodologies when exploring the impact of outdoor loose parts play on children's FMS. The findings also speak to the value of exploring the impact outdoor loose parts play has on children's FMS (and other health/developmental indicators) using qualitative data and analysis, to better answer the question of what developmental domains are supported by outdoor loose parts play, and also why and how they are supported. These results have the potential to influence how researchers, in future, evaluate the impact of unstructured outdoor play interventions on children's FMS, potentially leading to a more accurate understanding of children's FMS and how they are supported through unstructured outdoor play.

5.9 Future Directions

Literature exploring the impact of unstructured outdoor play on children's FMS development has had mixed results, making it an important area for future research. Very few studies have examined the benefits unstructured outdoor play has on children's FMS development, with none, prior to this study, examining the influence outdoor loose parts play has on children's FMS. As this is the first study of its kind, it is difficult to compare the results to previous literature. More research is needed to strengthen the concept that outdoor loose parts play supports children's physical literacy development, of which FMS is part of. This study highlighted the impact outdoor loose parts play has on not only children's physical development, but all aspects of their development, indicating that outdoor loose parts play may be an effective strategy for promoting children's physical literacy (the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life; Tremblay et al., 2018). More research is needed to further explore this.

Another important future direction is including both quantitative and qualitative data sources, similarly to the current study's multi-methods approach, which was an important strength that allowed for novel findings to emerge. Having multiple data sources will strengthen the quality of literature in this area, providing insight on what is happening in addition to why and how. This will aid in the creation of unstructured play interventions, as well as FMS/physical literacy interventions. Continuing, studies with a greater number of children participating within each site will help to strengthen the generalizability of the results, a notable limitation within the current study. Future research should consider video recording children's outdoor loose parts play. This will allow both the educators and the researchers to document the child's play experiences. Having both the educators' perceptions of the children's play, as well as the researchers' documentation, would facilitate a greater understanding of how the children are playing with the loose parts, and the accuracy of how outdoor loose parts play supports FMS. Another important aspect to explore is the impact of outdoor loose parts play on specific FMS, rather than to total FMS scores. This could lead to a deeper understanding of which specific skills are being influenced the most. Lastly, it is important that future researchers consider their dissemination strategies and provide their main findings to key stakeholders. This field of research has the potential to influence early childhood education curriculum and how children’s physical development is supported, making it a critical field of research.

5.10 Conclusion

This study aimed: 1) To explore the impact of a childcare-based outdoor loose parts intervention on NS preschoolers’ FMS (assessed quantitatively); and, 2) To explore educators’ perceptions of a childcare-based outdoor loose parts intervention on NS preschoolers’ FMS. Previous literature has shown the benefits outdoor loose parts play has on children’s socio-emotional and cognitive development. However, there is limited understanding of how outdoor loose parts play impacts children’s physical development. As the early years are such as critical time in a child’s development, it seemed important to explore ways of supporting it.

Using quantitative measures, the change in children’s FMS was assessed. Although several correlates of children’s FMS were discovered, multilevel modelling revealed that the outdoor loose parts intervention did not significantly improve children’s total locomotor skills, total object control skills, total FMS, or total balance skills.

Exploring educators’ perceptions of the childcare based outdoor loose parts intervention on the children’s FMS revealed that when children were playing with the loose parts outdoors, they were not only developing physically (e.g. executing various FMS), but simultaneously developing cognitively and socio-emotionally. Another important finding was that when educators described the children playing with the loose parts outdoors, they often described multiple FMS occurring within one activity. This indicates that outdoor loose parts play enables children to use a combination of FMS, as opposed to one movement per activity. It was also found that children often repeat and extend their play, further providing opportunities for them to develop their movement skills. Additionally, playing with the loose parts provided children with the opportunity to engage in risky play, encouraging FMS development. Lastly, focus group discussions with the educators revealed that participating in the PLEY project made the educators more aware of how outdoor loose parts play supports children's physical development, and how they can encourage and support it.

Despite the fact that quantitative analyses revealed no significant difference in FMS between children exposed to outdoor loose parts play (intervention group) and children exposed to standard outdoor play (control group) qualitative analyses of educator focus group data revealed important connections between outdoor loose parts play and children's FMS development. The discrepancy between the quantitative and qualitative results is novel and an important finding for future researchers. These results show how the TGMD-3 and PGMQ are not effective tools for measuring all of children's movement skills, especially those skills associated with outdoor loose parts play. Educators spoke of how the outdoor loose parts intervention simultaneously supported children's FMS and children's cognitive and socio-emotional development (holistic development). The value of outdoor loose parts play for encouraging holistic development in the early years is an important message that may help encourage and sustain outdoor loose parts play in diverse early years settings. This change in practice could improve children's health and wellness here in Nova Scotia and elsewhere, and in time, enhance overall population health and wellness.

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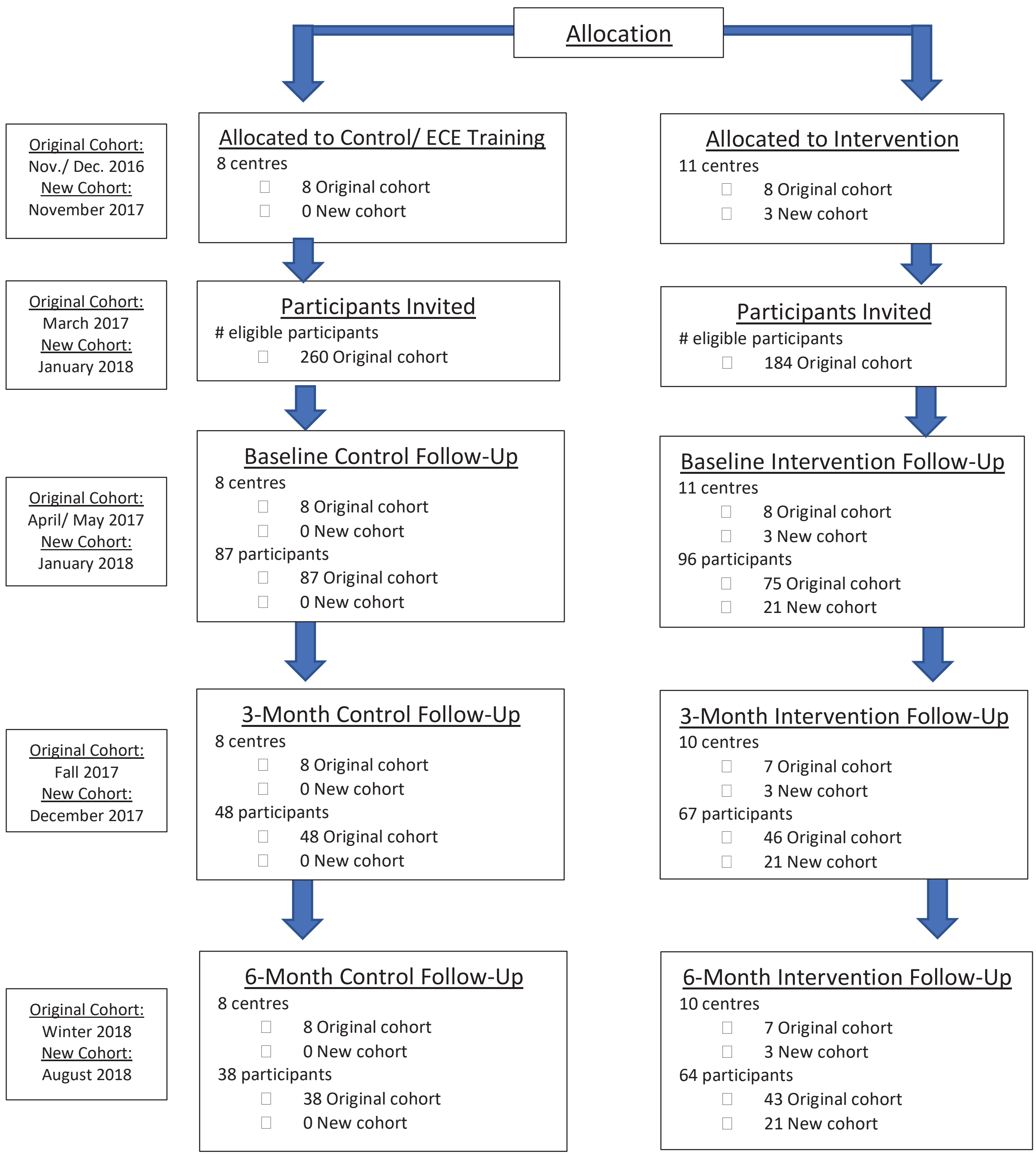
Appendix A – Data Collection Timeline



Appendix B – Dalhousie Research Ethics Approval

DALHOUSIE UNIVERSITY
Research Services

Social Sciences & Humanities Research Ethics Board
Amendment Approval

October 10, 2019
Sara Kirk
Health\School of Health and Human Performance

Dear Sara,
REB #: 2016-3924
Project Title: Physical Literacy in the Early Years (PLEY) Project
The Social Sciences & Humanities Research Ethics Board has reviewed your amendment request and has approved this amendment request effective today, October 10, 2019.
Sincerely,

Dr. Karen Foster, Chair

Appendix C: Information Sheet and Consent Form for Parent and Child

DALHOUSIE UNIVERSITY

INFORMATION SHEET AND CONSENT FORM FOR PARENTS AND CHILDREN

Project title: Physical Literacy in the Early Years (PLEY) Project

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Funding provided by: The Lawson Foundation Outdoor Play Strategy

Introduction
We invite you to take part in a research study being conducted by a team of researchers from Dalhousie University, Mount Saint Vincent University and St. Francis Xavier University. Dr. Sara Kirk and Dr. Michelle Stone from Dalhousie University are leading this research. The study is called

“Physical Literacy in the Early Years (PLEY) Project” and through this research, we hope to get a better understanding of how active outdoor play might help children develop skills that can help them to stay active for life. These skills are collectively called ‘physical literacy’. Your child’s participation in the study is voluntary and you may withdraw him or her from the study at any time. There will be no impact on the quality of care your child receives at their current daycare program if you decide not to have them participate in this research. The information below tells you about what is involved in the research, what you will be asked to do and about any benefit, risk, inconvenience or discomfort that you might experience.

You should discuss any questions you have about this study with the research coordinator who gave you this letter. Please ask as many questions as you like. If questions arise later, please contact the lead researchers (Sara Kirk or Michelle Stone).

Purpose and Outline of the Research Study
Many children in Canada are not getting enough physical activity. Being active is important to prevent chronic diseases. Encouraging children to be active in the early years can help them to stay active for life. Unfortunately, changes in outdoor play spaces in early learning centres have restricted children’s opportunities to engage in unstructured, self-directed and “risky” play, movements necessary for children to develop these physical literacy skills. For children’s curiosity to be sparked and heightened, they require access to new environments that offer freedom, wonderment, and access to open-ended and natural materials like logs, sticks, balls and hoops (“loose parts”). For this reason, this research will look at outdoor play areas in centres across Nova Scotia, and measure the effect that the addition of loose parts materials has on children, educators, and parents.

The objectives of this research are to evaluate if providing children with “loose parts” (things like logs, sticks, balls, hoops, etc) during outdoor play will 1) improve children’s physical literacy; 2) increase time in active outdoor play; 3) improve educators’ attitudes, beliefs, perceived competency, and intentions towards incorporating the intervention into practice, and 4) increase educators’ understanding of play in child health and development. Loose parts kits including these materials will be provided to some centres to include in their outdoor play environment for the intervention. Other centres will continue with their usual practice for outdoor play. This will allow us to see if the loose parts kits actually have any effect over and above what a centre would normally do.

All participating parents will complete a survey about you and your child, with questions about where you live (demographic information), physical activity participation (of both you and your child), physical literacy, sedentary behaviour, sleep, and your views about risks and benefits of your child’s physical activity participation.Parents in the intervention group will also be invited to participate in parent interviews to gain an in-depth insight of their understanding of the benefits and challenges of active outdoor play.

Who Can Take Part in the Research Study
All children between the ages of 3 and 5 years attending the involved centres will be able to participate in the project. Only children whose parents provide informed consent will be formally assessed. The participating centres will be randomly assigned with an even number part of the control group or the intervention group. Therefore, your child may be part of the control group or the intervention group for the duration of the study.

You are eligible to take part if you are the parent or primary care-giver of a child between the ages of 3 and 5 years attending the involved centre. Only those who consent to participate will be eligible.

What Will Your Child Be Asked To Do
All participating children will complete a movement skill assessment using the Test of Gross Motor

Development (TGMD-3) and an additional balance assessment. These assessments will take approximately 15-20 minutes and will be done at the start of the project, then again at two other time points. The assessment will involve the evaluation of 13 movement skills including: run, skip, slide, gallop, hop, jump, overhand throw, underhand throw, catch, dribble, kick, one-hand strike and two-hand strike. The balance component consists of four skills including single leg standing, tandem standing (standing with one foot in front of the other, heel to toe), walking a line forward, and walking a line backward. Your child will be demonstrated each skill by the researcher, then asked to perform it themselves.

Your child will also wear an accelerometer (device that measures physical activity levels, similar to a Fitbit) for nine days, at the same time points as the assessment. In other words, your child will wear the accelerometer for 9 days on three separate occasions including baseline, 3 months after the intervention, and 6 months after the intervention. A diary will be provided for you to record the time that the monitor is put on in the morning and removed at night, along with any periods during the day that it is removed (such as for bathing or swimming). This information will be used to verify whether the days contain enough valid wear time to be included in analyses. You will also be provided with an accelerometer-wearing guide to remind you how your child needs to wear and properly care for their monitor during the study. Following the 9-day period, the devices will be returned to the daycare and collected by the lead researcher. Although it is very important that the accelerometer is returned at the end of the study, if it is misplaced or broken, you will not be expected to purchase a replacement. If after a few tries your child still chooses not to wear the accelerometer, we ask that you return it to your child's daycare teacher/director. We do not know whether your child will be in the intervention group or control group. However, centres that are in the control group will receive the loose parts kit at the end of the intervention.

What You Will Be Asked to Do

If you choose to participate, you will be asked to complete a 10-15 minute survey pertaining to themselves and their child on areas such as demographic information, physical activity participation (of both child and themselves), physical literacy, sedentary behaviour, sleep, and the perceptions and influence of risk taking in their child's physical activity participation. If you are part of the intervention group, you will also have the opportunity to participate in an interview to gain an in-depth insight of your understanding of the benefits and challenges of active outdoor play. You will need to express their interest in participating in interviews separately when signing the consent form. Children may also have photos of them using the loose parts materials taken by the educators as part of the educator assessment for this intervention. You will be asked to provide your consent for photographs to be taken and used in research presentation.

For your child's accelerometer, a diary will be provided for you to record the time that the monitor is put on in the morning and removed at night, along with any periods during the day that it is removed (such as for bathing or swimming). This information will be used to verify whether the days contain enough valid wear time to be included in analyses. You will also be provided with an accelerometer-wearing guide to remind you how your child needs to wear and properly care for their monitor during the study. Following the 9-day period, the devices will be returned to the daycare and collected by the lead researcher.

Possible Benefits, Risks and Discomforts

There are no direct benefits to participating in this study. Indirect benefits for participating include an improved understanding of and use of loose parts materials in outdoor settings. For the children, this will provide an opportunity to use loose parts that may not have been part of the outdoor play setting prior to this intervention. If your child is in the intervention group, these loose parts will be available to them from the beginning, but if your child is in the control group, they will only have these materials available after the intervention is complete. All centres (both control and intervention) will be provided with loose parts kits to keep at their centre. Early childhood educators from across NS will have an opportunity to develop their knowledge and skills around promoting outdoor play and, once trained, will be able to support other educators in the province to achieve this goal. It may also contribute to the long-term health and development of young children, improve relationships within a community, and improve the supports available to families while parenting children between the ages of 3-5 years.

We do not anticipate any substantial safety concerns for those children who participate in this study. All of the testing activities for the study are similar to what your child would perform in their regular outdoor play at the centre. There are no invasive procedures. However, as with any type of physical activity, there is a small risk of a child falling or getting hurt. All of the research equipment is similar to what the children would use in their own centres' play activities. Safety is our first priority and all study personnel are trained in First Aid and CPR, and in the event of an injury, standard organizational policies will be followed. A trained expert will observe all assessments.

Participating in interviews may make you feel uncomfortable sharing specific information about your thoughts on outdoor play, physical activity, and the impact of this intervention on your child. In order to minimize the risk associated with the evaluation interviews, informed consent will be required for you to participate. Interviews will be conducted in an environment comfortable to you. You are not obligated to respond to any questions that you are not comfortable answering and you may withdraw from the study at any time up to the point that data are analyzed. All identifying information will be removed and replaced with a code number. Any quotes from interviews used in reports, publications, or presentations will not contain identifiers. If you consent to photos being taken of your child, we will use digital photo-editing software to fade out your child's features so that they cannot be identified.

How your information will be protected
Researchers will be completing movement skill assessments face-to-face with all the children, therefore your child's identity cannot remain anonymous. Your child's name will only be recorded on a separate page that can then be removed. Any identifying data collected from you or your child (e.g., name, birthdate, phone number etc.), will be removed from data before it is included within any written report of the research and will remain private. Hard copies will be carefully stored in a locked filing cabinet while all electronic data will be encrypted on a password-protected computer ensuring confidentiality. All identifying information will be available solely to the research team.

It is expected that the final results will be described and shared through presentations and publications. Any data collected, including movement skill test scores, will be included within average scores of the group and no individual test scores will be reported. Therefore, your child will not be identified in any way in our reports. Photos of your child will only be used for research presentation, and in this case, the identity of your child will not be revealed. The research team has an obligation to keep all information private and participant numbers, as opposed to names, will be used in our written and computer records.

Every effort will be made to ensure confidentiality and we will not disclose any information about your child's participation with anyone unless compelled to do so by law. That is, in the unlikely event that your child discloses that he or she is the subject of neglect or abuse, or we witness, or suspect abuse. If so, we are required to contact authorities.

The accelerometer data will be stored electronically on a password-protected computer accessible only be the researchers. Hard copy data (i.e., accelerometer tracking logs) will be stored in a locked and secure area within the Healthy Populations Institute at Dalhousie University.

Because the primary recruitment is at the level of the centres, it may not be possible to fully protect the confidentiality of parents, children or educators from other parents, children or educators at the same centre. Educators will know which other educators are receiving training, or participating in the focus group, parents may discuss their own participation (or otherwise) with other parents. Educators may take photos that feature your child (with your permission) but we will use digital photo-editing software to fade out identifying features of your child. If you do not give permission for your child to be photographed, we will not use any photographs in which your child may be featured.

If You Decide to Stop Participating
Your child's or your own data can be withdrawn from the majority of the study at any time up to the time that data are analyzed. After analysis begins, it will not be possible to remove yours or your child's data from the study. If you do decide to withdraw from the study, we ask that you inform the research team as soon as possible by contacting Sara Kirk at 902 494-8440 or sara.kirk@dal.ca. Once we have received notice of this, all of your child's data or your own data collected up to this point will be destroyed immediately and will not contribute to final results. However, once you or child has completed the study and analysis has taken place, no data can be removed.

How to Obtain Results
Reports will be provided to participating centres, as well as to provincial and regional community, public health, education and government partners to inform them of results and supports needed to expand and sustain the loose parts model provincially. Parents can access group results through the early years centre, or by contacting the research team, who will provide you with a group summary of the results. This research summary will be written in plain language and will provide an overview of the results of the intervention, with no identifying information of specific participant results.

Questions
We are happy to talk with you about any questions or concerns you may have about your participation in this research study. Please contact Sara Kirk (at 902 494-8440, Sara.Kirk@dal.ca) at any time with questions, comments, or concerns about the research study (if you are calling long distance, please call collect). We will also tell you if any new information comes up that could affect your decision to participate.

If you have any ethical concerns about your participation in this research, you may also contact Research Ethics, Dalhousie University at (902) 494-1462, or email: ethics@dal.ca (and reference REB file # 20XX-XXXX).

Signature Page

Project Title: Physical Literacy in the Early Years (PLEY) Project

Lead Researchers:

Sara Kirk, Healthy Populations Institute, Dalhousie University, sara.kirk@dal.ca, (902) 494-8440
Michelle Stone, Health and Human Performance, Dalhousie University, michelle.stone@dal.ca, (902) 494-1167

CHILD PARTICIPATION:

I, ____ (Your Name),
the parent/guardian of _____________________________________(Your Child's Name)

__ **Give** consent to my child's participation in the above study.
__ **Do not give** consent to my child's participation in the above study.
(check one of the above sentences to indicate whether or not you give consent)
__ I **give** consent for my child to be photographed by their educators
__ I **do not give** consent for my child to be photographed by their educators

Please note that if you do not wish for your child to participate in this study, you are not eligible to participate as a parent.

I have read and understood the attached study information or had the attached information verbally explained to me. I understand that my child will be asked to be physically active, and to do the best that they can for each assessment. I have been fully informed of the details of the study and have had the opportunity to discuss any concerns. I understand that I am free to withdraw my child at any time up to the point of data analysis or not answer questions that make us uncomfortable, and that my child's performance outcomes will not be affected if I do. I have received a copy of the study information and consent form.

_______________________	______________________	__________
Name of Parent/Guardian	Signature of Parent	Date

Home phone number ____________________ Mobile phone number ___________________

PARENT PARTICIPATION:

I have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I understand that my participation is voluntary and that I am free to withdraw from the study at any time, until data is analyzed. I agree to participate in the survey portion of this study.

_________________________	________________________	__________
Name	Signature	Date

Only parents in the intervention groups will be contacted for the interview portion of this project. I understand that I have been asked to take part in an interview that will occur at a location acceptable to me. I agree to take part in this study. I realize that my participation is voluntary and that I am free to withdraw from the study at any time, until data is analyzed.

I agree that my interview may be audio-recorded ☐Yes ☐No
I agree that direct quotes from my interview may be used without identifying me ☐Yes ☐No

_________________________	________________________	__________
Name	Signature	Date

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Email Address ________________________
I understand that I have been asked to take part in a survey that will occur at a location acceptable to me. I agree to take part in this study. I realize that my participation is voluntary and that I am free to withdraw from the study at any time, until data is analyzed.

___________________________	_________________________	___________
Name	Signature	Date

Appendix D - Information Sheet and Consent Form for Educators

DALHOUSIE UNIVERSITY

INFORMATION SHEET AND CONSENT FORM FOR EDUCATORS

Project title: Physical Literacy in the Early Years (PLEY) Project

Lead researchers:
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Joan.Turner@msvu.ca

Funding provided by: The Lawson Foundation Outdoor Play Strategy

Introduction

We invite you to take part in a research study being conducted by a team of researchers from Dalhousie University, Mount Saint Vincent University and St. Francis Xavier University. Dr. Sara Kirk and Dr. Michelle Stone from Dalhousie University are leading this research. The study is called “Physical Literacy in the Early Years (PLEY) Project” and through this research, we hope to get a better understanding of how active outdoor play might help children develop skills that can help them to stay active for life. The information below tells you about what is involved in the research, what you will be asked to do and about any benefit, risk, inconvenience or discomfort that you might experience.

You should discuss any questions you have about this study with Sara Kirk. Please ask as many questions as you like. If questions arise later, please contact the lead researcher.

Purpose and Outline of the Research Study

The mental and physical health and wellbeing of children in Nova Scotia (NS) is in jeopardy, as a result of rates of chronic diseases that are among the highest in Canada. A modifiable risk factor in chronic disease prevention is physical activity (PA). Changes in outdoor play spaces in early learning centres have restricted children’s opportunities to engage in unstructured, self-directed and “risky” play, movements necessary for children to develop physical literacy. For children’s curiosity to be sparked and heightened, they require access to new environments that offer freedom, wonderment, and access to open-ended and natural materials like logs, sticks, balls and hoops (“loose parts”). For this reason, this research will implement loose parts into the outdoor play areas in centres across Nova Scotia, and measure the effect these parts have on children, educators, and parents.

The objectives of this research are to evaluate the efficacy of the loose parts intervention versus standard early years settings’ practice to 1) improve children’s physical literacy; 2) increase time in active outdoor play; 3) improve educators’ attitudes, beliefs, perceived competency, and intentions towards incorporating the intervention into practice, and 4) increase educators’ understanding of play in child health and development. Loose parts kits including materials such as logs, sticks, balls and hoops will be provided to the centres to include in their outdoor play environment for the intervention.

All participating educators will complete the Go NAP SACC outdoor play and learning self-assessment tool. The instrument is based on four categories including outdoor play time, outdoor play environment, education and professional development, and policy, and will take approximately 10-15 minutes to complete. This instrument will be used to assess the outdoor environment in the daycare settings. The Go NAP SACC will be completed for each centre once during the intervention by the research coordinator. Educators will also take part in a focus group session conducted by the researchers after the intervention.

Who Can Take Part in the Research Study

Early childhood educators working at the participating centres will be eligible to participate in the study. The 20 participating centres will be randomly assigned as the control group or the intervention group, with 10 centres in each group. Therefore, your centre may be part of the control group or the intervention group for the duration of the study.

What You Will Be Asked to Do

Participating educators will be asked to complete a 10-15 minute survey related to the outdoor play and learning environment of your centre. The instrument is based on four categories including outdoor play time, outdoor play environment, education and professional development, and policy. This instrument will be used to assess the outdoor environment in the daycare settings.

Photovoice focus groups will be conducted with you and other educators to explore their experiences and to document changes they note in their attitudes, control beliefs, perceived competency and intentions towards incorporating the intervention. These focus groups will allow for more in-depth exploration of what made it challenging or what assisted them in using the loose parts in their daily activities, and are intended to take approximately 45 minutes to 1 hour. These stories will provide more context and allow for better understanding of play in healthy child development. You will be asked to take photos of children using the loose parts materials throughout the intervention. These photos will be discussed in the focus group sessions. One focus group will be held at each centre in the intervention.

Possible Benefits, Risks and Discomforts

There are no direct benefits to participating in this study. Indirect benefits for participating include an improved understanding of and use of loose parts materials in outdoor settings. For the children, this will provide an opportunity to use loose parts that may not have been part of the outdoor play setting prior to this intervention. Early childhood educators from across NS will have an opportunity to develop their knowledge and skills around promoting outdoor play and, once trained, will be able to support other educators in the province to achieve this goal. It may also contribute to the long-term health and development of young children, improve relationships within a community, and improve the supports available to families while parenting children between the ages of 3-5 years.

We do not anticipate any substantial safety concerns associated with your participation in this study. All of the testing activities for the study are similar to activities you may complete while working at the centre. There are no invasive procedures. Safety is our first priority and all study personnel are trained in First Aid and CPR, and in the event of an injury or any harm, standard organizational policies will be followed. A trained expert will observe all assessments.

Participating in focus groups may make you feel uncomfortable sharing specific information about planning and implementing the programs and services in the EYC site to which you are associated. In order to minimize the risk associated with the evaluation interviews, informed consent will be required for participants. Interviews will be conducted at the early years centre. You are not obligated to respond to any questions that you are not comfortable answering and you may withdraw from the study at any time up to the point that data are analyzed. All identifying information will be removed and replaced with a code number. Any quotes from interviews used in reports, publications, or presentations will not contain identifiers.

How your information will be protected:

Researchers will be conducting the interviews and focus groups face-to-face, therefore your identity cannot remain anonymous. However, your name will not be used on any testing sheets or reports and all data related to your responses on the questionnaire and in interviews will be linked solely to participant ID numbers. Any identifying data collected from you (e.g., name, birthdate, phone number etc.), will be removed from data before it is included within any written report of the research and will remain private. Hard copies will be carefully stored in a locked filing cabinet while all electronic data will be encrypted on a password-protected computer ensuring confidentiality. All identifying information will be available solely to the research team.

It is expected that the final results will be described and shared through presentations and publications. Any data collected, including movement skill test scores, will be included within average scores of the group and no individual responses will be reported. Therefore, you will not be identified in any way in our reports. The research team has an obligation to keep all information private and participant numbers, as opposed to names, will be used in our written and computer records.

Because the primary recruitment is at the level of the centres, it may not be possible to fully protect the confidentiality of parents, children or educators from other parents, children or educators at the same centre. Educators will know which other educators are receiving training, or participating in the focus group, parents may discuss their own participation (or otherwise) with other parents.

If You Decide to Stop Participating

Your data can be withdrawn from the majority of the study at any time up to the time that data are analyzed. After analysis begins, it will not be possible to remove your data from the study, though you can still decide to stop participating. If you do decide to withdraw from the study, we ask that you inform the research team as soon as possible by contacting Sara Kirk at 902 494-8440 or sara.kirk@dal.ca. Once we have received notice of this, all of your child's data collected up to this point will be destroyed immediately and will not contribute to final results. However, once you have completed the study and analysis has taken place, no data can be removed.

How to Obtain Results

Reports will be provided to participating centres, as well as to provincial and regional community, public health, education and government partners to inform them of results and supports needed to expand and sustain the loose parts model provincially. This research summary will be written in plain language and will provide an overview of the results of the intervention, with no identifying information of specific participant results.

Questions

We are happy to talk with you about any questions or concerns you may have about your participation in this research study. Please contact Sara Kirk (at 902 494-8440, Sara.Kirk@dal.ca) at any time with questions, comments, or concerns about the research study (if you are calling long distance, please call collect). We will also tell you if any new information comes up that could affect your decision to participate.

If you have any ethical concerns about your participation in this research, you may also contact Research Ethics, Dalhousie University at (902) 494-1462, or email: ethics@dal.ca (and reference REB file # 20XX-XXXX).

Signature Page

Project Title: Physical Literacy in the Early Years (PLEY) Project

Lead Researchers:

Sara Kirk, Healthy Populations Institute, Dalhousie University, sara.kirk@dal.ca, (902) 494-8440

Michelle Stone, Health and Human Performance, Dalhousie University, michelle.stone@dal.ca, (902) 494-1167

I have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I understand that I have been asked to take part in a focus group session that will occur at a location acceptable to me, and complete a short self-assessment survey (Go NAP SACC). I agree to take part in this study. I realize that my participation is voluntary and that I am free to withdraw from the study at any time, until data is analyzed.

______________________________ ____________________________ ____________

Name Signature Date

I agree that my focus group session may be audio-recorded ☐Yes ☐No

I agree that direct quotes from my focus group may be used without identifying me ☐Yes ☐No

I agree to participate in the training session offered on loose parts and active outdoor play

☐Yes ☐No

______________________________ ____________________________ ____________

Name Signature Date

Appendix E - Test of Gross Motor Development (TGMD-3)

Test of Gross Motor Development–Third Edition

TGMD-3

Examiner Record Form–Norming

Dale A. Ulrich

Section 1. Identifying Information

Child's Name or ID #: ______________________

Examiner's Name: ______________ Affiliation: ______________ Examiner's Email Address: ______________

Date of Testing: ______________ Date of Birth: ______________

Gender: Male ☐ Female ☐ Age in Years: ______________ Child's Weight Status: Underweight ☐ Normal ☐ Overweight ☐

Child's Residential Location: City ☐ Suburb of City ☐ Rural or Small Town ☐ Preferred Hand: Right ☐ Left ☐ Not Established ☐ Preferred Foot: Right ☐ Left ☐ Not Established ☐

Section 2. Scoring Notes

- Directions for all test items require you to first give the child a good demonstration of the skill, which includes all of the performance criteria; give the child a practice trial, followed by two test trials that you score.
- Score each performance criterion as:
  - 1 = performs correctly
  - 0 = does not perform correctly
- **Performance criteria scores** are calculated by summing the score on trial 1 and trial 2 for each performance criterion.
- **Skill scores** are calculated by summing all of the performance criteria scores for each skill.
- The total **locomotor subtest score** is calculated by summing **all** 6 locomotor skill scores.
- The total **ball skills subtest score** is calculated by summing the 7 ball skill scores.
- The total **gross motor test score** is calculated by summing the total locomotor subtest score and the total ball skills subtest score.
- We have learned that test administrator bias occurs when the tester is unsure how to score a performance criterion. When testing a child, if you are unsure of whether the child performed a performance criterion correctly, administer another trial and just look at that performance criterion and score it.
- When testing children with a disability or very young children who appear to be distracted easily, it is recommended that you to have them stand on a small poly spot or other marker and tell them to stand on the marker and watch your demonstration. It is also helpful to use another poly spot or marker as the child's starting position for the locomotor skills. Giving these children more structure during your testing should be helpful.

Locomotor Subtest

Skill	Materials	Directions	Performance Criteria	Trial 1	Trial 2	Score
1. Run	60 feet (18.3 meters) of clear space to run, and two cones or markers	Place two cones 50 feet (15.2 meters) apart. Make sure there is at least 8–10 feet (2.4–3.1 meters) of space beyond the cone for a safe stopping distance. Tell the child to run fast from one cone to the other cone when you say, "Go." Repeat a second trial.	1. Arms move in opposition to legs with elbows bent			
			2. Brief period where both feet are off the surface			
			3. Narrow foot placement landing on heel or toes (not flat-footed)			
			4. Non-support leg bent about 90 degrees so foot is close to buttocks			
				Skill Score		
2. Gallop	25 feet (7.6 meters) of clear space, and two cones or markers	Place two cones 25 feet apart. Tell the child to gallop from one cone to the other cone and stop. Repeat a second trial.	1. Arms flexed and swinging forward			
			2. A step forward with lead foot followed with the trailing foot landing beside or a little behind the lead foot (not in front of the lead foot)			
			3. Brief period where both feet come off the surface			
			4. Maintains a rhythmic pattern for four consecutive gallops			
				Skill Score		
3. Hop	A minimum of 15 feet (4.6 meters) of clear space, and two cones or markers	Place two cones 15 feet apart. Tell the child to hop four times on his/her preferred foot (established before testing). Repeat a second trial.	1. Non-hopping leg swings forward in pendular fashion to produce force			
			2. Foot of non-hopping leg remains behind hopping leg (does not cross in front of)			
			3. Arms flex and swing forward to produce force			
			4. Hops four consecutive times on the preferred foot before stopping			
				Skill Score		
4. Skip	A minimum of 30 feet (9.1 meters) of clear space, and two cones or markers	Place two cones 30 feet apart. Mark off two lines at least 30 feet apart with cones/markers. Tell the child to skip from one cone to the other cone. Repeat a second trial.	1. A step forward followed by a hop on the same foot			
			2. Arms are flexed and move in opposition to legs to produce force			
			3. Completes four continuous rhythmical alternating skips			
				Skill Score		
5. Horizontal jump	A minimum of 10 feet (3.1 meters) of clear space, and tape or markers	Mark off a starting line on the floor, mat, or carpet. Position the child behind the line. Tell the child to jump far. Repeat a second trial.	1. Prior to take off both knees are flexed and arms are extended behind the back			
			2. Arms extend forcefully forward and upward reaching above the head			
			3. Both feet come off the floor together and land together			
			4. Both arms are forced downward during landing			
				Skill Score		

Skill	Materials	Directions	Performance Criteria	Trial 1	Trial 2	Score
6. Slide	A minimum of 25 feet (7.6 meters) of clear space, a straight line, and two cones or markers	Place two cones 25 feet apart on a straight line. Tell the child to slide from one cone to the other cone. Let the child decide which direction to slide in first. Ask the child to slide back to the starting point. Repeat a second trial.	1. Body is turned sideways so shoulders remain aligned with the line on the floor (score on preferred side only)			
			2. A step sideways with the lead foot followed by a slide with the trailing foot where both feet come off the surface briefly (score on preferred side only)			
			3. Four continuous slides to the preferred side			
			4. Four continuous slides to the non-preferred side			
				Skill Score		

Locomotor Subtest Total Score ________

Ball Skills Subtest

Skill	Materials	Directions	Performance Criteria	Trial 1	Trial 2	Score
1. Two-hand strike of a stationary ball	A 4-inch (10.2-centimeter) plastic ball, a plastic bat, and a batting tee or other device to hold ball stationary	Place ball on batting tee at child's waist level. Tell child to hit the ball hard, straight ahead. Point straight ahead. Repeat a second trial.	1. Child's preferred hand grips bat above non-preferred hand			
			2. Child's non-preferred hip/shoulder faces straight ahead			
			3. Hip and shoulder rotate and derotate during swing			
			4. Steps with non-preferred foot			
			5. Hits ball sending it straight ahead			
				Skill Score		
2. One-hand forehand strike of self-bounced ball	A tennis ball, a light plastic paddle, and a wall	Hand the plastic paddle and ball to child. Tell child to hold ball up and drop it (so it bounces about waist height); off the bounce, hit the ball toward the wall. Point toward the wall. Repeat a second trial.	1. Child takes a backswing with the paddle when the ball is bounced.			
			2. Steps with non-preferred foot			
			3. Strikes the ball toward the wall			
			4. Paddle follows through toward non-preferred shoulder			
				Skill Score		
3. One-hand stationary dribble	An 8–10 inch (20.3–25.4 centimeter) playground ball for ages 3–5 years, a basketball for ages 6–10 years, and a flat surface	Tell the child to bounce the ball at least four times consecutively without moving their feet, using one hand, and then stop by catching the ball. Repeat a second trial.	1. Contacts ball with one hand at about waist level			
			2. Pushes the ball with fingertips (not slapping at ball)			
			3. Maintains control of the ball for at least four consecutive bounces without moving the feet to retrieve the ball			
				Skill Score		

Ball Skills Subtest *(continued)*

Skill	Materials	Directions	Performance Criteria	Trial 1	Trial 2	Score
4. Two-hand catch	A 4-inch (10.2-centimenter) plastic ball, 15 feet (4.6 meters) of clear space, and tape or a marker	Mark off two lines 15 feet apart. The child stands on one line and the tosser stands on the other line. Toss the ball underhand to the child aiming at the child's chest area. Tell the child to catch the ball with two hands. Only count a trial in which toss is near child's chest. Repeat a second trial.	1. Child's hands are positioned in front of the body with the elbows flexed			
			2. Arms extend reaching for the ball as it arrives			
			3. Ball is caught by hands only			
				Skill Score		
5. Kick a stationary ball	An 8–10 inch (20.3–25.4 centimeters) plastic, playground, or soccer ball; tape or a marker; a wall; and clear space for kicking	Mark off one line about 20 feet (6.1 meters) from the wall and a second line 8 feet (2.4 meters) beyond the first line. Place the ball on the first line closest to the wall. Tell the child to run up and kick the ball hard toward the wall. Repeat a second trial.	1. Rapid, continuous approach to the ball			
			2. Child takes an elongated stride or leap just prior to ball contact			
			3. Non-kicking foot placed close to the ball			
			4. Kicks ball with instep or inside of preferred foot (not the toes)			
				Skill Score		
6. Overhand throw	A tennis ball, a wall, and 20 feet (6.1 meters) of clear space	Attach a piece of tape on the floor 20 feet from the wall. Have the child stand behind the tape line facing the wall. Tell the child to throw the ball hard at the wall. Repeat a second trial.	1. Windup is initiated with a downward movement of hand and arm			
			2. Rotates hip and shoulder to a point where the non-throwing side faces the wall			
			3. Steps with the foot opposite the throwing hand toward the wall			
			4. Throwing hand follows through after the ball release, across the body toward the hip of the non-throwing side			
				Skill Score		
7. Underhand throw	A tennis ball, tape, a wall, and 15 feet (4.6 meters) of space	Attach a piece of tape 15 feet from the wall. Have the child stand behind the tape line facing the wall. Tell the child to throw the ball underhand and hit the wall. Repeat a second trial.	1. Preferred hand swings down and back reaching behind the trunk			
			2. Steps forward with the foot opposite the throwing hand			
			3. Ball is tossed forward hitting the wall without a bounce			
			4. Hand follows through after ball release to at least chest level			
				Skill Score		

Ball Skills Subtest Total Score ______

Total Gross Motor Score ______

Appendix F - Preschool Gross Motor Quality Scale (PGMQ) – Balance Subscale

PGMQ Balance Subscale

Skill	Directions	Performance Criteria	Trial 1	Trial 2	Score
1. Single leg standing	Instruct the child to stand on his/her preferred leg, hands on his/her hips as long as possible.	1. Both hands remain on waist			
		2. Two legs do not lean against each other			
		3. Non-prefferred leg keeps hip extension and knee flexion			
		4. Prefferred leg stands on ground without moving for 5 sec			
			Skill Score		
2. Tandem standing	Instruct the child to place one foot in front of the other in a straight line, hands on hips, and to hold the position as long as possible.	1. both hands remain on waist			
		2. Postural sway forward and backward is less than 30 degrees			
		3. Postural sway side to side is less than 30 degrees			
		4. Feet contact ground more than 10 seconds			
		5. Feet contact ground more than 20 seconds			
			Skill Score		
3. Walking line forward	Instruct the child to walk forward regularly placing one foot in front of the other (heel-toe) along the line	1. Walks with each foot contacting the line fully			
		2. Does not open arms for balance			
		3. Steps on line precisely without trial			
		4. Continues heel-toe walking on line for 6 steps			
			Skill Score		
4. Walking line backward	Instruct the child to walk backwards along the line, placing one foot behind the other. (no shuffle stepping)	1. Walks with each foot contacting the line fully			
		2. Does not open arms for balance			
		3. Steps on line precisely without trial			
		4. Each step goes behind the previous one			
		5. Walks backward with standard position for 6 steps			
			Skill Score		

Appendix G – Phase 1: Photo Documentation Forms

OBSERVING & DOCUMENTING FUNDAMENTAL MOVEMENT SKILLS

Recording your observations:

- Focus on one or more children as they play with the loose parts
- Choose what is significant to record (FMS – see list)
- Take a photo or series of photos to document the experience
- Record details/highlights of the play experience

Physical Literacy:

- Physical Literacy is an individual's motivation, confidence, physical competence, knowledge and understanding to be physically active for life. Children with higher physical literacy are more likely to be physically active in a range of different ways.
- One of the major parts of physical literacy is the development of fundamental movement skills, some of these skills are listed below.

Locomotion skills	Object control skills	Balance movements
Walking	Kicking	Balancing
Running	Rolling	Dodging
Crawling	Striking	Spinning
Climbing	Catching	Stopping
Jumping	Stopping	Stretching
Sliding	Trapping	Twisting
Hopping	Pulling/pushing	
Skipping	Throwing	

Date: ____________________ Time of Day: ________________________________ Child(re)n: ____________________ __________________ _________________ ____________________ ________________ ________________
Setting:
What caught your attention? Write a brief account of a selected play experience soon after it occurs
Details: How did the children use the loose parts? Were they doing specific movements or actions?
What teaching strategies (questions, resources,) were used to extend the play? What teaching strategies were used to support physical literacy?
Opportunities for Challenge: High --------------- Moderate --------------- Low 10 9 8 7 6 5 4 3 2 1 0
Recorder: ___________________________

Appendix H - Phase 2: Photo Documentation Forms

Photo Elicitation Sharing

The intervention group educators will share the "stories" of their photographs with the control group educators. They will…

- Highlight experiences and attitudes towards active outdoor play and physical literacy
- Describe how active outdoor play with loose parts might help children learn fundamental movement skills which supports the development of physical literacy

Setting and context:
What caught your attention? Write a brief account of a selected play experience (with loose parts) soon after it occurs.
Details: How did the children use the loose parts? Were they doing specific movements or actions? What did you see, hear think and/or wonder? What FMS were being used during the in-class play? – provide examples Locomotor Skills: Balancing Skills: Object Control Skills:
What teaching strategies (questions, resources,) were used to extend the play? What teaching strategies were used to support FMS and physical literacy? What other areas of development were enhanced through this play with loose parts? After observing the play, what loose parts could be added to extend and enhance the experience?
Evaluate the Risk: High --------------- Moderate --------------- Low 10 5 0 Provide a comment on potential risks of the recorded outdoor play activity.

Appendix I - Introductory Comments and Verbal Consent

INTRODUCTORY COMMENTS

Hello, my name is _______, I'll be facilitating this focus group today. I'd like to thank everybody for taking the time to participate in this focus group about your experience with the Physical Literacy in the Early Years (or PLEY) Project.

The purpose of the focus group is to gather feedback from educators who have been a part of the PLEY Project at the intervention sites. The information we acquire from you will be used to form a report and contribute to the larger evaluation of loose parts and physical literacy of preschool aged children in Nova Scotia.

Participation in this focus group is voluntary and you can stop participating at any point in time. All the information provided in this interview will be kept confidential. Answers will not be connected with any names or any centres in any reports or presentations. To help with the analysis of the information, with your collective permission, we will be audio-recording our conversation as well as taking notes. The recordings will be transcribed word for word by an individual who has signed a confidentiality agreement and all identifying information will be removed (i.e., names, etc.). The responses provided will be reported all together, and although individual responses may be used to highlight ideas in the overall report, no one will be personally identified.

Before we get started I'd like to review some 'guidelines' for this focus group. To ensure the privacy and confidentiality of all participants in this focus group we'd like to remind everybody that what is said in the focus group is confidential and should not be repeated or shared outside the group. Also, we welcome everybody's opinion and feedback. We don't all have to agree with the discussion and it is important that everyone's opinion is respected. Please participate and respond to questions as you feel comfortable. You can skip any questions or part of the discussion. Finally, I'd like to ask that when participants speak you identify yourself by site and that once you've spoken you give the floor to somebody else, so all have equal opportunity to participate.

Does anybody have any questions on this so far?

Do you consent to participate in the focus group?

☐ Yes ☐ No

Do I have your permission to audio-record this focus group?

☐ Yes ☐ No (If no, ask if notes can be taken)

Do I have your permission to use anything you say as a quote in any reports? As a reminder, you will not be personally identified

☐ Yes ☐ No

Appendix J - Phase 1: 3-Month Focus Group Questions

Focus Group Questions

Group facilitators do not have to stick to the order of these questions. If a comment about risk-taking emerges from a loose parts question, follow the lead of the discussion. Focus on physical literacy and fundamental movement skills.

1. Outdoor Active Play
   - How would you describe your role as an educator in the outdoor play environment?
   - What do you do when children are playing outside?
   - How comfortable do you feel when children are playing outside?
   - Provide examples
2. Loose Parts
   - What happened when loose parts were introduced in the outdoor environment for the children? For you?
   - Describe any changes you may have seen in the children's development- social, cognitive, **physical**, emotional, or others.
   - How did your own role, attitude, and/or intentions change when loose parts were introduced into the active outdoor play environment? Describe.
   - Did your usual patterns of interactions with children change? How did they change?
   - Were the loose parts used equally or were there favourites? By all children?
   - Which loose parts were rarely used?
   - Can you describe how loose parts were used? Are some loose parts needing to be replaced or supplemented?
3. Risk-taking
   - How would you define risky play?
   - Describe an outdoor activity that you would consider risky for children.
   - Do the children at your centre engage in risky play (provide an example)?

- Why do you think the children are engaging in this kind of play? …or why not?
- Did the introduction of loose parts add an element of risk to the children's play?
- What are your professional/personal attitudes about risk? Are they the same?

4. Policies
   - What policies are in place regarding active outdoor play at your centre?
   - Can you describe why these policies were implemented?
   - Have these policies been affected by the PLEY project (if at all?). Will anything need to change?
5. Challenges/Benefits
   - What are some of the challenges or benefits with this project? With outdoor play in general? With the introduction of loose parts?

Appendix K - Phase 2: 3-Month Focus Group Questions

<u>Focus Group Questions</u>

Group facilitators do not have to stick to the order of these questions. If a comment about risk-taking emerges from a loose parts question, follow the lead of the discussion. Focus on physical literacy and fundamental movement skills.

1. Outdoor Active Play
   - How would you describe your role as an educator in the outdoor play environment?
   - What do you do when children are playing outside?
   - How comfortable do you feel when children are playing outside?
   - Provide examples
2. Loose Parts
   - What happened when loose parts were introduced in the outdoor environment for the children? For you?
   - Describe any changes you may have seen in the children's development-physical
   - Describe any changes you may have seen in the children's development-social, cognitive, emotional, or others.
   - How did your own role, attitude, and/or intentions change when loose parts were introduced into the active outdoor play environment? Describe.
   - Did your usual patterns of interactions with children change? How did they change?
   - Were the loose parts used equally or were there favourites? By all children?
   - Which loose parts were rarely used?
   - Can you describe how loose parts were used? Are some loose parts needing to be replaced or supplemented?
   - Have any parents commented on the loose parts since the intervention began? Describe

- Have any children commented on the loose parts since the intervention began? Describe

3. Risk-taking
    - How would you define risky play?
    - Describe an outdoor activity that you would consider risky for children.
    - Do the children at your centre engage in risky play (provide an example)?
    - Why do you think the children are engaging in this kind of play? …or why not?
    - Did the introduction of loose parts add an element of risk to the children's play?
    - What are your professional/personal attitudes about risk? Are they the same?
4. Policies
    - What policies are in place regarding active outdoor play at your centre?
    - Can you describe why these policies were implemented?
    - Have these policies been affected by the PLEY project (if at all?). Will anything need to change?
5. Challenges/Benefits
    - What are some of the challenges or benefits with this project? With outdoor play in general? With the introduction of loose parts?

Appendix L - Phase 1: 6-Month Focus Group Questions

<u>Focus Group Questions</u>

Group facilitators do not have to stick to the order of these questions. If a comment about risk-taking emerges from a loose parts question, follow the lead of the discussion. Focus on physical literacy and fundamental movement skills.

Intervention Group Question for FG

1. Introduction question: If you were given the task of supporting one of the control sites, what advice would you give about how to introduce the loose parts to their preschool children? Describe children's reactions and comments? Did families or colleagues show an interest in the addition of the lp to your outdoor spaces?
2. How have you grown as an educator in terms of your understanding of physical literacy and fundamental movement skills? Are you more aware of PL outdoors/indoors? Are you having conversations with your team and families about PL and fundamental movement skills? Expand. What might be an engaging way to involve families and educators who were not involved in the PLEY Project?
3. Have any of the other domains (cognitive, language, social, emotional) been enhanced following the introduction of loose parts? Provide specific examples. Probe for information about changes in children's behaviours after the introduction of the loose parts into their outdoor spaces.
4. How have you helped your children assess their own risk? Materials? Strategies? Examples?

Wrap up questions at end of intervention focus group with all participants

- What ideas do you have for sustaining the focus on PL and FMS?
- How did the changing seasons effect the loose parts play?
- What loose parts would you like to add to your outdoor spaces? Ideas for different ones?
- Brainstorm storage issues and solutions!

- What is missing in our in-service and preservice training in relation to the understanding of physical literacy and fundamental movement skills?

Intervention group participants sharing with control group participants

1. Photo sharing session- Use the guidelines
2. Have the intervention group share advice on introduction of LP (Q1 from focus group)
3. What were the benefits of being involved in the PLEY project?
4. What were the challenges?

Any advice? - flip chart paper and the facilitators write down the advice down (take photos and send to the control group)

Appendix M - Phase 2: 6-Month Focus Group Questions

<u>Focus Group Questions</u>

Group facilitators do not have to stick to the order of these questions. If a comment about risk-taking emerges from a loose parts question, follow the lead of the discussion. Focus on physical literacy and fundamental movement skills.

Intervention Group Question for FG

1. Introduction question: If you were given the task of supporting a center that has not been involved in the PLEY project that wanted to incorporate loose parts in their outdoor environment, what advice would you give about how to introduce the loose parts to their preschool children? Describe children's reactions and comments? Did families or colleagues show an interest in the addition of the lp to your outdoor spaces?
2. *Provide all participants with copy of PL apple image say to the facilitators have a quick look at the apple together to develop a comfort level moving into the conversation about PL)
3. How have you grown as an educator in terms of your understanding of physical literacy and fundamental movement skills? Are you more aware of PL outdoors/indoors? Are you having conversations with your team and families about PL and fundamental movement skills? Expand. What might be an engaging way to involve families and educators who were not involved in the PLEY Project?
4. Have any of the other domains (cognitive, language, social, emotional) been enhanced following the introduction of loose parts? Provide specific examples.
5. Probe for information about changes in children's behaviours after the introduction of the loose parts into their outdoor spaces.
6. How have you helped your children assess their own risk? Materials? Strategies? Examples?
7. If we were to do the project over again, how could we have better engaged and involved families?

Wrap up questions at end of intervention focus group with all participants

- What are the benefits/challenges in participating in the PLEY project?

What ideas do you have for sustaining the focus on PL and FMS?

- How did the changing seasons effect the loose parts play?
- What loose parts would you like to add to your outdoor spaces? Ideas for different

ones?

- Brainstorm storage issues and solutions!
- What is missing in our in-service and preservice training in relation to the understanding of physical literacy and fundamental movement skills?
- How will you keep the momentum going after we leave?